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NOVEMBER 20, 2023

Town of Sturbridge Planning Board
c/o Jean Bubon, AICP
Town Planner
301 Main Street, First Floor
Sturbridge, MA 01566
RE: Proposed Photovoltaic System, 200 Haynes Street, Response to Peer Review, Fire Department & Public Comments

Dear Jean,

BSC Group, Inc. (BSC) has reviewed the comments provided by CMG, as contained in correspondence to the Sturbridge Planning Board, dated November 1, 2023. In addition, this letter also provides responses to comments received from the Sturbridge Fire Department and the Sturbridge Retirement Co-op. The original comments are shown below and the Applicant's responses follow in bold font.

Peer Review Comments from CMG

General Engineering & Stormwater Management Design Comments

1. CMG recommends Applicant coordinate proposed site access with the Sturbridge Fire Department to determine if emergency apparatus can enter and exit the site safely. A truck turn diagram for the Sturbridge Fire Department's apparatus should be provided.

   A diagram showing a Sturbridge Fire Department's apparatus is now included in the plan set using vehicle tracking for Civil 3D.

2. Site Grading Plan is difficult to read due to the 1" = 60' scale and does not provide existing elevation contour labels on all proposed grading areas.

   Plans were prepared at a scale of 1" = 60' because it is desirable to see the entire site on one sheet, rather than two. It has the added benefit of reducing unnecessary paper. However, we do recognize that it is more difficult to read. In an effort to accomplish both, we have modified the site plans to a scale of 1" = 50' and also added a sufficient number of contour labels to ease the review of the plans. A waiver from §3.01B.2 to allow presentation of site plans, at the submitted scale.

3. A portion of the proposed solar voltaic panels are proposed within the limits of the proposed steep grades (associated with the Infiltration Basin). Please verify constructability of the panels along this slope.

   The location of proposed solar voltaic panels has been shifted outside of the 3:1 slope to the maximum extent possible. The portion of the panels that remains within the 3:1 slope shall be constructed in a way to ensure stability.

4. CMG recommends all proposed slopes on the Grading Plan be labelled to identify 2:1 and 3:1 slopes.

   Callouts have been included in the drainage and grading plans so specify the 3:1. There are no longer any portions of the site that are graded at a 2:1 slope.

5. There is no proposed drain pipe or accompanying design calculations to accommodate existing runoff flow through Haynes Street roadside swale underneath the proposed driveway apron.

Please see updated design and calculations, a 12" RCP culvert is now implemented below the driveway apron to catch runoff flow toward the street.

6. Driveway apron construction detail should be provided. More grading detail of this area should also be shown to determine if guard rails are necessary adjacent to the drainage swale on either side of the entrance.

   Spot grades have been added to the driveway apron, it will meet the grade of the existing roadway. Guardrails shall not be necessary as the slopes off of the driveway are not greater than 3:1. The grading plan now shows the existing and proposed profile of the driveway.

7. Applicant to obtain a Street Entrance Permit from the Department of Public Works.

   A Street Entrance Permit shall be submitted to the Department of Public Works prior to the start of construction.

8. Applicant needs to accurately locate the nearby adjacent septic system at the Sturbridge Crossing Condominium property on Bentwood Drive and verify the distance to the proposed infiltration basin. Proposed Site Infiltration Basin #1 appears to be located approximately 80 feet from the condominium's property line greater than the Massachusetts Stormwater Standards setback requirement of 50 ft. and 310 CMR 15.211 Title V setback for stormwater infiltration = 25 ft.

   There is no obligation on the part of the Applicant to locate the existing soil absorption system that is located on an abutting parcel of land, which is not under the control of the Applicant. The proposed infiltration basin is located 72.0 feet away from the property line at it closest point, and therefore complies fully with the setback requirements of both Title V and also the MA Stormwater Management Standards. No further action is necessary in this regard.

9. Site plans show a proposed 7' height chain link fence. CMG recommends a gate detail also be provided.

   A gate detail has been added to the site plans.

10. Planting Plan notes planting of trees and shrubs in certain areas but does not provide planting details and/or planting list or schedule.

    The planting of trees is not proposed at this time. We feel that the site will be sufficiently screened, as indicated on the Planting Plan. Upon construction, if the Town Planner determines that screening is insufficient, trees will be provided at that time, as necessary. Tree planting details have been added to the site plans.

Stormwater Standard 1: *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or water of the Commonwealth.*

11. How will runoff from the first 90± ft. of the proposed access driveway apron be routed and treated to prevent runoff flow into the Haynes Street roadway gutter line?

    The proposed access driveway is crowned, directing runoff to the proposed grassed channels on either side of the driveway.

12. Site's interior gravel access road appears to be super elevated with proposed catch basin locations on the high side of the road. Catch basins should be located on the low side in order to collect roadway runoff. In addition, CMG recommends catch basin grates be constructed with concrete collars and a detail provided for all locations within the gravel access road.

    Catch basins have been relocated to the low side of the road.

Stormwater Standard 2: *Stormwater management systems shall be designed so that post development peak discharge rates do not exceed pre-development peak discharge rates.*

13. Stormwater report indicates very small increases to post-development peak rate discharge at several stormwater outfalls during the 2-year and 10-year storm events. CMG recommends Engineer reduce all post-development discharge rates to be equal to or below pre-development conditions.

    The stormwater design has been modified. There are no longer increases anticipated for any of the design storms.

14. Rational method pipe sizing calculations are not included in the submitted stormwater report for the proposed drain pipes.

    Rational method pipe sizing calculations are included in the Stormwater Report.

Stormwater Standard 3: *Loss of annual recharge of groundwater shall be eliminated or minimized.*

15. Subcatchment Area 1S does not appear to account for the proposed concrete equipment pads. The HydroCAD model, required recharge volume calculations, and required water quality volume calculations should be revised to incorporate the increase in impervious area.

    The concrete equipment pads have been relocated and are no longer within sub catchment area 1S. They are now within sub catchment are 5S and have been accounted for in the HydroCAD model.

16. The engineer shall revise the Grading Plan to include elevations associated with test pit locations.

    The grading plan now includes elevations associated with test pit locations.

17. Estimated seasonal high groundwater elevations in proximity to the infiltration BMP's cannot be determined due to the scale and lack of existing contour labels on the Grading Plan.

    The scale of the drawings has been modified to 1" = 50'. Multiple contour labels have been added to the plans for ease of review.

18. Infiltration basin side slopes appear to be greater than 3:1.

    Infiltration basin #1 side slopes are graded at 3:1.

19. The top of berm elevation for Infiltration Basin #1 is unclear. A minimum of 1 ft. of freeboard must be provided during the 100-year storm event. Calculations indicate top of berm = 705 with peak elevation during 100-year storm = 704.4.

    The top of berm elevation for infiltration basin #1 is 706.0', the peak elevation during the 100-year storm is 704.79' which provides 1.21' of freeboard.

Stormwater Standard 4: *Stormwater management systems shall be designed to remove 80% of the average annual post construction load of Total Suspended Solids (TSS).*

20. Section 2.04 of the submitted stormwater report includes a required water quality volume calculation which utilizes a rainfall depth of 0.45". Section 7.03 of the same report includes a water quality volume calculation which utilizes a rainfall depth of 1-inch due to the presence of soils with rapid infiltration rates. CMG is in agreement with the calculation utilized in Section 7.03. The stormwater report should be revised to include the correct WQV calculation in both sections.

    A rainfall depth of 1-inch has been utilized in both calculations.

Stormwater Standard 5: *Land uses with higher potential pollutant loads (LUHPPL), source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.*

Not Applicable – CMG is in agreement the Site is not considered a LUHPPL.

Stormwater Standard 6: *Stormwater discharges within a Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area.*

Not Applicable – CMG is in agreement the project is not a critical area.

Stormwater Standard 7: *Redevelopment Projects*

Not Applicable – Site is not a redevelopment project.

Stormwater Standard 8: *Construction period erosion and sedimentation control*

21. The Site is > 1 Acre therefore an NPDES SWPPP is required to be submitted prior to construction. CMG recommends the Planning Board make this a condition of approval.

    The Applicant is aware of the NDPES Phase II requirements and will comply fully.

22. Inlet protection for the proposed catch basins shall be included in the Soil & Sediment Control Plan.

    Inlet protection will be installed in all new catch basins upon installation. The Erosion & Sediment Control Plan (Sheet 7) has been modified accordingly and a detail has been added to Sheet 8.

23. Slope stabilization measures, such as an erosion control blanket, shall be implemented for 3:1 slope or greater. The slope for the cut associated with the proposed infiltration basin cannot be determined on the provided 1" = 60' scale plan. Slope stabilization measures such as rip-rap armoring may be necessary for slopes steeper than 2:1.

    Erosion control blankets are now proposed for all proposed 3:1 slopes. There are no proposed 2:1 slopes.

24. Due to the presence of relatively steep slopes, CMG recommends the engineer include silt fence backing as part of the erosion control compost filter sock.

    Silt fence backing will be provided for the compost filter sock, as recommended by CMG.

25. Erosion and Sediment control plan should provide properly sized temporary sediment basins and swale locations to control sediment laden runoff during construction.

    Suggested location(s) of temporary sediment basins and swales have been added to the Erosion & Sediment Control Plan (Sheet 3).

Stormwater Standard 9: *Long term operation and maintenance plan*

26. Standard Met – a comprehensive long-term operation and maintenance plan is included as part of the submitted stormwater report.

    No further comment.

Stormwater Standard 10: *Illicit discharges*

27. A signed Illicit Discharge Statement is not provided within the O&M Plan.

    A signed Illicit Discharge Statement has been provided by the Applicant and appended to the O&M Plan.

General Engineering & Stormwater Management Design Comments

28. §300-10.3.B.(4) – Applicant proposes to utilize an anti-reflective coating on the solar panel's front glass to mitigate glint and glare. Applicant should provide manufacturer's specifications indicating the specific properties of the anti-reflective coating to document there will be "no" glare. Otherwise, CMG recommends a glare analysis be provided.

    Please see the attached letter which specifies the glare/reflection required by the manufacturer.

29. §300-10.5.A – The proposed equipment pads appear to be located within 100' of the front property line setback.

    The equipment pads have been relocated accordingly.

30. §300-10.5.A – Applicant notes the solar field utilizes approximately 17% of the parcel's square footage. Please provide additional supporting calculations as the limits of the proposed solar project appear to be larger than 17% of the site's square footage. Only twenty percent (20%) of a parcel's total square footage may be used for a solar facility.

    Total Site Area = 8.42 acres (366,775.2 sq. ft.)

    Total Area of Solar facility = 1.42 acres (61,852 sq. ft.)

    61,852 sf / 366,775 sf = 0.168 = 16.8 %

31. §300-10.5.B – The project does not meet the 200' buffer setback from a residential use for the Sturbridge Crossing Condominiums property located to the South.

    The site plans have been revised accordingly.

32. §300-10.6.A – Applicant states there will be no lighting for the project. CMG recommends Applicant verify if there will be security lighting and if so please provide a manufacturer's cut sheet showing it will be a full cut-off dark sky compliant fixture.

    Security lighting is not proposed. There will be no lighting of any kind.

33. §300-10.6.E – CMG recommends a cut/fill analysis be provided to document proposed site grading impacts to the property.

    Total Fill = 8,022.76 cubic yards

    Total Cut = 8,492.38 cubic yards

    Net Volume = 469.58 cubic yards of cut

34. §300-19.3.B.3 – Applicant is requesting a waiver not to provide a traffic study for the proposed solar project as the project will not generate traffic to and from the subject parcel, with the exception of maintenance visits. CMG defers to the Planning Board regarding this waiver request.

    No further comment.

Town of Sturbridge Planning Board Rules & Regulations

35. §3.01B.2 – Site Plan Review applications shall include a site plan with a scale of one-inch equals 40 feet (Also See Comment #2).

    As noted above, BSC shall submit a waiver from §3.01B.2 to allow presentation of site plans at the submitted scale.

Town of Sturbridge Wetlands Regulations

36. §365-3.4B & 365-6.2 – Tree cutting is proposed within the 100' to 200' wetland buffer along the north end of the project. Applicant should document compliance with this section based on discussions with the Conservation Commission.

    The Applicant is aware of this requirement and has discussed the proposed tree blearing with the Conservation Agent.

37. §365-3.7.A – The proposed surface stormwater basin does not contain a sediment forebay.

A sediment forebay is not necessary because there are no impervious surfaces conveying stormwater runoff to this facility.

38. §365-3.7.C – Stormwater maintenance plans must be submitted to and approved by the DPW Director before the Sturbridge Conservation Commission will accept them.

    Stormwater maintenance plans shall be submitted to the Sturbridge DPW director.

39. §365-3.8.A – O&M Plan should be revised to note the Commission prohibits the use of pesticides, fertilizers and herbicides within the 100-foot buffer and prohibits the use of salts, quick release fertilizers and quick release herbicides within the 200' buffer.

    This has been stated in Section 5.0 of the Operations and Maintenance Plan.

40. §365-7.6.B – Plan scale shall be 1" = 20' or as appropriate (Also see Comment #2 & #35).

    As noted above, BSC shall submit a waiver from §3.01B.2 to allow presentation of site plans at the submitted scale.

Comments from Sturbridge Fire Department

There will be an ESS on site to collect from the panels. The fire department requests the following to be included in the final proposed plans:

1. A knox box mounted at a fixed location at the exterior of the fencing for access.

   A Knox Box will be provided and mounted to the gate.

2. All NFPA required signage be provided.

   All required NFPA signage will be provided.

3. A gate providing direct access to the ESS and any shutoffs for efficient emergency management.

   The proposed development will be secured by fence and gate, as previously described.

4. Manufacturer/cut sheets with the specs on the ESS and the solar panels.

   This information is included on the Interconnection Plans, which have been submitted to the Town.

Questions from the Sturbridge Retirement Co -Op (SRCC)

1. Will construction plans be submitted to Planning Board for design review?

   No. This is not the process. A detailed technical review of the site plans has been performed by the Town's consultant, CMG.

2. Will all contractors be given a copy of and sign their receipt of all approved Documents?

   The Applicant and BSC will ensure that the General Contractor is provided with the plans and documentation necessary to construct the proposed development in accordance with the approved plans.

3. Will there by any contaminating runoff, pollutants, pesticides, fertilizer, hazardous materials used or generated by the ground-mounted photovoltaic system or infrastructure?

   No. Fertilizers and pesticides will not be used at this site, and there will not be any stormwater runoff generated containing these or hazardous materials.

4. Where does Infiltration Basin 1 overflow?

   There is no proposed overflow for the Infiltration Basin. The basin has over 1.2' of available freeboard in the 100-year storm. In the event that this basin would ever overflow, it would surcharge in all directions. This would be an extreme and unlikely event.

5. Where are the stumps, boulders and other deleterious soils to be disposed of?

   All excavated materials not reused on site will be removed by the Contractor and disposed of in accordance with local, state and federal regulations.

6. Could the Siltsoxx and temporary diversion swale with check dams to remain as long as possible?

   No, all proposed erosion and sedimentation controls will be removed prior to the filing of a Notice of Termination, as required by NPDES.

Please do not hesitate to contact us should you have further questions or concerns. We look forward to discussing the revised site plans at the next public hearing.

Sincerely,

BSC Group, Inc.

Brian G. Yergatian, P.E., LEED AP
Manager of Civil Engineering, Senior Associate

CSI Solar Co., Ltd
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RoadSuzhou New District, Jiangsu, China
215129
www.canadiansolar.com

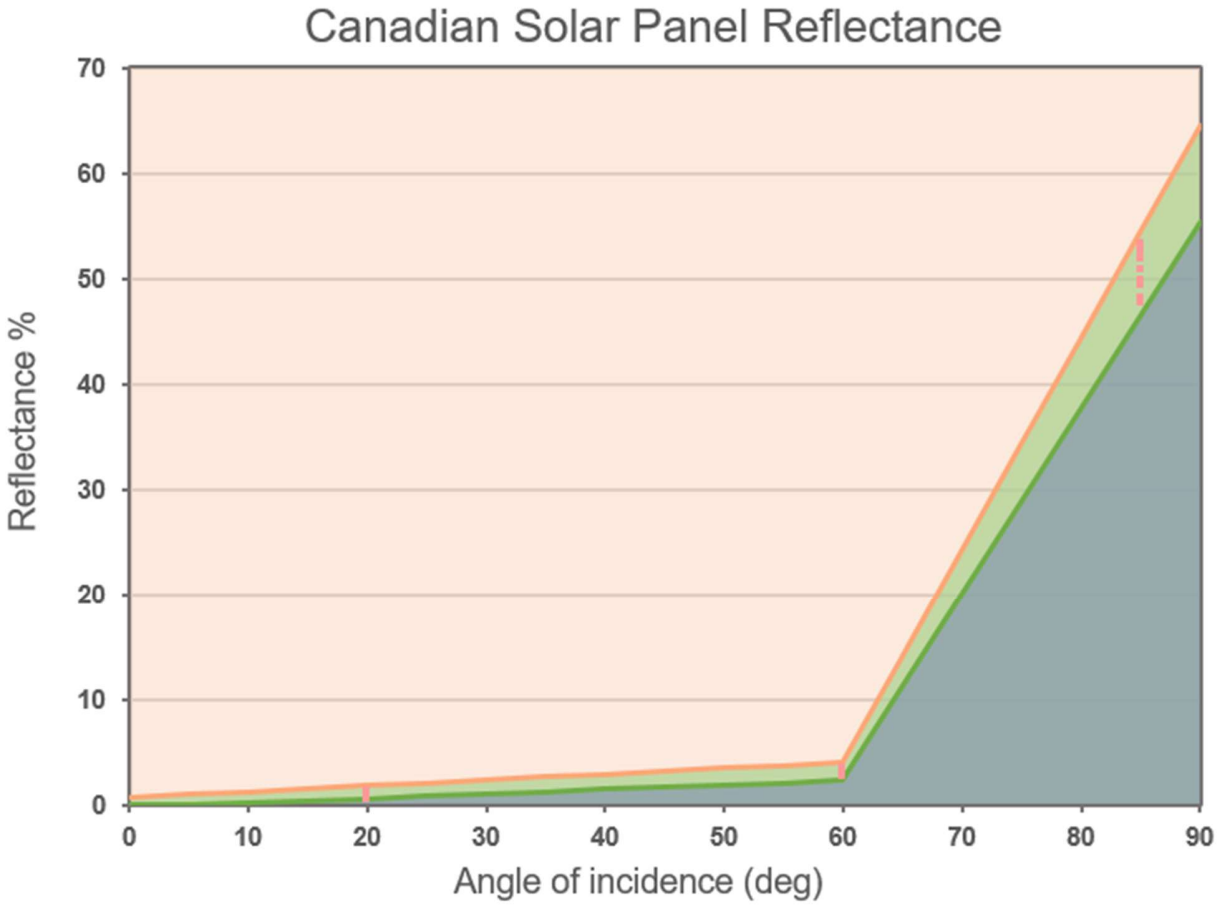
NO. TS202333035

Date: November 07, 2023

Subject: Statement about modules' reflection

To whom it may concern,

Reflectance is dependent on incidence angle, and becomes very high at large incidence angles (see below picture for reference, test results from CSI CPTL Lab refer to ISO 2831:1994, the standard module reflectance of CSI is likely to plot in the light green area).



Canadian Solar uses "high-transmission low-iron" glass in our solar modules, and narrow down the accepted range of glass surface roughness. This type of glass transmits more light, producing less glare and reflectance than normal glass. This high-transmission glass meets the military's reflectance requirement, where this value has to be less than 10%. Canadian Solar declares that Modules produced using antireflection coated solar glass have a reflectance value below 5% when with up to 60°angle of incidence.

CSI Solar Co., Ltd
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RoadSuzhou New District, Jiangsu, China
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Canadian Solar is committed to guarantee our product quality so that we can deliver high quality modules to our valued customers.

It is the responsibility of the system designer and installer to conduct load calculation and to select the appropriate support structure. The mounting design and procedures must comply with local electrical and building codes. System designers and installers are solely responsible for load calculations and the proper design of the supporting structure.

Sincerely,

Cris.Zhang

Cris Zhang
Technical Support Engineer
Email: cris.zhang@csisolar.com

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System Bulletin No 2

Solar Glare Hazard and Evaluation Methodology

Contents:

References:

1. **ISO 9050-2003 total solar energy transmittance and related glazing factor.**
2. **EN 410-2011 Determination of luminous and solar characteristics of glazing**
3. **Methodology to Assess Potential Glint and Glare Hazards DOI: 10.1115/ 1.4004349]**

October 2014

Scope:	Solar Glaring Hazard and Evaluation Methodology
Intended Exposure:	External, Internal
Groups:	Product, R&D, Marketing, Sales Technical Support departments Customers
Technical Contact:	PV Product Development Department

Emdee Xing, wanrong.xing@canadiansolar.com, EXT: 66169
Jean-Nicolas Jaubert, Jn.jaubert@canadiansolar.com, EXT: 66139

Fig.1 Solar glare scene of PV arrays

Multiple agencies and governmental bodies such as air force, energy commissions and academies are interested in evaluating potential safety risks brought by emerging energy technologies. Having several large PV plants installed at or close to main airports, Canadian Solar Inc. has been worrying its customers who enquire about aviation safety. In the last few years, we launched various studies and analyses related to glint and glare caused by reflective surface of photovoltaic (PV) arrays. Some approaches involve developing in-house capability for glare risk evaluation, with the glare risk being strongly related to the PV plant design. Meanwhile we keep working on offering total solutions to glint and glare impacts of solar energy, and supporting the aviation community and our customer base by cooperating with well-known laboratories on further research work.

Reflection occurs when a light beam hits a surface. When the beam hits a flat surface at a given angle, the angle of rebound of the beam will be equal to the incident beam angle relative to the surface normal. Refraction is like reflection governed by Descartes law. When the beam hits the surface, it doesn't totally reflect but part of the energy passes through, so the refracted beam now has a different direction relative to the surface normal.

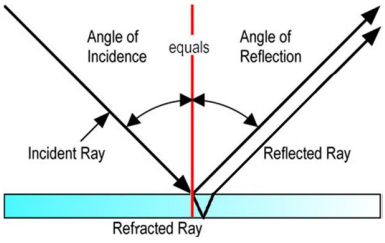

Fig.2 Refraction and reflection

The incident rays that have been reflected are the sources for producing glint and glare phenomena, which are also referred to as light pollution. Standard photovoltaic glass transmits about 91.5% of incident light beam and reflects about 5%, which is under or close to normal incidence.

Other than light beam paths, refraction index is also one of the key parameters that influence the transmission and reflection rate. Air has a refraction index of 1.00 by convention, and reduction of reflection when light coming through air strikes a transparent surface is basically a matter of reducing the refraction index of that surface to or as close to 1.00 as possible. The most familiar reflective material is water, which has an index of refraction of 1.333. Under windless weather condition a quiet pond will have a very smooth, reflective surface. With the information above, one would expect that anti-reflective coated glass should be slightly less reflective than the water (Index 1.25 versus Index 1.333). Surface roughness is another relevant parameter that influences the light reflection mechanisms by modifying the part of specular reflected light (by opposition to–diffuse reflected light, which does not contribute to glare and glint). **Knowledge of the photovoltaic glass reflectivity under different incident light angles is the first stone of a reliable glare evaluation**.

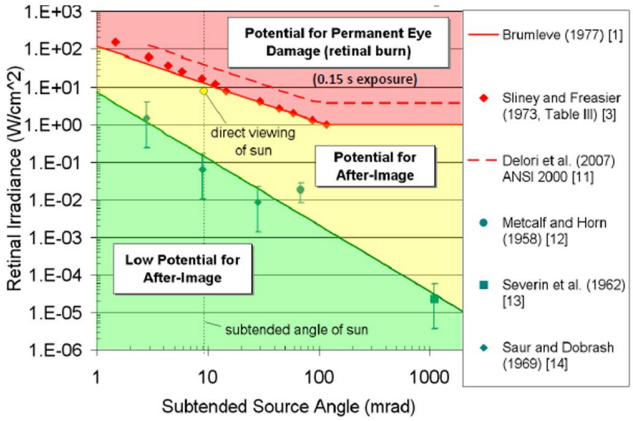

Fig.3 Ocular hazard metrics

Besides intrinsic reflectivity characteristics of the surface evaluated, occurrences of glint and glare will be

governed mainly by the respective positions of the sun and observation points (control tower, flights), as well as by the design of the photovoltaic power plant. Based on data inputs covering peak irradiance, source angle and distance between glare spot and observation points, detailed calculations could be done to evaluate the amount of reflected radiant energy that will reach the retina of an observer located at a given place and a given point in time. **This calculation is the core of any glare evaluation performed by Canadian Solar Inc., which requires various input information about the PV plant and airport**.

Fig.3 has been defined by Ho et al. (2010, 2011) from SANDIA Laboratories and aims to correlate glare conditions (retinal irradiance, subtended source angle) to ocular hazard metrics, including potential for permanent eye damage and after-image effect or low potential for after-image effect. Canadian Solar Inc. is applying the metrics established by this third party to its solar glare hazard evaluations. Once we obtain the calculation results of retinal irradiance versus subtended source angle for the various observation points of a given project, we can locate them on SANDIA chart, which can tell us whether the glare impact on pilots or controllers could pose risks.

Canadian Solar Inc. has been characterizing the optical performance of its solar modules, and working with several specialized test laboratories to perform extensive measurements for various solar glasses it uses. By now, the main reflectivity data has been tested and verified by Sandia National Laboratory, a 3rd party with recognized expertise in the field of glare research.

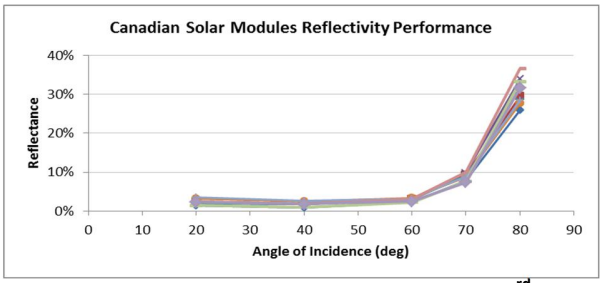

Fig.4 Canadian Solar Inc. Module reflectivity by 3rd parties

In order to estimate potential glare and glint hazards from solar farms under construction, Canadian Solar Inc. has put in place a procedure and a team for performing rigorous and scientific evaluations, on demand of customers or aviation authorities.

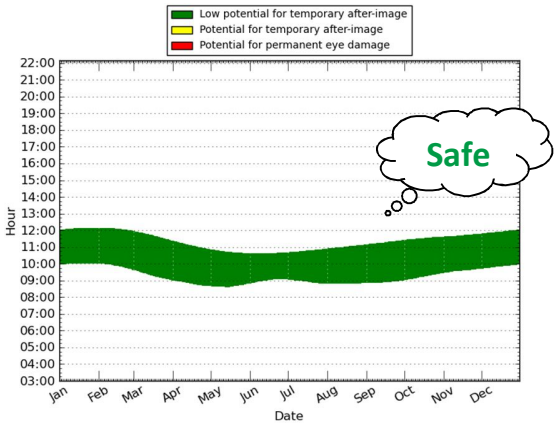

Fig.5 Analyzed spot glare status plot

All the simulations are processed using 3rd party owned software and meteorological data source, along with reflectivity data for Canadian Solar Inc. products. In cases where hazardous glare is detected, proper mitigation methods are proposed, ranging from simple caution boards on risk areas to modifications of the solar array configurations. Detailed analysis is also provided in the latter case, including expected effect on system energy yield.

Fig.6 Caution board

Any further modifications of the photovoltaic array design may cause significant changes to the simulation results.

In the past months, Canadian Solar Inc. team has run analysis on several projects all around the world, and issued 4 engineering evaluation reports. For the first project located in southern Australia, our customer already received a recognition letter for our technical evaluation from CASA (Civil Aviation Safety Authority of Australia).

Beyond all these evaluations, Canadian Solar Inc. has also further experience installing photovoltaic arrays near airports. Within the past decade, Canadian Solar Inc. has been offering modules or turnkey service for solar plants located at proximity from airports of Thunder Bay, Ontario with 8.5MW in February, 2012; San Jose, California with 1.12MW in June, 2010; and Ahlorn, Germany with 27MW in Nov, 2012.

Regulatory provisions

(US) FAA Guidelines

In the USA, the Federal Aviation Administration published its first guidance on the use of solar energy technologies around airports in November 2010. Chapter 3 of that document lists glare as one of the potential hazards of solar technologies at or near airports. It should be noted that the FAA guide specifically addresses solar technology at or near airports, but it does not address any issues arising from solar energy facilities that is not located in the vicinity of an airport.

The FAA study points out that, while solar collector technology adopts highly reflective surfaces, PV technology is primarily absorptive since the purpose of the PV panel is to absorb as much of the sun energy as possible. The study notes that the degree of reflectivity of a PV panel will depend upon the intensity of the incoming light and the reflectivity of the panel surface.

(UK) CAA Guidelines

The UK Civil Aviation Authority (CAA) issued interim guidance on the impact of solar photovoltaic systems on aviation in December 2010. Following internal review of the FAA guidance, the CAA will issue formal policy and guidance on this issue, including the impact of systems deployed farther than 15km away from aerodromes.

(FR) DGAC guidelines

The DGAC (French equivalent of FAA for airport regulation) also has detailed guidelines for installation of PV modules in airport. The document, very detailed, has specific requirements that luminance should be lower than:

- 10,000 cd/m^2 for PV arrays located in zone B (light beam in direction of the pilot, sight angle -90/+90º between reflected beam and sight axis toward the road, airplane located in zone B itself).

- 20,000 cd/m^2 for PV arrays located in zone A (light beam in direction of the pilot, sight angle -30/+30º between reflected beam and sight axis toward the road, distance below 3000m).

- No PV installations authorized in zone C.

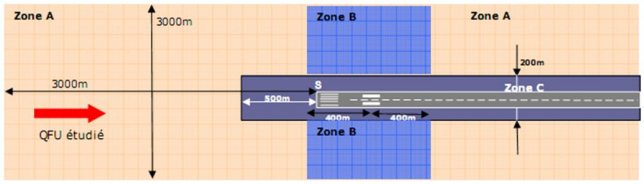

Fig.7 DGAC regulation zoning of airport

Amendment Records

AMENDMENT NUMBER	DATE	AMENDMENT MADE BY	AMENDMENT APPROVED BY	AMENDMENT DESCRIPTION (pages removed, added or modified)	AMENDMENT JUSTIFICATION
EN_A/0	2014-02-25	Emdee XING	Jean-Nicolas JAUBERT	Original edition	
EN_A/1	2014-12-18	Emdee XING	Jean-Nicolas JAUBERT	Updated info about PV farms using CSI modules. Review English.	