Solar Sun System: The sun changes its east-west orientation throughout the day. It also changes its north-south position throughout the year. The sun reaches its highest position in the sky at noon during the summer months and its lowest position in the sky at noon during the winter months (see Figure 9). Sun calculations and results were based on the National Oceanic and Atmospheric Administration (NOAA) hours of operational daylight and solar clocks (NOAA 2013). The 3D computer simulations incorporated a precise solar algorithm based on the latitude and longitude of the Project's location in Southern California. All calculations were performed using 3D software designed for calculating and animating solar cycles. The following times of year were analyzed:

Spring Equinox (March 20, 2013): 12 hours 8 minutes of daylight, where the day and night are equal in length. Apparent sunrise at 6:49 a.m. and apparent sunset at 6:57 p.m.

Summer Solstice (June 21, 2013): 14 hours 18 minutes of daylight, where the length of sunlight hours is at its peak and the sun has reached its northernmost extremes. Apparent sunrise at 5:38 a.m. and apparent sunset at 7:56 p.m.

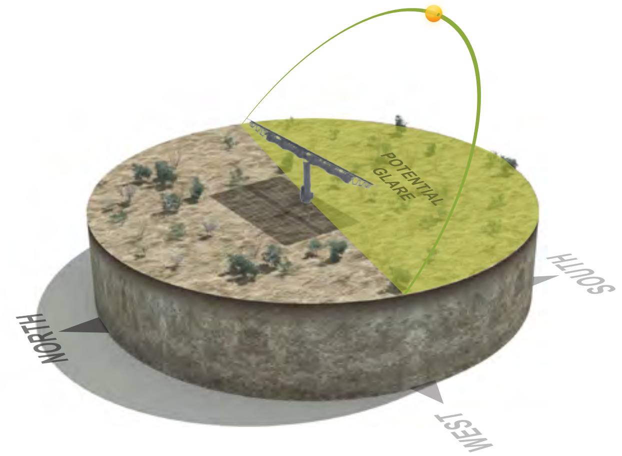
Autumnal Equinox (September 22, 2013): 12 hours 7 minutes of daylight, where the day and night are equal in length. Apparent sunrise at 6:34 a.m. and apparent sunset at 6:41 p.m.

Winter Solstice (December 21, 2013): 10 hours of daylight, where the length of sunlight hours is at its lowest and the sun has reached its southernmost extremes. Apparent sunrise at 6:44 a.m. and apparent sunset at 4:44 p.m.

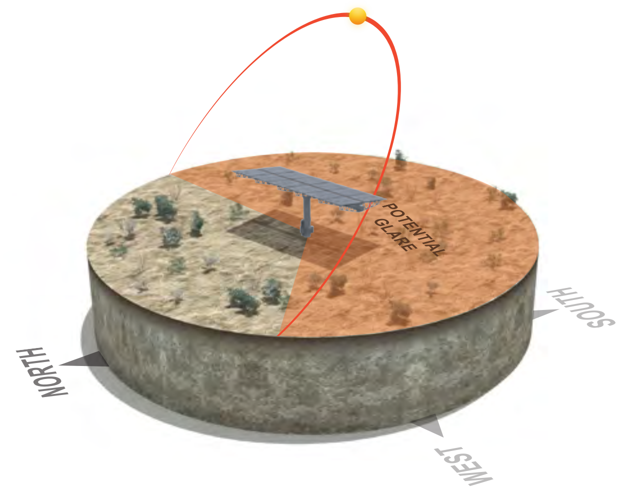
By analyzing the equinox and solstice dates, seasonal trends can be established to accurately predict the occurrence of glare throughout the year.

3.3 Glare Evaluation: 3D Geometric Analysis

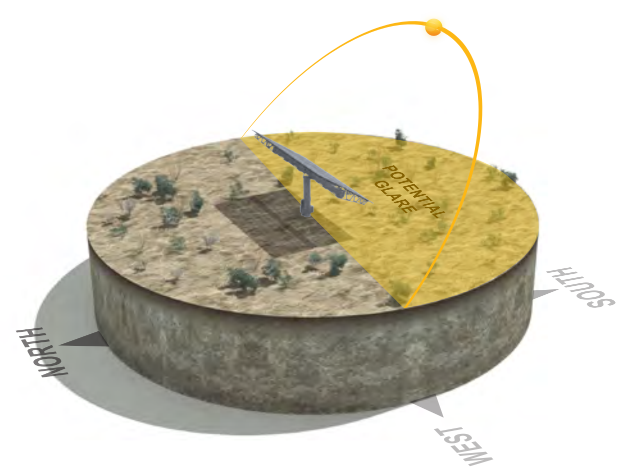
The occurrence of glare was studied by performing a 3D geometric analysis, which takes into account the position of the sun in relation to the angle of the solar modules to determine the path of glare (see Figure 10). The computer simulation also included movement of the CPV modules during the stow and tracking phases of the operations. Once all the conditions were simulated in a 3D computer program, visual analysts were able to determine if, when, and where glare may cross into the KOP's vision. A visual analyst recorded the occurrence of glare in a series of spreadsheets (refer to Section 4.0 and Appendix A for glare results).



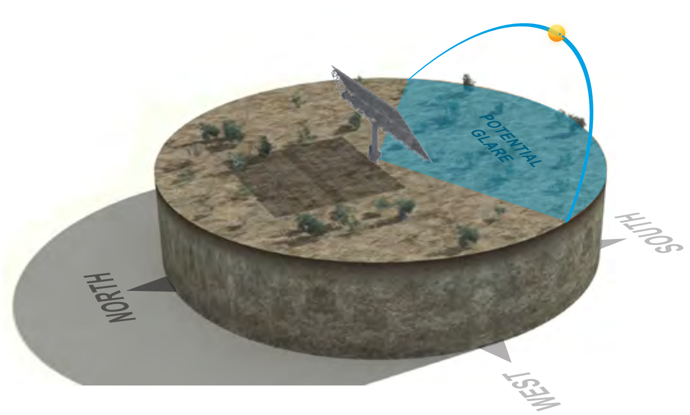
Spring Equinox
March 20, 2013
12 hours 9 minutes of daylight
Sunrise - 6:45 a.m.
Sunset - 6:54 p.m.



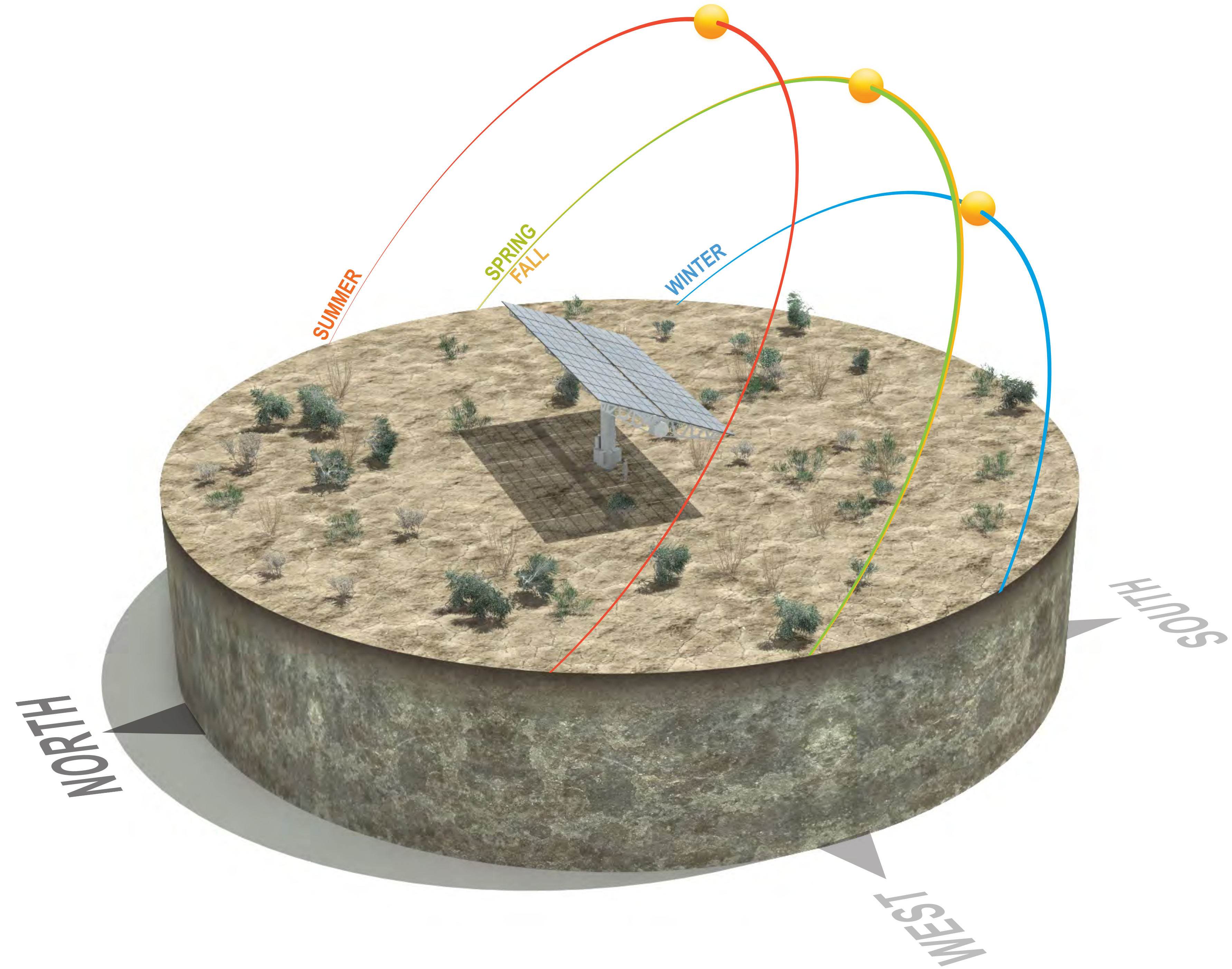
Summer Solstice
June 21, 2013
14 hours 18 minutes of daylight
Sunrise - 5:35 a.m.
Sunset - 7:53 p.m.



Fall Equinox
September 22, 2013
12 hours 7 minutes of daylight
Sunrise - 6:31 a.m.
Sunset - 6:38 p.m.



Winter Solstice
December 21, 2013
10 hours 1 minutes of daylight
Sunrise - 6:40 a.m.
Sunset - 4:41 p.m.



The sun changes its east-west orientation throughout the day. It also changes its north-south position throughout the year. The sun reaches its highest position in the sky at noon in the summer months and its lowest position in the sky at noon during the winter months.

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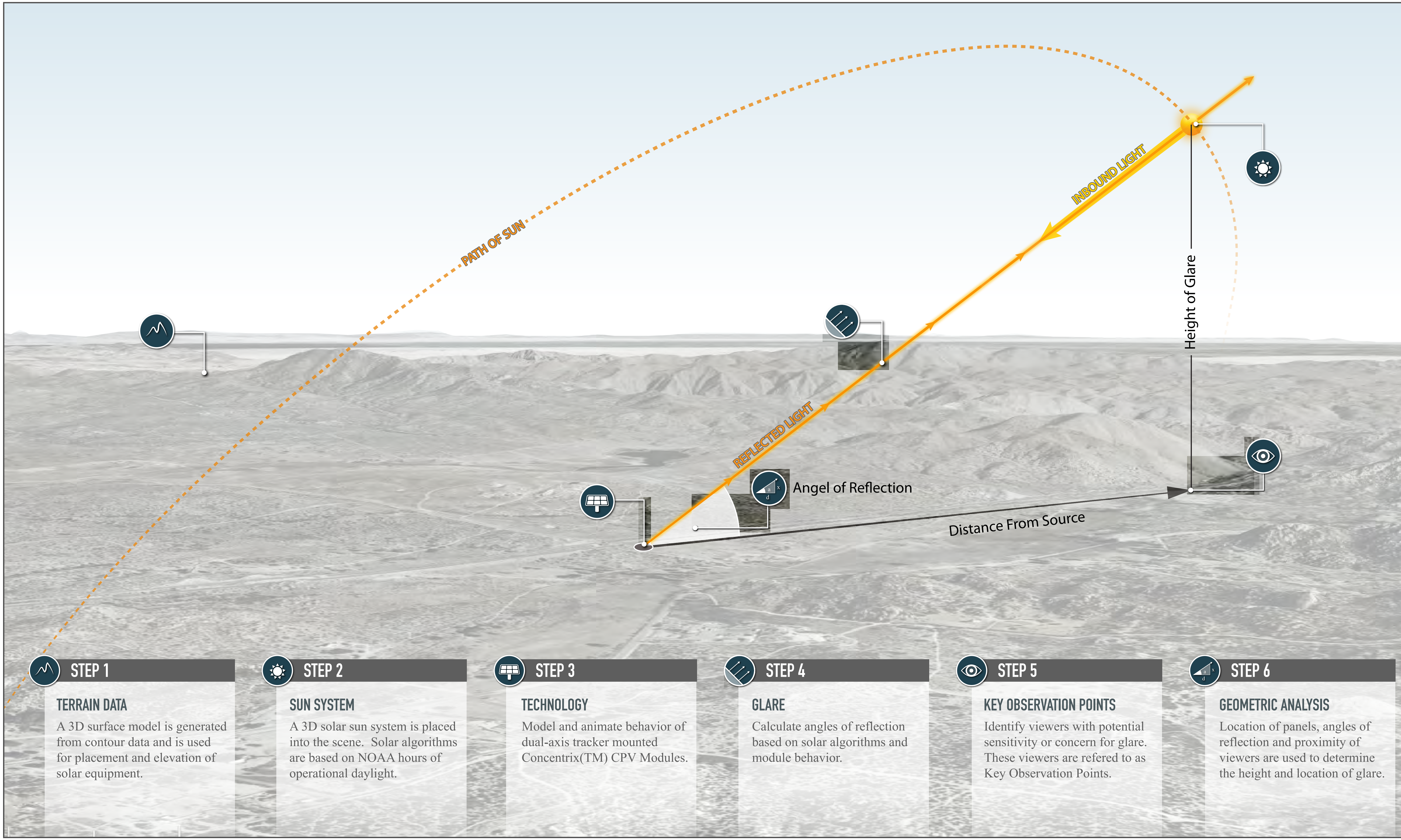
GLARE BEHAVIORAL ANALYSIS

Figure 9 - Solar Sun System



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NOTE: Illustration demonstrates location of glare for one solar module only. Actual analysis includes the entire solar project.

GLARE BEHAVIORAL ANALYSIS

Figure 10 - Geometric Analysis

4.0 RESULTS

POWER's analysts reviewed each proposed solar site and documented when glare may be visible to residential viewers and motorists on Interstate 8. Review of the 3D geometric analysis determined glare would be visible from multiple residences and Interstate 8 throughout the year. In most cases, these conditions would appear during the first and last hours of daylight when the angle of the module and elevation of the sun are at their lowest. Results have been reported in a worst-case scenario, where minor terrain undulation and native vegetation are not treated as a visual screen to glare. For a map of each KOP location and detailed tabular results, please see Appendix A. The following is a description of glare resulting from each proposed solar site and the impacts to corresponding KOPs.

4.1 Rugged Solar

Residential: Glare from the proposed Rugged Solar site was recorded during the last hour of the day with duration not exceeding 50 minutes. Glare would be limited to five residences directly west of the Project location, with two residences being impacted during every season.

- KOP1: Glare was recorded on and around the spring equinox from 6:23 p.m. to sunset. Glare was recorded on and around the summer solstice from 7:13 p.m. to sunset. Glare was recorded on and around the autumnal equinox from 6:08 p.m. to sunset.
- KOP2: Glare was recorded on and around the spring equinox from 6:23 p.m. to sunset. Glare was recorded on and around the summer solstice from 7:23 p.m. to sunset. Glare was recorded on and around the autumnal equinox from 6:08 p.m. to sunset.
- KOP3: Glare was recorded on and around the spring equinox from 6:23 p.m. to sunset. Glare was recorded on and around the summer solstice from 7:25 p.m. to sunset. Glare was recorded on and around the autumnal equinox from 6:08 p.m. to sunset. Glare was recorded on and around the winter solstice from 4:11 p.m. to sunset.
- KOP4: Glare was recorded on and around the spring equinox from 6:23 p.m. to sunset. Glare was recorded on and around the summer solstice from 7:25 p.m. to sunset. Glare was recorded on and around the autumnal equinox from 6:08 p.m. to sunset. Glare was recorded on and around the winter solstice from 4:11 p.m. to sunset.
- KOP5: Glare was recorded on and around the winter solstice from 4:02 p.m. to sunset.

Ribbonwood Road: Glare from the proposed Rugged Solar site was recorded year round with duration not exceeding one hour. Glare is concentrated between mile markers 1.2 and 1.7 and occurred in the late evening.

McCain Valley Road: Glare from the proposed Rugged Solar site was recorded on and around the spring/autumnal equinoxes with duration not exceeding one hour. Glare is concentrated between mile markers 1.4 and 1.6 and occurred in the late evening.

Interstate 8: No glare is anticipated for motorists traveling on Interstate 8.

4.2 Lan West Solar

Residential: Glare from the proposed Lan West Solar site was recorded during the last hour of the day with duration not exceeding 40 minutes. Glare was recorded on and around the winter solstice and would be limited to four residences located southwest of the Project location.

- KOP1: Glare was recorded on and around the winter solstice from 4:17 p.m. to sunset.
- KOP2: Glare was recorded on and around the winter solstice from 4:14 p.m. to sunset.
- KOP3: Glare was recorded on and around the winter solstice from 4:09 p.m. to sunset.

- KOP4: Glare was recorded on and around the winter solstice from 4:15 p.m. to sunset.

Interstate 8: Glare from the proposed Lan West site was recorded on and around the summer solstice with a duration not exceeding 45 minutes. Glare was concentrated between mile markers 2.5 and 2.6 in the morning and between mile markers 2.0 and 2.1 in the evening.

Old Highway 80: Glare from the proposed Lan West site was recorded on and around the spring/autumnal equinoxes and winter solstice with duration not exceeding 1 hour. Glare was concentrated between mile markers 0.2 and 0.4 in the evening.

4.3 Lan East Solar

Residential: Glare from the proposed Lan East Solar site was recorded during the first hour and last two hours of the day with duration not exceeding one hour and 55 minutes. Glare was recorded throughout the year and would be limited to two residences centrally located in the Project site.

- KOP5: Glare was recorded on and around the spring equinox from 5:35 p.m. to sunset. Glare was recorded on and around the summer solstice from 7:04 a.m. to 7:15 a.m. Glare was recorded on and around the autumnal equinox from 5:20 p.m. to sunset.
- KOP6: Glare was recorded on and around the spring equinox from 5:25 p.m. to sunset. Glare was recorded on and around the summer solstice from sunrise to 6:24 a.m. and 6:03 p.m. to sunset. Glare was recorded on and around the autumnal equinox from 5:10 p.m. to sunset. Glare was recorded on and around the winter solstice from 4:21 p.m. to sunset.

Interstate 8: Glare from the proposed Lan East site was recorded on and around the summer solstice and spring/autumnal equinoxes with a duration not exceeding one hour. Around the summer solstice, glare was concentrated between mile markers 2.5 and 3.8 in the morning and between mile markers 2.0 and 3.6 in the evening. Around the spring/autumnal equinoxes, glare was concentrated between mile markers 2.7 and 3.9 in the morning.

Old Highway 80: Glare from the proposed Lan East site was recorded on and around the spring/autumnal equinoxes and winter solstice with duration not exceeding one hour. Glare was concentrated between mile markers 0.3 to 0.4 and 0.8 to 1.0 in the evening.

McCain Valley Road: Glare from the proposed Lan East site was recorded year round with duration not exceeding two hours. Glare was concentrated between mile markers 0 to 0.3 in the morning and evening.

4.4 Tierra Del Sol Solar

Residential: Glare from the proposed Tierra Del Sol Solar site was recorded during the last hour of the day with duration not exceeding one hour. Glare would be limited to six residences located west and north of the Project location, with three residences being impacted during every season.

- KOP1: Glare was recorded on and around the spring equinox from 6:03 p.m. to sunset. Glare was recorded on and around the summer solstice from 6:56 p.m. to sunset. Glare was recorded on and around the autumnal equinox from 5:48 p.m. to sunset. Glare was recorded on and around the winter solstice from 3:58 p.m. to sunset.
- KOP2: Glare was recorded on and around the spring equinox from 6:03 p.m. to sunset. Glare was recorded on and around the summer solstice from 6:56 p.m. to sunset. Glare was recorded on and around the autumnal equinox from 5:48 p.m. to sunset. Glare was recorded on and around the winter solstice from 3:58 p.m. to sunset.
- KOP3: Glare was recorded on and around the summer solstice from 7:23 p.m. to sunset.
- KOP4: Glare was recorded on and around the summer solstice from 7:26 p.m. to sunset.

- KOP5: Glare was recorded on and around the summer solstice from 7:27 p.m. to sunset.
- KOP6: Glare was recorded on and around the summer solstice from 7:26 p.m. to sunset.
- KOP7: Glare was recorded on and around the summer solstice from 7:26 p.m. to sunset.

Tierra del Sol Road: Glare from the proposed Tierra del Sol site was recorded year round with duration not exceeding two hours. Around the summer solstice, glare is concentrated between mile markers 1.0 and 2.0 occurring in the early morning and late evening. Around the winter solstice and the spring/autumnal equinoxes, glare is concentrated between mile marker 1.0 and 1.3 occurring in the late evening.

5.0 DISCUSSIONS

CPV modules are designed to directly face and track the sun throughout the day. This design allows for maximum efficiency and energy output of the modules. By tracking the sun, reflections and subsequent glare are predictable. During hours of operation, reflections bounce directly back towards the sun. Due to operational limits, panels never move lower than five degrees off horizon. To account for slight deviations in panel tracking movement and surface scattering, POWER allowed for a one degree light spread from the face of the panel resulting in reflections never lower than four degrees off horizon.

POWER took a conservative approach when recording glare, and did not account for slight deviations in the terrain or vegetation that may block glare to off-site viewers. Even when taking a worst-case scenario approach, POWER concluded that occurrences of glare are limited. KOPs immediately adjacent to the site in an easterly or westerly direction, and Interstate 8 motorists in a northerly direction are the most likely to experience glare. In all cases, the occurrence of glare is limited to the early mornings and late evenings when the sun is lowest in the sky. As distance increases from the Project sites, glare continues to rise above the terrain and above most KOPs observed.

In addition to the primary glare source resulting from the top glass plate, POWER's visual analysts recorded a secondary lighting effect while visiting Soitec's Newberry site near Barstow, California. Although the effect does not produce a bright glare source, it is visible to the offsite viewer as having a colored effect, changing hue with viewing angle and distance (see Figure 11).

GLARE BEHAVIORAL ANALYSIS

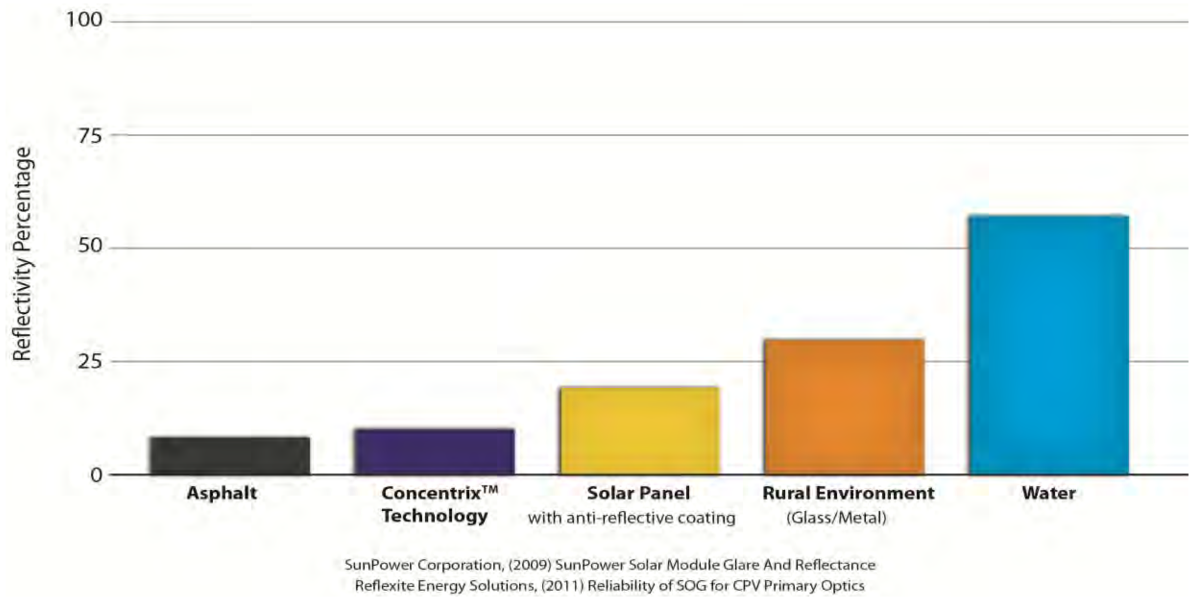
Figure 11 - Secondary Lighting Effect

5.1 Glare Intensity

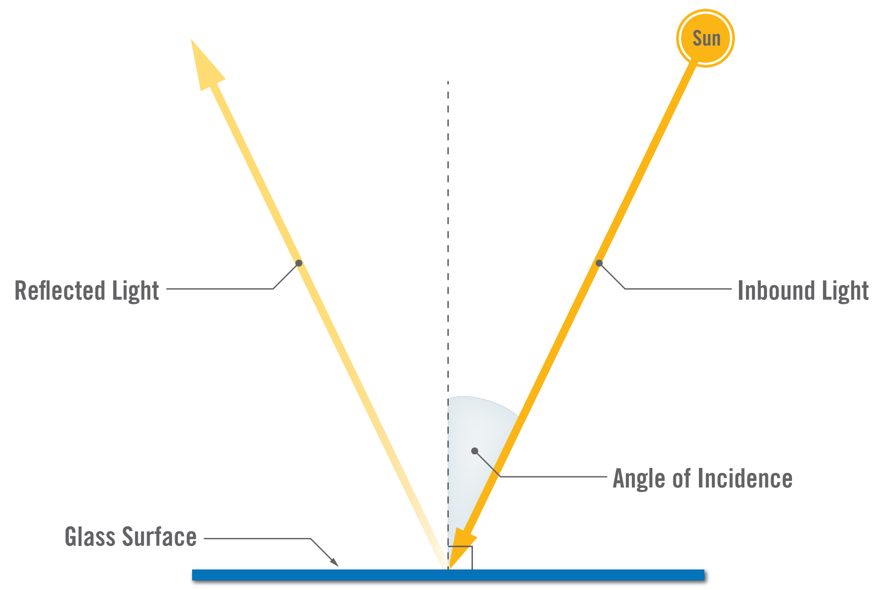
As solar operations continue to increase in size and number throughout the United States, so does the concern for glare. Concerned parties may ask, “If glare is experienced, what will the intensity be?

CPV Modules are designed to absorb solar energy inward towards the panel to produce electricity. CPV modules do not use mirrors to redirect the sun as seen with trough systems or heliostats, but rather use Fresnel lenses to concentrate sunlight onto a solar cell inside the module to produce electricity. CPV systems are similar in glare intensity to that of a PV panel because both technologies rely on a top glass plate to protect the solar equipment. Glare is primarily produced from the top plate which reflects a small portion of the sun’s image back to the viewer, making the glare comparable to other PV technology, building glass, and water (see Figure 12).

FIGURE 12 COMPARATIVE REFLECTIVE ANALYSIS



In recent years, there have been many studies reporting different levels of glare percentages associated with PV panels and panel glass. Studies range from 2% glare intensity (FAA 2010) to 25% intensity (SunPower 2009). It is important to understand that glare intensity is directly related to the angle of incidence of the sun striking the panel, and may account for the wide range of past results. As reported in a presentation by Sandia Labs, glare intensity is at its lowest when the angle of incidence is at its lowest, near perpendicular to the sun (see Figure 13). Static PV panels can see a varying range of reflection values as the sun changes position throughout the day. Angle of incidence and glare are at their lowest around noon where the sun can pass directly through the panel glass. In the early mornings and late evenings, incidence angles and glare values are higher as a result of the sun glancing off static panel glass.



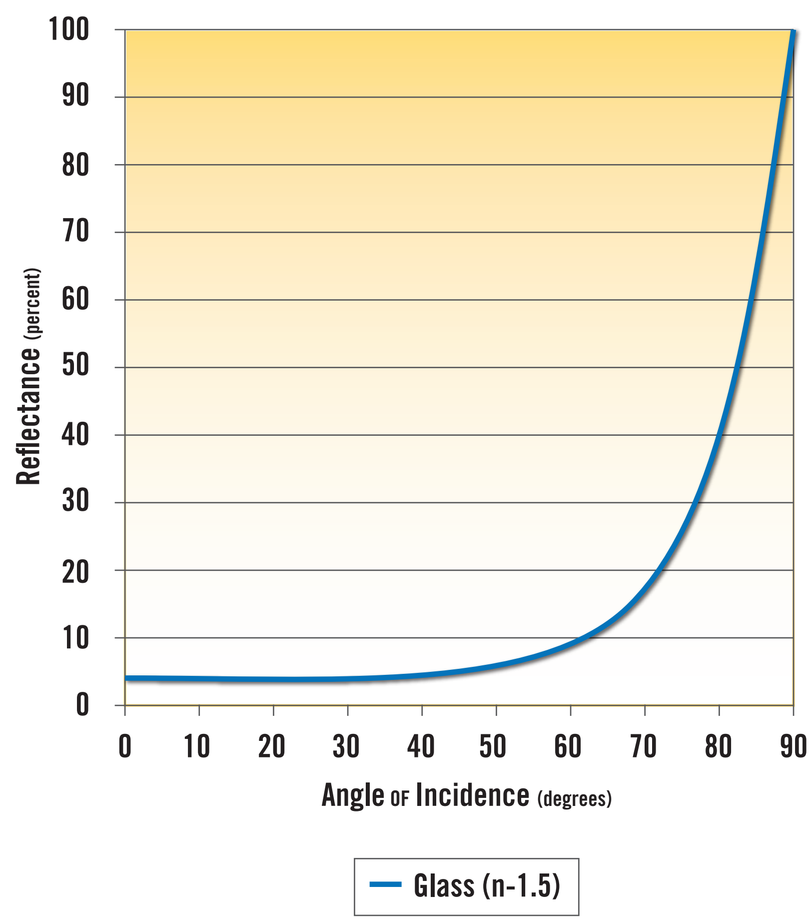


Figure 13 - Angle of Incidence

CPV modules maintain overall lower reflection levels than static PV panels due to the two-axis solar tracker technology. This technology follows the sun, and maintains a continuous low angle of incidence throughout the day which results in high solar transmission and minimal offsite glare. According to a white paper presented by Reflexite Energy Solutions in 2011, the Concentrix system are designed to transmit over 90% of the solar energy, resulting in reflectance levels much lower than that of other common reflective surfaces (refer to Reflexite Energy Solutions White Paper, Appendix B). Anti-reflective coatings, high incidence angles, and high transmission glass reduce the reflectivity below levels to cause damage to the eyes and below many common surfaces found in both the man-made and the natural environment.

Emergency Air Vehicles may find it necessary to operate in and around proposed CPV solar operations. This may include air search and rescue or helicopter life flight operations. Typically, these operations must maintain the minimum en-route ceiling of 500 feet in remote areas, 1,000 feet in rural areas and 2,000 feet in populated areas until the emergency landing zone is reached. Occurrences of these glare situations resulting from solar operations are anticipated to be low. The conditions will be dependent on the vector and speed of travel, time of day, and proximity to solar facilities. If aircraft must land adjacent to a solar facility, and if glare is experienced, the result will be similar to landing near a body of water with solar reflections.

6.0 CONCLUSION

Due to the following factors, it is POWER's professional opinion that glare resulting from the proposed solar operations will have the following impacts to residences and motorists:

- Impacts to Residences: (LOW)
    - Glare Occurrence: Occurrence of glare would be brief (typically less than 0.5 hour seasonally), and limited to KOPs immediately adjacent to the east or west of the Project site and having an elevated view of the Project area.
    - Glare Intensity: CPV modules are designed to maximize efficiency by maintaining a perpendicular relationship to the sun, resulting in reflection values that are not considered hazardous to vision. Reflections from this system would be lower than that of man-made surfaces (metal roofs, glass, etc.) or even water.

- Impacts to Motorists: (LOW)
    - Glare Occurrence: Occurrence of glare would be brief and limited to motorists heading west in the early morning (spring, summer and fall) or heading east during the late evening on or around the summer solstice. During these periods, glare would be located within the focus and peripheral view and last approximately one minute and 20 seconds, assuming a speed of 60 miles per hour. As discussed above, and as shown in the Reflexite Report (Appendix B), glare from CPV technology will be less intense than the reflections experienced from water, glass or metal.

7.0 SOURCES

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APPENDIX A: TABULAR GLARE RESULTS