



04.02.2018

Memorandum

TO:

Chris Anderson
City Planner
City of Ramsey
Ramsey, MN 55303

FROM:

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RE: Anoka Solar Project: Glare Analysis Summary

As part of the zoning review, a glare analysis was completed using Forge Solar software for the proposed solar facility. Glare impact was measured at eleven different observation points (OP) around the solar array. The solar panels will be south facing and tilted at 25 degrees. This means that there is no potential for any glare to occur north of the array, which is the primary location the public may view the project from. The results of the glare analysis are summarized below and the full results are given in the attached report.

Solar panels are designed to absorb light rather than reflect it. There are several important considerations to keep in mind when evaluating the glare study results:

- **The panels are covered with anti-reflective coatings**, and are constructed with dark-colored (usually blue or black) materials.
- **Similar panels are used on airports**, including Minneapolis-St. Paul, Denver, Indianapolis, and Sacramento. They have been approved by the FAA for this use as any potential glare is determined not to negatively impact pilot navigation.
- The panels proposed for this project, unlike other types of solar technology, **do not utilize reflective mirrors**. It is a common misconception that glare is a potential problem for all solar due to people's experiences with mirror technology which is not commonly deployed.

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- The Forge Solar software **has a conservative default panel reflectivity value of 10%, which cannot be adjusted**, but it is important to note that the application of anti-reflective coatings and textured glass used on this site **reduces reflectivity to as low as 2%** according to studies performed on the proposed solar panels. This two percent value is about the same as water and less than soil or even wood shingles.
- Because trees, existing structures, and slopes between the array and observation points are ignored, it is very likely the majority of this glare potential is significantly reduced or eliminated.

This analysis is a conservative study method that allows us to gain a high level of confidence that the risk of glare is minimal.

Seven (OP 1,2,3,4,8,10,11) out of the eleven observation points will experience **no potential for glare**.

Four (OP 5,6,7,9) observation points indicated potential for glare. This report refers to this as **“Green”** and **“Yellow”** glare.

It is important to note that the terms **“Green”** and **“Yellow”** glare only refer to the **potential** for glare, not the presence of it.

“Green” glare is defined as “glare with low potential to cause a temporary after-image”, meaning even if you are standing at the observation point and stare at the reflective surface specifically where the sun rays are hitting the panel, there is a low potential that you would even experience the effects of temporary after-image.

“Yellow” glare is defined as “glare with potential to cause a temporary after-image”, meaning if you are again standing at the observation point and stare at the reflective surface specifically where the sun is glaring, there is a potential that you would experience the effects of temporary after-image. This after-image effect is similar to what you experience when you glance at a light bulb and then look away or close your eyes.



The figures below illustrate what “glare” looks like on a solar array. It is the reflection of the sun’s rays where they hit the array in one location – an entire array does not reflect the sun from every panel. It is a temporary reflection similar to the sun’s rays hitting any other kind of glass. In the case of solar panels their dark color and anti-reflective coating make them even less reflective than glass. Glass buildings which are much more reflective than solar panels are commonly installed worldwide with no impacts or need for mitigation.



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Generally, all potential glare timeframes are limited to 0-20 minutes around sunrise or sunset during the months of March through September, and is only visible if the viewer is standing at specific locations close to the array and staring directly into the localized glare spot on the array. Below are the specific times and durations of potential glare at each of these observation points – as noted, most of which are not accessible by the general public, obstructed from existing trees/buildings, or out of view due to topography.



Observation Point #5

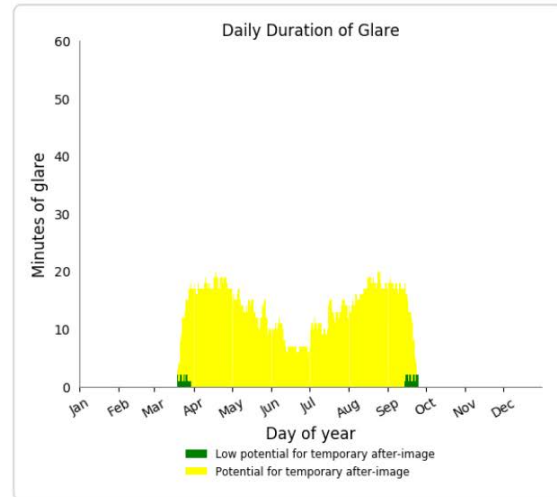
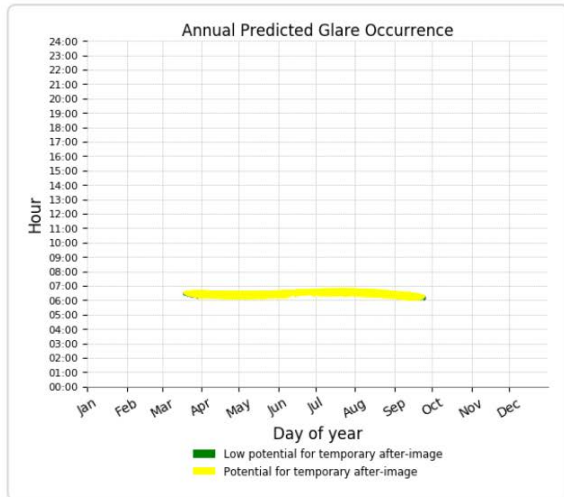
Green Glare: N/A; Low potential for 1 minute around 6:20pm on 2-3 days of the year.

Yellow Glare: N/A

Observation Point #6 – (This point is obstructed by existing trees and site topography, but this obstruction is not accounted for in the study)

Green Glare: Low potential for 0-3 mins around 6:30am on 5-7 days a year in March & Sept.

Yellow Glare: Potential for 0-20 mins around 6:30am (March 20th – September 20th)

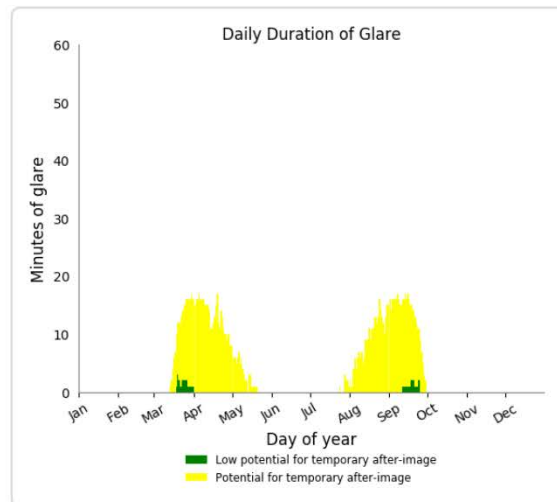
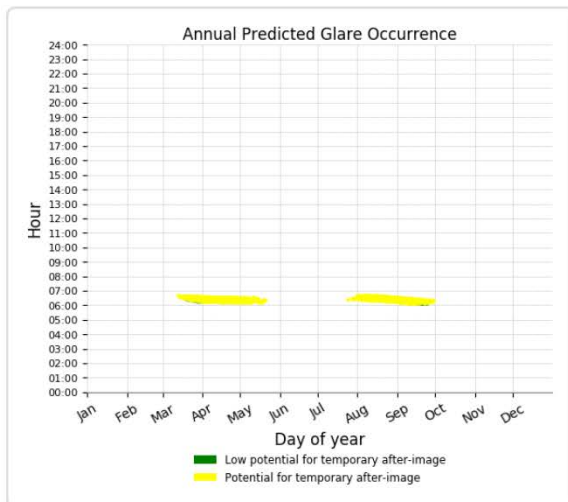


- **Obstructions:** This point is surrounded by trees and there are additional tree on-site that block the view, in addition to the site’s topographic changes.

Observation Point #7 – (This point is obstructed by existing trees)

Green Glare: Low potential for 0-5 mins around 6:30am on 6-8 days a year in March & Sept.

Yellow Glare: Potential for 0-19 mins around 6:30am (3/15 – 5/20 & 7/30 – 9/31)

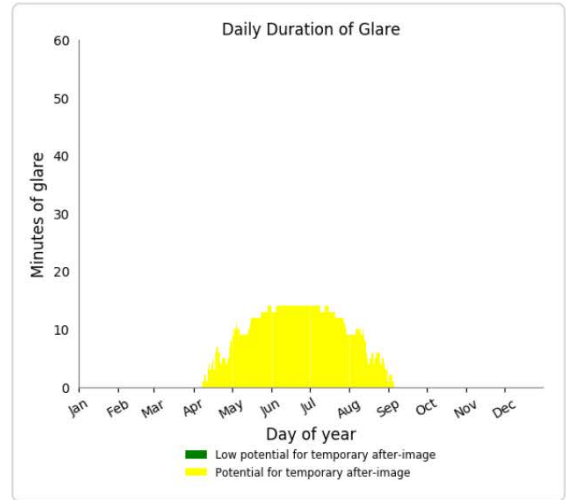
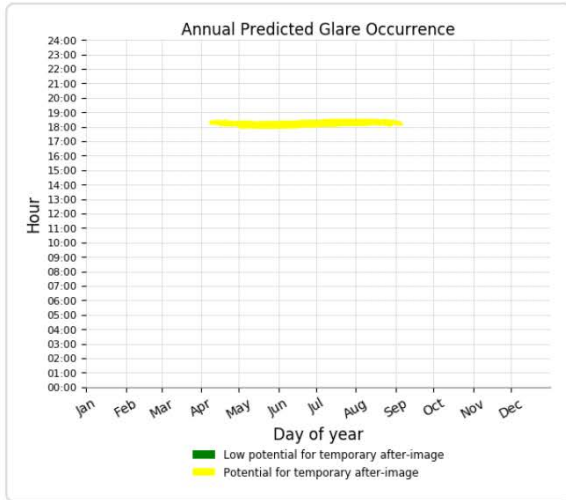


- **Obstructions:** OP is surrounded by trees and there are additional tree on-site that block the view.

Observation Point #9

Green Glare: N/A

Yellow Glare: Potential for 0-18 mins around 6:15pm (April 1st – Sept. 1st)



- **Obstructions:** This glare potential only exists if you are standing on the west side of the barn, otherwise the barn itself obstructs the potential glare.