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2 **BEFORE THE**
3 **PUBLIC SERVICE COMMISSION OF WISCONSIN**

4 Application for Grant County Solar, LLC to Construct a New
5 Solar Electric Generation Facility located near Potosi and Docket No. 9804-CE-100
6 Harrison Townships, in Grant County, Wisconsin
7

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9 **SURREBUTTAL TESTIMONY OF VALERIE LOCKER**
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13 **Q. Are you the same Valerie Locker who filed direct and rebuttal testimony in this**
14 **proceeding?**

15 A. Yes.

16 **Q. What is the purpose of your surrebuttal testimony?**

17 A. I am responding to certain portions of rebuttal testimony filed by Grant County Intervenor
18 (“GCI”) witnesses Daniel and Connie Cray and Brianna Eisentrout Frear and Henry Frear
19 (collectively, the “GCI Witnesses”). Specifically, I address the following topics: avian
20 monitoring, wetlands and waterways, and the potential for a Photovoltaic Heat Island
21 (“PVHI”) impact.

22 **Q. Do you sponsor any exhibits with your surrebuttal testimony?**

23 A. Yes. I am sponsoring the following exhibit:

24 Ex.-Grant County Solar-Locker-10: Grant County Solar Response to Grant County
25 Intervenors Data Requests 6-5 to 6.11.

26 **Avian Monitoring**

27 **Q. The GCI Witnesses assert that “monitoring of [avian] impacts must be planned and**
28 **performed” for the Project. (Rebuttal-GCI-Frear-4-5; Rebuttal-Cray-11-12). Is a**
29 **post-construction avian mortality study necessary for the Project?**

1 A. No. As discussed in my direct testimony and in my rebuttal testimony, the Grant County
2 Solar site is a low risk site for avian collisions. (Direct-Grant County Solar-Locker-9-12;
3 Rebuttal-Grant County Solar-Locker-2-5). Based on research from multiple sources
4 (including U.S. Fish and Wildlife Service (“USFWS”) and independent scientists), there
5 are various anthropogenic causes of avian mortality. (See Ex.-Grant County Solar-Locker-
6 3). As Commission witness Mr. Tomaszewski acknowledges, the greatest avian mortality
7 causes are cats and collisions with buildings and vehicles. (Direct-PSC-Tomaszewski-9).
8 Avian fatalities due to wind turbines have been extensively studied in the U.S. and are
9 consistently found to cause less than one percent of all avian fatalities. (See Ex.-Grant
10 County Solar-Locker-3). Assuming that photovoltaic (“PV”) solar results in less avian
11 mortality than wind turbines due in part to the stationary nature and lower profile of PV
12 solar in comparison to wind, avian mortalities at this facility will not impact avian
13 populations regionally or nationally. Additionally, Grant County Solar is not aware of any
14 documented impacts on avian species within solar sites in the Midwest.

15 Moreover, Grant County Solar does not believe that the lake effect hypothesis (*i.e.*,
16 evaluation of reflective surfaces of panels and orientation leading to perception as
17 wetland/open water by waterfowl or other birds) is applicable to the Project given its
18 proximity to naturally occurring bodies of water, including the Mississippi River, located
19 approximately 4 miles south of the Project, and major tributaries. Importantly, studies on
20 this hypothesis are generally conducted in dry, arid landscapes with respect to solar
21 facilities that cover large land areas. NextEra Energy Resources, LLC (“NEER”), the
22 indirect parent of Grant County Solar, has found to date that there are no population level
23 impacts on species found at solar projects. In addition, NEER is participating in and
24 partially funding a study led by the United States Geological Survey (“USGS”) on the lake

1 effect hypothesis in the desert southwest where it is thought the phenomenon may be more
2 prevalent due to the area being one of the most water-poor places on Earth.

3 The area of the Mississippi River flyway where the Project is located is nearby
4 other suitable habitat that is available for utilization, including the Mississippi River and
5 its major tributaries, and clearly offers more natural conditions for water-dependent birds
6 and other avian species. In comparison, the desert Southwest, where the previously
7 mentioned studies were conducted, is significantly different from the Mississippi River
8 flyway as temperatures in the desert Southwest can rise as high as 120°F and water
9 resources are scarce. Birds migrating through the arid desert Southwest habitat have very
10 limited stopover choices available. The landscape in southwestern Wisconsin, however,
11 includes many available stopover water resources within a 25-mile buffer of the Project
12 Site, as well as a matrix of different habitat communities available for migrating and
13 foraging birds. For example, GIS-based comparison of features in the National
14 Hydrography Dataset within 25 miles of two PV sites in the Mojave Desert of California
15 to the Project Site demonstrates substantially greater availability of water in the regional
16 vicinity of the Project. A total of 1,024 waterbodies totaling 2,792 acres are located within
17 a 25-mile radius of the Project, while the two PV sites studied in the Mojave Desert of
18 California, the Desert Sunlight Solar Farm and Genesis Solar Energy, had 57 waterbodies
19 totaling approximately 99 acres of surface water and 181 waterbodies totaling
20 approximately 393 acres of surface water, respectively. Thus, the 25-mile radius around
21 the Project has between 5-17 times more waterbodies available for use by migrating birds,
22 with 7-28 times more available surface water acreage compared to the two respective
23 Mojave Desert PV sites.

1 With respect to reflection, solar panels, including the panels which will be used for
2 the Project, are designed to absorb light rather than reflect it. Nevertheless, the tracking
3 panels in the array at the Grant County Solar Project will include anti-reflection coating.

4 Moreover, as discussed in my direct and rebuttal testimony, (Direct-Grant County
5 Solar-Locker-11; Rebuttal-Grant County Solar-Locker-4), post-construction avian
6 mortality monitoring will be conducted at both the 300 MW Badger Hollow Solar
7 generation facility located in Iowa County, which is adjacent to Grant County and
8 approximately thirty miles from the Project, and the Two Creeks Solar Facility in
9 Manitowoc and Kewaunee Counties. *See*, Docket 9697-CE-100, *Application for a*
10 *Certificate of Public Convenience and Necessity of Badger Hollow Solar Farm, LLC to*
11 *Construct a Solar Electric Generation Facility, to be Located in Iowa County, Wisconsin,*
12 *Final Decision, issued on April 18, 2019 (PSC REF#: 364425); see also, Docket 9696-CE-*
13 *100, Application for a Certificate of Public Convenience and Necessity of Two Creeks*
14 *Solar, LLC to Construct a Solar Electric Generation Facility, to be Located in Manitowoc*
15 *and Kewaunee Counties, Wisconsin, Final Decision, issued on April 18, 2019 (PSC REF#:*
16 *364423). The avian studies at these geographically diverse solar generation facilities,*
17 *which share the same fundamental technology as the Grant County Solar Project, will*
18 *provide the Commission with a scientifically meaningful basis to address this issue.*
19 *Moreover, the Project Site has similar vegetation, avian habitat, and is similar to the Badger*
20 *Hollow Solar site from an environmental perspective. Thus, any additional study of avian*
21 *mortality at the Grant County Solar Project Site would be redundant, costly, and*
22 *unnecessary. Importantly, the Commission implicitly recognized the redundancy of such*
23 *a study when it declined to require an avian mortality study in the Point Beach Solar and*
24 *Paris Solar proceedings. (See generally Docket No. 9804-CE-100, Application for a*

1 *Certificate of Public Convenience and Necessity of Point Beach Solar, LLC to Construct a*
2 *Solar Electric Generation Facility, to be Located in Manitowoc County, Wisconsin, Final*
3 Decision, February 12, 2020 (PSC REF#: 383720) (“Point Beach Solar Final Decision”)
4 p. 29; Docket No. 9801-CE-100, *Application for a Certificate of Public Convenience and*
5 *Necessity of Paris Solar Farm, LLC, to Construct a Solar Electric Generation Facility in*
6 *the Town of Paris, Kenosha County, Wisconsin, Final Decision, December 29, 2020 (PSC*
7 REF#: 402226) p. 28).

8 Moreover, as discussed in my direct testimony, for the life of the Project, Grant
9 County Solar will voluntarily develop and implement a Wildlife Response and Reporting
10 System (“WRRS”) to standardize actions taken by site personnel to detect wildlife
11 incidents within Project boundaries. (Direct-Grant County Solar-Locker-9). The WRRS
12 provides direction for site personnel who may encounter wildlife on-site, in an effort to
13 fulfill obligations in reporting wildlife detections. All dead or injured wildlife found by
14 Project personnel or others in the Project Site will be reported to the Project owner’s
15 appropriate environmental services personnel. Personnel will conduct walking WRRS
16 inspections of two panel array sections per day with every panel array section inspected on
17 a weekly basis.

18 Therefore, with evaluation of the Project demonstrating low risk for avian
19 collisions, Grant County Solar’s voluntary implementation of a WRRS, and formal post-
20 construction mortality monitoring planned for another project in close proximity to the
21 Project, additional post-construction avian mortality monitoring for this Project would be
22 duplicative and unnecessary.

23 **Q. The GCI Witnesses seek clarification that Grant County Solar will provide the**
24 **Commission and the Wisconsin Department of Natural Resources (“WDNR”) Staff**

1 **annual reports of Grant County Solar’s WRRS. (Rebuttal-GCI-Frear-4; Rebuttal-**
2 **GCI-Cray-12). Is Grant County Solar willing to provide the Commission and WDNR**
3 **Staff annual reports of Grant County Solar’s WRRS?**

4 A. Yes. As stated in my rebuttal testimony, Grant County Solar will provide the Commission
5 and WDNR staff with annual reports of Grant County Solar’s WRRS if the Commission
6 determines that such reporting is reasonable and necessary. (Rebuttal-Grant County Solar-
7 Locker-5).

8 **Wetlands and Waterways**

9 **Q. In their rebuttal testimony, Mr. and Mrs. Cray sponsor an exhibit that claims to**
10 **“clearly mark” all waterways on the Project Site. (Rebuttal-GCI-Cray-3-5; Ex.-GCI-**
11 **Cray-11). Have you reviewed Ex.-GCI-Cray-11?**

12 A. Yes, I have reviewed Ex.GCI-Cray-11.

13 **Q. Does Ex.-GCI-Cray-11 clearly mark all waterways on the Project Site?**

14 A. No. The map image provided in Ex.-GCI-Cray-11 lacks important information necessary
15 to help identify the content within the map, including a source citation and legend.
16 Moreover, the links provided as source citations for these maps do not link to the map
17 source. Although a legend and source are necessary to accurately determine the map
18 content, the map image appears to depict the drainage basin and drainage patterns around
19 the property of Mr. and Mrs. Cray. It is very likely that portions of the depicted
20 drainageways have been captured underground within culverts. Culverted drainageways
21 are not regulated by the U.S. Army Corps of Engineers or the WDNR as waterways.
22 Nevertheless, the applicable features shown on Ex.-GCI-Cray-11 that are within or
23 adjacent to the Project have been taken into account in the development of Stormwater
24 Management and Erosion Control Plans.

1 **Q. How were wetlands and waterways in the Project Study Area identified and verified?**

2 A. As described in my direct testimony, wetlands and waterways in the Project Study Area
3 were identified and verified using field delineation methods per the U.S. Army Corps of
4 Engineers 1987 manual, in accordance with Wis. Stats § 281.36(2m). (Direct-Grant
5 County Solar-Locker-5-6). The Application also includes a desktop review of an
6 approximately 60-acre area that was added to the Project Study Area after the end of the
7 2019 growing season. Field delineation of these 60 acres was completed in the 2020
8 growing season and were resubmitted with the response to PSCW 1.13 REVISED
9 Appendix O – Wetland Delineation and Stream Assessment Report. (Ex.-PSC-Data
10 Request Response PSCW-1.13). A total of fifteen (15) field verified wetlands and twelve
11 (12) field verified waterways were delineated within the Project Study Area. Additionally,
12 eleven (11) WDNR mapped waterways are located within the Project Study Area that did
13 not exhibit evidence of stream characteristics during field delineation.

14 Approximately 6.671 acres of non-forested wetland (89% of total wetlands) and
15 less than one-acre of forested wetland (11% of total wetlands) are located within the Project
16 Study Area. Wetlands identified in the Project Study Area include wet meadow, floodplain
17 forest, shallow marsh, and seasonally flooded basin, and farmed wetlands. Both permanent
18 and temporary wetland and waterway impacts have been avoided by all Project
19 components including the arrays, underground collection system, and associated facilities.
20 Additional information regarding wetlands and waterways within the Project Study Area
21 can be found in REVISED Wetland Delineation and Stream Assessment Report (Ex.-PSC-
22 Data Request Response PSCW-1.13).

1 **Q. Mr. and Mrs. Cray assert that the Project will impact wetlands and waterways on the**
2 **Project Site (Rebuttal-GCI-Cray-5, 10-11). How do you respond?**

3 A. I disagree. As discussed in my direct and rebuttal testimony and consistent with Wis. Stat.
4 § 196.491(3)(d)3 and 4, the Project is designed to avoid temporary or permanent impacts
5 to wetlands and waterways. (Direct-Grant County Solar-Locker-6; Rebuttal-Grant County
6 Solar-Locker-6). The Project includes minimum 20-foot setbacks around wetlands and 75-
7 foot setbacks around both field delineated and WDNR mapped waterways. Underground
8 collection line crossings of waterways and wetlands within both the Proposed Array and
9 Alternative Array will be installed via Horizontal Directional Drilling. As described
10 below, indirect impacts to wetlands and waterways resulting from stormwater runoff will
11 be minimized under the Project’s Stormwater Management and Erosion Control Plans.

12 No sensitive wetlands, state or federally listed waterways, trout streams, fisheries,
13 wilderness areas, wild or scenic rivers, recreational areas, or other sensitive resources of
14 state or federal concern will be impacted by construction activities. Moreover, no surface
15 waters identified as outstanding or exceptional resources (Wis. Admin. Code Ch. NR 102)
16 will be impacted. Thus, no undue adverse effect to environmental values relating to
17 ecological balance including wetland functions and relating to recreational use will occur
18 as a result of the Project.

19 **Q. Does the WDNR agree with your conclusion?**

20 A. Yes. As set forth in my rebuttal testimony (Rebuttal-Grant County Solar-Locker-6-7),
21 direct testimony submitted by WDNR witness Tekler states “[n]one of the wetlands or
22 waterways within the project area are proposed to be impacted, as avoidance of these
23 sensitive areas was achieved due to siting project components outside of their boundaries,
24 avoiding traversing across these areas with vehicles and equipment, and by utilizing

1 trenchless underground installation for collection lines.” (Direct-WDNR-Tekler-3). There
2 is no record evidence to validly challenge the conclusion.

3 **Q. GCI Witnesses Mr. and Mrs. Frear assert that Grant County Solar is “proposing to**
4 **create a 2,000 acre brownfield.” (Rebuttal-GCI-Frear8). How do you respond to the**
5 **Frears’ assertion?**

6 A. The Frears’ assertion is false. As set forth in Sections 1.7.3 and 5.13.6 of the Application
7 and discussed in my direct testimony and in my rebuttal testimony, the construction and
8 operation of the Project will involve minimal soil disturbance on the approximately 1,403-
9 acre Project Site. (See Ex.-Grant County Solar-Application: Sections 1.7.3 and 5.13.6;
10 Direct-Grant County Solar-Locker-14; Rebuttal-Grant County Solar-Locker-13-15). Grant
11 County Solar will minimize the amount of grading that is required to reduce disruption to
12 the valuable topsoil. Importantly, construction and operation of the Project is not
13 anticipated to significantly change the soil nutrient content in the Project Site. Moreover,
14 the Vegetation Management Plan for the Project will stabilize soil following construction
15 activities and protect neighboring crop fields and natural areas by minimizing the
16 establishment of invasive vegetation and noxious weeds, thereby maintaining or improving
17 the health of the soil for future agricultural use. The temporary removal from agricultural
18 usage during the lifespan of the Project will reduce the runoff from pesticides and allow
19 the land to rest as managed perennial grassland. Vegetation management will be completed
20 primarily through mechanical means, with targeted herbicide use as needed for invasive
21 vegetation and noxious weeds.

22 To facilitate a return to agricultural use following decommissioning, the land would
23 be tilled to break the new vegetative growth, which will enhance the topsoil condition.
24 Preliminary seeding and re-vegetation plans are provided in CONFIDENTIAL Appendix

1 H – Vegetation Management Plan. (Ex.-Grant County Solar-Application: Appendix H).
2 Locations on the Project Site that have been compacted or excavated and backfilled will
3 be graded and decompacted, as necessary, to restore the land to conditions suitable for
4 agricultural or other pre-construction land use. If present, drain tiles that have been
5 damaged will be repaired or replaced to at least pre-construction condition. Topsoil will
6 be placed on disturbed areas and seeded with appropriate vegetation or in coordination with
7 landowners within agricultural land.

8 Once the Project is fully decommissioned, each property owner can sample the soils
9 and, as needed, add fertilizer to match the crop(s) to be planted. As such, it is very likely
10 the cropland will be returned to pre-construction yields. Accordingly, once the Project Site
11 is fully decommissioned the property owners will be able to return the land to agricultural
12 use.

13 **Potential Photovoltaic Heat Island Effect**

14 **Q. The GCI Witnesses continue to express concern that the Project will produce a PHVI**
15 **effect that will result in significant adverse impacts to their property. (Rebuttal-GCI-**
16 **Frear-6; Rebuttal-GCI-Cray-10). Does the Project pose a significant risk due to**
17 **potential PHVI effects?**

18 **A.** No. As set forth in my direct and rebuttal testimony, and discussed more fully in Grant
19 County Solar’s Response to Public Service Commission of Wisconsin Data Request 2.01
20 and in Response to Grant County Intervenors Data Request GCI-6.4 to 6.11, measurement-
21 based studies evaluating the potential PVHI effect do not indicate a consistent pattern of
22 significant temperature differences. (See Direct-Grant County Solar-Locker-19-21;
23 Rebuttal-Grant County Solar-Locker-20-24; Ex.-PSC-Data Request Response PSCW-
24 2.01; Ex.-Grant County Solar-Locker-5; Ex.-Grant County Solar-Locker-10). For

1 instance, initial data from Demirezen et al. (2018) did not identify statistically significant
2 differences in temperature distributions inside and outside the array for any timeframe.
3 Moreover, Armstrong et al., (2017), provided in Response to GCI Data Request No. 6.4,
4 indicated potential localized air and soil temperature cooling directly beneath or between
5 arrays at a fully vegetated solar facility in the southern United Kingdom. (See Ex.-Grant
6 County Solar-Locker-5).

7 Taken collectively, the studies indicate that any effect on air temperature is highly
8 localized. Armstrong et al., (2017), the only study conducted at a site with similar climate
9 and vegetation characteristics to the proposed Project, did not show a significant increase
10 in air or soil temperatures. Based on the studies, any potential increases in air temperature
11 are limited to the space directly above, and in very close proximity to, the solar arrays.
12 Any increase will quickly dissipate with distance from the array perimeter due to daytime
13 convective mixing. The panels are likely to cool at night. Moreover, the presence of access
14 roads between arrays and re-vegetation under and around the arrays will have additional
15 cooling effects.

16 In addition, the temperate climate of the Project Site will further reduce any
17 potential PVHI effect. In contrast to the majority of studies documenting the PVHI effect,
18 the Grant County Solar Project is located in a temperate region. Importantly, studies on
19 the PVHI effect hypothesis have primarily been conducted in arid and semiarid landscapes
20 (e.g., Arizona) on solar facilities with bare ground beneath and around arrays. However,
21 background temperatures could greatly impact the PVHI effect. For example, the theory
22 of PVHI has been compared to the better-documented Urban Heat Island (“UHI”) effect,
23 which measures the temperature impact of human activity in urban areas. Studies have
24 found that the UHI effect varies with background temperatures, such that the magnitude of

1 the UHI effect was greater in areas with higher temperatures. As demonstrated with the
2 climate data provided in my direct testimony, Lancaster, Wisconsin is consistently cooler
3 than southern Arizona in both maximum and minimum temperatures across all seasons.
4 (*See Direct-Grant County Solar-Locker-19*).

5 Although the magnitude of potential impact from PVHI is much smaller than that
6 of UHI, researchers are drawing on strategies identified by UHI studies to reduce any
7 potential PVHI effect. Primary among these strategies is the implementation of vegetation
8 to provide cooling benefits through ground shading and evapotranspiration. Ground
9 shading, such as that produced by PV panels or underlying vegetation, reduces surface
10 temperatures by reducing the amount of solar radiation that reaches and is absorbed by the
11 ground. Evapotranspiration combines evaporation, the conversion of liquid water to water
12 vapor, and transpiration, the process by which plants absorb water through their roots and
13 emit it through their leaves. Evapotranspiration uses heat from the air to evaporate
14 transpired water, thereby providing a cooling effect. In fact, research in southern Arizona
15 demonstrated that PV installations that were revegetated with grasses under the panels had
16 a strong cooling effect, significantly lowering air temperatures within the array when
17 compared to arrays underlain by bare ground. (*See Ex.-Grant County Solar-Locker-5*).

18 Significantly, the Project Site will be planted with perennial vegetation beneath and
19 around arrays. A Vegetation Management Plan was developed and submitted in Appendix
20 H – Vegetation Management Plan to CPCN Application (Ex.-Grant County Solar-
21 Application: Appendix H) to ensure the long-term condition of the on-site vegetation,
22 providing further cooling.

23 Due to the documented dissipation of PVHI with distance from the facility, the
24 decreased PVHI effect anticipated for lower background temperatures, and the anticipated

1 temperature reducing effects of vegetation established beneath and around the arrays, the
2 PVHI effect will not result in a significant impact to the community surrounding the
3 Project.

4 **Q. GCI Witnesses Mr. and Mrs. Frear assert that the Fthenakis and Yu Study (2013)**
5 **included in Grant County Solar's Response to PSCW Data Request No. 2.01**
6 **demonstrates that a change in temperature of 0.5° C will occur at their home.**
7 **(Rebuttal-GCI-Frear-6). Do you agree with the Frear's conclusion?**

8 A. No. As discussed in my rebuttal testimony and stated and documented in Grant County
9 Solar's Responses to GCI Data Request No. 6.4 through 6.11, there is a low risk for the
10 Project to have a significant effect on temperature. (*See* Rebuttal-Grant County Solar-
11 Locker-20-24; Ex.-Grant County Solar-Locker-5; Ex.-Grant County Solar-Locker-10).
12 Armstrong et. al. (2017), the only study conducted at a site with similar climate and
13 vegetation characteristics to the proposed Project did not show a significant increase in air
14 or soil temperatures. The studies provided in Ex-GCI-Frear-5 all present different patterns
15 of findings, with Demirezen et al. (2018) finding no significant differences in temperature
16 distributions for any timeframe. All studies finding an increase in air temperatures
17 associated with the solar array were completed in semiarid locations with bare ground
18 beneath and around arrays.

19 Although Fthenakis and Yu (2013) suggests potential effects on temperature up to
20 300 meters from a solar facility, the study relied on existing weather stations that do not
21 represent a gradient of distance from the facility and whose sensor accuracy for air
22 temperature is only $\pm 0.5^{\circ}\text{C}$. As the stations located 100 meters and 210 meters from the
23 facility differed from the reference station by approximately 0.6 and 0.5°C respectively,
24 the sensor accuracy could have a large impact on the study conclusions. Unfortunately,

1 the study does not present data on variation or certainty. The Barron-Gafford Research
2 Group (2016) research presented in Response to PSCW Data Request 2.01 also used
3 sensors with an accuracy for air temperature of $\pm 0.5^{\circ}\text{C}$ and measured distances from the
4 solar array at 10-meter intervals. (See Ex.-PSC-Data Request Response PSCW-2.01). This
5 study, also conducted in the semiarid southwest on arrays underlain by bare ground, found
6 temperature increases dissipated between 20 and 30 meters (approximately 65 to 98 feet)
7 from the array edge. The Barron-Gafford Research Group (2018) further found that PV
8 installations in the semiarid southwest that were revegetated with grasses beneath arrays
9 were significantly cooler than arrays underlain by bare ground. As stated earlier, due to
10 the documented dissipation of potential PVHI effect with distance from the facility, the
11 decreased PVHI effect anticipated for lower background temperatures, and the anticipated
12 temperature reducing effects of vegetation established beneath and around the arrays, the
13 PVHI effect will not result in a significant impact to the community surrounding the
14 Project.

15 **Q. Mr. and Mrs. Frear sponsor an article titled “The Impact of Utility-Scale**
16 **Photovoltaics Plant on Near Surface Turbulence Characteristics in Gobi Areas” as**
17 **Ex.-GCI-Frear-13 to their rebuttal testimony. Did you review Ex.-GCI-Frear-13?**

18 A. Yes, I have reviewed Ex.-GCI-Frear-13.

19 **Q. Does Ex.-GCI-Frear-13 demonstrate that the Project will produce a PHVI effect that**
20 **will result in significant adverse impacts to the community surrounding the Project?**

21 A. No. The study provided as Ex.-GCI-Frear-13, Jiang et. al. (2020), does not directly address
22 the PVHI effect. The study evaluates near surface turbulence at a solar facility in Xinjiang,

1 China, “located at the intersection of the [Gobi] desert and oasis.”¹ Photographs and aerial
2 imagery confirm the arid conditions and lack of vegetation within and around the facility
3 (*see* Ex.-GCI-Frear-13, Figure 1). Ex.-GCI-Frear-13 confirms that the “underlying surface
4 is Gobi [desert] with sparse vegetation,” and describes the climate as a “typical continental
5 temperate arid climate.” The facility evaluated in the study appears to contain fixed-tilt
6 PV arrays, while the proposed Project will use tracking arrays.

7 The Jiang et. al. study observed different patterns in near surface turbulence
8 characteristics between the solar facility and a reference site located an undisclosed
9 distance outside of the facility. The study did not directly address temperature differences
10 between the studied site and reference site. Rather, the study identified differences in the
11 pattern of heat exchange between the studied site and the reference site, finding an increase
12 in sensible heat flux (*i.e.*, atmospheric heat exchange resulting in temperature changes) and
13 a corresponding decrease in latent heat flux (*i.e.*, atmospheric heat exchange resulting in
14 phase changes, such as the change of liquid water to water vapor) within the facility
15 compared to the reference site. The magnitude and statistical significance of the difference
16 is not reported. The study additionally identified unstable turbulence conditions in both
17 the PV facility and reference site during the day and stable conditions overnight. Both
18 magnitude of difference and variation were greater within the PV facility; however,
19 statistical significance is not reported.

20 The dissimilarity in the relative humidity, terrain, and ground covering between the
21 Project Site and the arid desert sites evaluated in Ex.-GCI-Frear-13 and other studies such
22 as Fthenakis and Yu (2013) precludes a relevant comparison.

¹ Near surface turbulence is the movement of air near the earth’s surface, such as from winds varying across surfaces including ground, vegetation, and other objects or from air rising and sinking with temperature differences.

1 **Q. Does this conclude your prefiled surrebuttal testimony?**

2 **A. Yes it does.**