Big Rock Cluster Solar Farms

REFLECTIVITY ANALYSIS

REVISION INDEX

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Contents

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1 Introduction

This document analyzes the risk of sun reflectivity due to a series of flat photovoltaic systems (PV) being developed by 90FI 8me LLC (Laurel) and 92JT 8me LLC (Big Rock) in the Imperial County. The cluster parcels are namely grouped in four different projects, called Laurel 1, Laurel 2, Laurel 3 and Big Rock 1 (Figure 1). The location is in relatively close proximity to a series of public roads, including but not limited to Drew Road (S29) in the East side of the cluster and Highway 8 in the North side.

Reflectivity events due to the presence of PV systems might have the possibility of affecting land traffic visibility if reflected sun light beam intersects the approaching vehicles' paths.

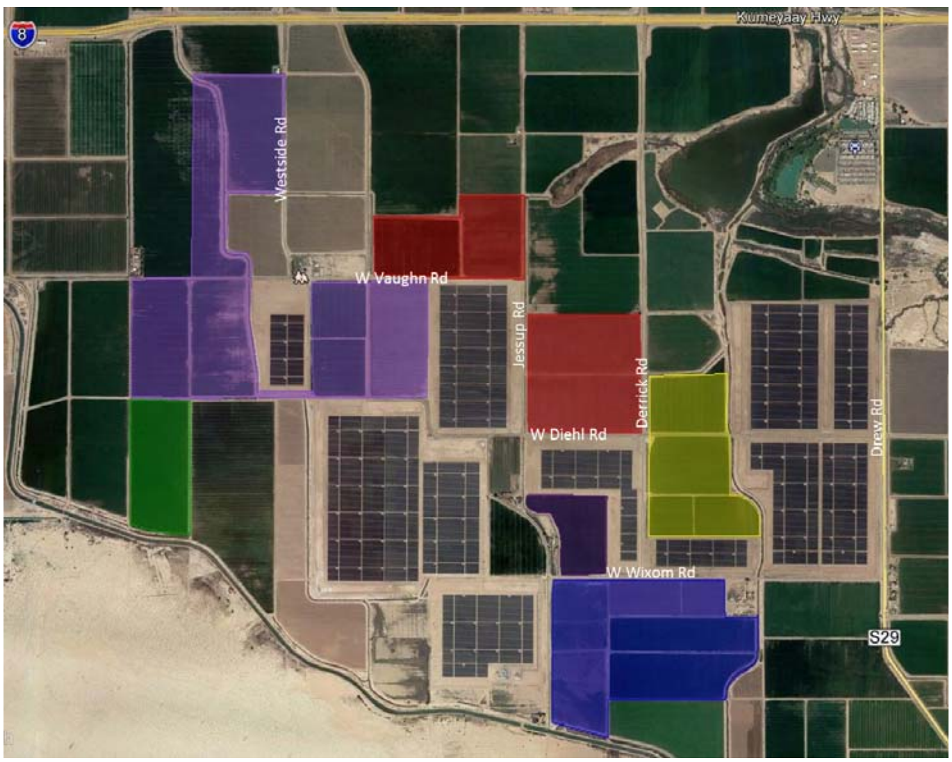

Fig 1. - Location of PV Project and public roads

This report focuses on addressing the potential risk for land traffic in paved roads in close proximity to the projects to suffer from glare by the cluster PV systems.

To evaluate the risk of direct sun light reflection events a mathematical (geometric) model has been developed. The model predicts which times of the year there is a possibility for approaching vehicles to suffer direct reflection from the PV systems.

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2 Definitions

The following definitions and descriptions are essential to understanding the methodology and results of this study:

Photovoltaic System – A PV system consist of a series of flat photovoltaic modules mounted on any of the following supporting structure types:

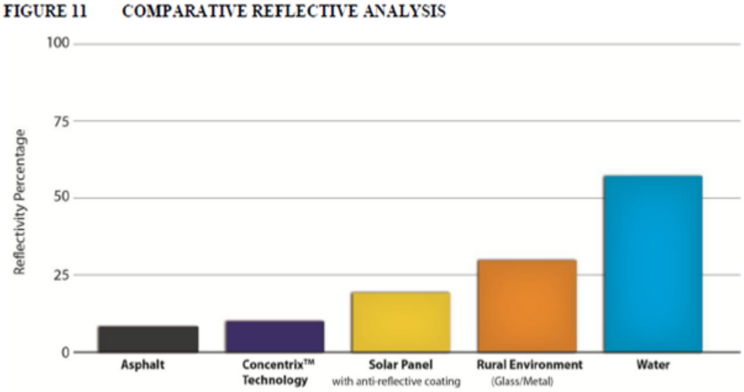
- Fix tilt structures
- Single axis tracker structures
- Two axis tracker structures

Depending on the supporting structure type, the modules shall be fix-tilt or moving towards the sun with appropriate solar tracker structures. A Varying orientation provides the PV modules a higher sun exposure.

By nature, PV panels are designed to absorb as much of the solar spectrum as possible in order to convert sunlight to electricity and are furnished with anti-reflective coating for that purpose. Reflectivity levels of solar panels are decisively lower than standard glass or galvanized steel, and should not pose a reflectance hazard to viewers. The graph in Fig. 2 below relates the reflectivity properties of solar modules as a function of the incidence angle, and compares them with other common reflecting surfaces in an airport related environment.

Reflected light from standard PV modules' surface is between 10% - 20% of the incident radiation, which is as low as free water surfaces; while galvanized steel (used in industrial roofs) is between 40% and 90%. It should also be noted that high incidence angles are always related to low sun elevation angles (i.e., the sun beams are close to being tangent to the reflecting surface) and, in this case, the intensity of incident light is much lower would be delivered at say noon time.

FIGURE 11 COMPARATIVE REFLECTIVE ANALYSIS



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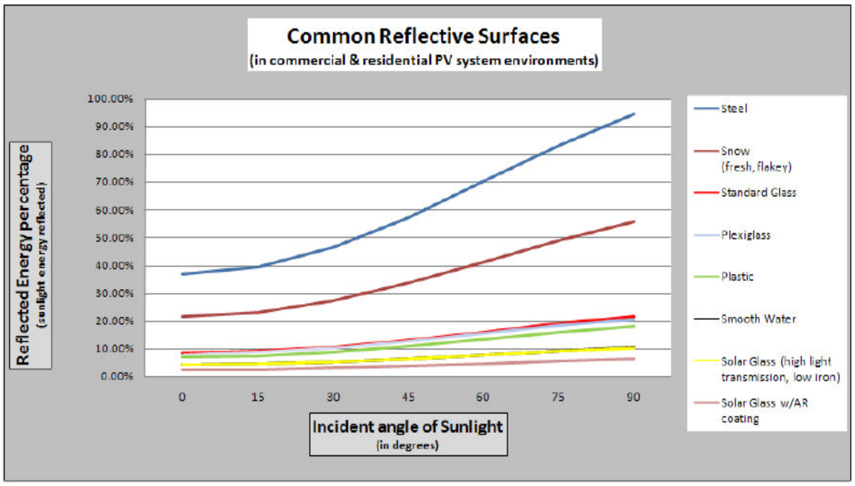

Fig. 2 – Reflectivity of several materials

Glint – Also known as a specular reflection, produced by direct reflection of the sun beam in the surface of the CPV solar module. This is the potential source of the visual/reflectivity issues regarding viewer distraction. Glint is highly directional, since its origin is purely reflective.

Glare – Is a continuous source of brightness, relative to diffused light. This is not a direct reflection of the sun, but rather a reflection of the bright sky around the sun disk. Technically this is described as the reflection of the circumsolar diffuse component. Glare is significantly less intense than glint and has negligible effects. As Glare is the reflection of diffuse irradiance, it is not a direct reflection of the sun. Other glare sources in nature (often called Albedo reflectance) are much more intense that glare from PV modules. For instance an agricultural environment or free water surfaces have higher glare effect than PV modules.

Key View Point (KVP) – KVPs are viewpoints used in the glint and glare study. In this analysis, a KVP can be any point located in the public roads around the PV Project.

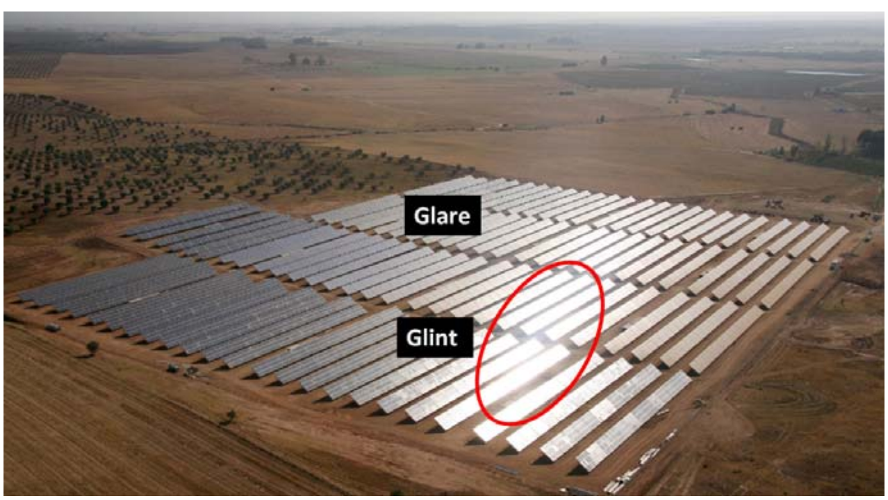

Fig 4. - Glint and Glare identification by a PV installation

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3 Mathematical analysis

3.1 Reference coordinate system

Solar reflection from flat surfaces is a mathematical problem that can be solved by means of 3D geometry concepts. In order to properly relate sun position, PV modules position and orientation, and the KVP location; it is necessary to define a global coordinate system which the previous position and orientation will be referenced to.

In this analysis, the 3D Cartesian coordinate system is defined as follows:

Positive X-Axis	Pointing South
Positive Y-Axis	Pointing East
Positive Z-Axis	Pointing upwards

The origin of the coordinate system is chosen at the North-West corner of the “Big Rock” future PV plant sections, as shown in Fig. 5 below (i.e., the intersection between *W Wixom Rd* and *Liebert Rd*). For other parcels in the cluster, different reference coordinate systems may be chosen.

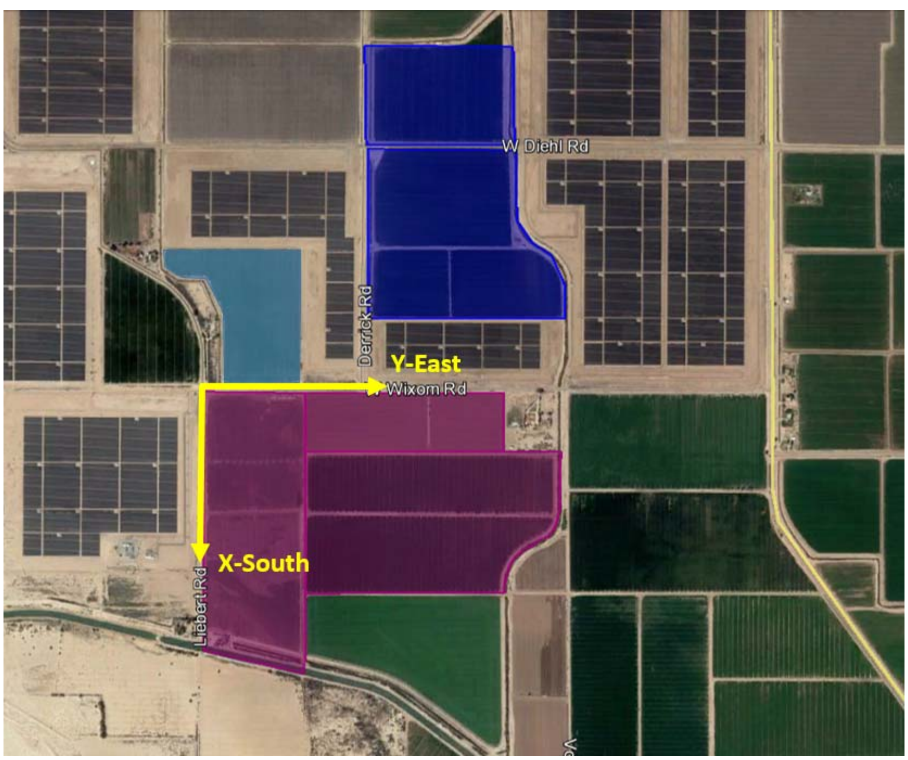

Fig 5. - Reference coordinate system

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3.2 Sun position

Instantaneous sun position is defined by two angular (spherical) coordinates. These angles are Azimuth (φ) and Elevation (θ). Azimuth is the deviation of sun's horizontal projection from South, while elevation is the angle between the horizontal plane and sun's position. The following graphs illustrates the above definitions, and criteria for positive values:

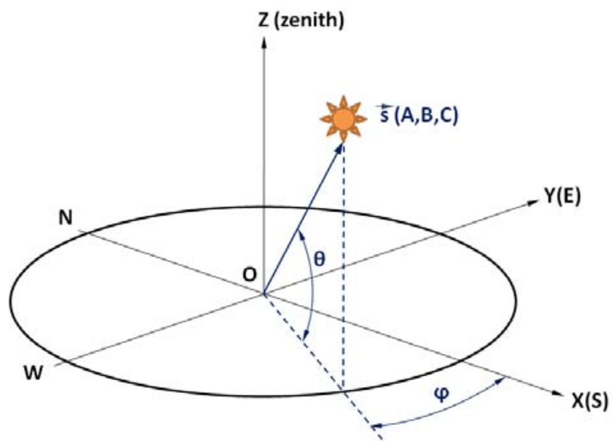

Fig 6. - Sun position coordinates

Sun position can be also defined by a unit-length pointing vector s = (A, B, C). Cartesian coordinates of the sun position vector are written in terms of the azimuth and elevation angles as follows:

$$A = \cos\theta \ \cos\varphi$$
$$B = -\cos\theta \ \sin\varphi$$
$$C = \sin\theta$$

Azimuth and elevation angular coordinates (φ, θ) are both function of:

- Earth latitude (L) at the origin
- Time: Day of the year (i) and hour of the day (H)

and can be calculated as per the following equations:
Earth declination:

$$D = 23.45 \ \sin(0.986[284 + i])$$

Azimuth and elevation angles:

$$\sin\theta = \sin D \sin L + \cos D \cos L \cos H$$
$$\cos\varphi = \frac{\sin D \ \cos L - \cos D \sin L \cos H}{\cos\theta}$$

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In the above expressions the day of the year (i) is following a Julian day convention (January, 1st is i=1; February, 1st is i = 32,… until i =365). The hour of the day (H) is referred to noon time (12:00 is H = 0; 10:00 is H = -2; 14:00 is H = +2; … etc).

As an example, the calculated values for azimuth and elevation angles for the equinox (March, 21st, i = 80) are plotted in function of the hour of the day in Fig. 7.

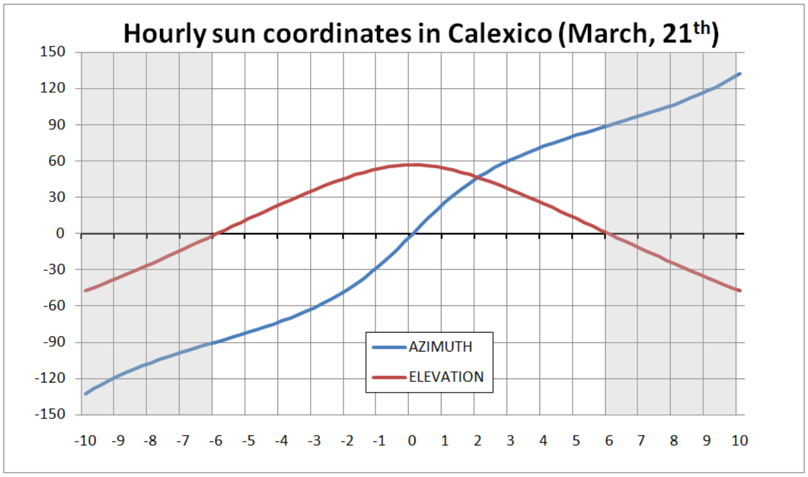

Fig 7. - Sun position coordinates in function of hour of the day

Negative values of the elevation angle means night time (the sun is below the horizon). In the above example the daylight period is 12 hours and the azimuth at sunrise is -90° (pure East), as expected for the equinox. Maximum elevation angle (at noon) is 56.88° for this latitude and particular day.

For the purpose of geometric calculations later in this report, the relevant results are the Cartesian coordinates of the sun position vector (A, B, C). For the sample day above, these are plotted in Fig. 8:

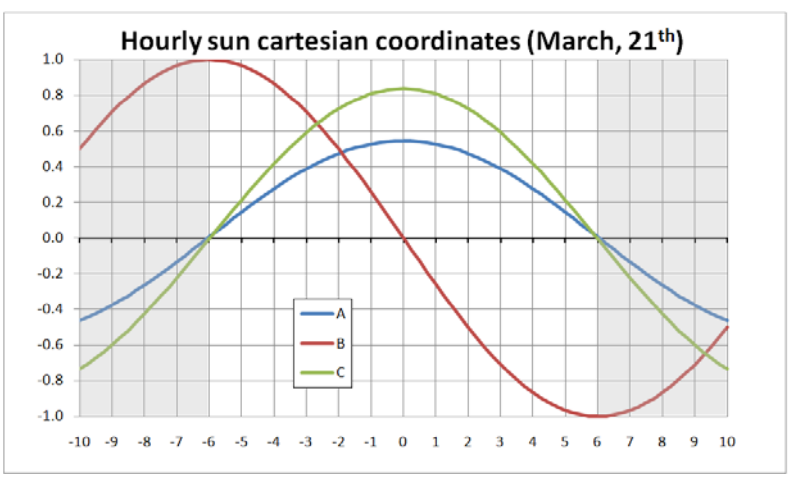

Fig 8. - Sun position vector Cartesian coordinates in function of hour of the day

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3.3 Reflection equations for fixed tilt systems

PV modules are considered reflecting planes located at the origin of the coordinate system (O). A plane is geometrically defined by its perpendicular (normal) unit vector [n]. Notation for Cartesian coordinates of this fixed vector is n = (Ap, Bp, Cp). From the PV plant optimum design, the PV modules are facing South with a tilt angle of 25°, as shown in Fig. 9.

Then the fixed coordinates of this normal vector for the reflecting plane are given by:

$$A_p = \sin 25° = 0.42262$$
$$B_p = 0$$
$$C_p = \cos 25° = 0.90630$$

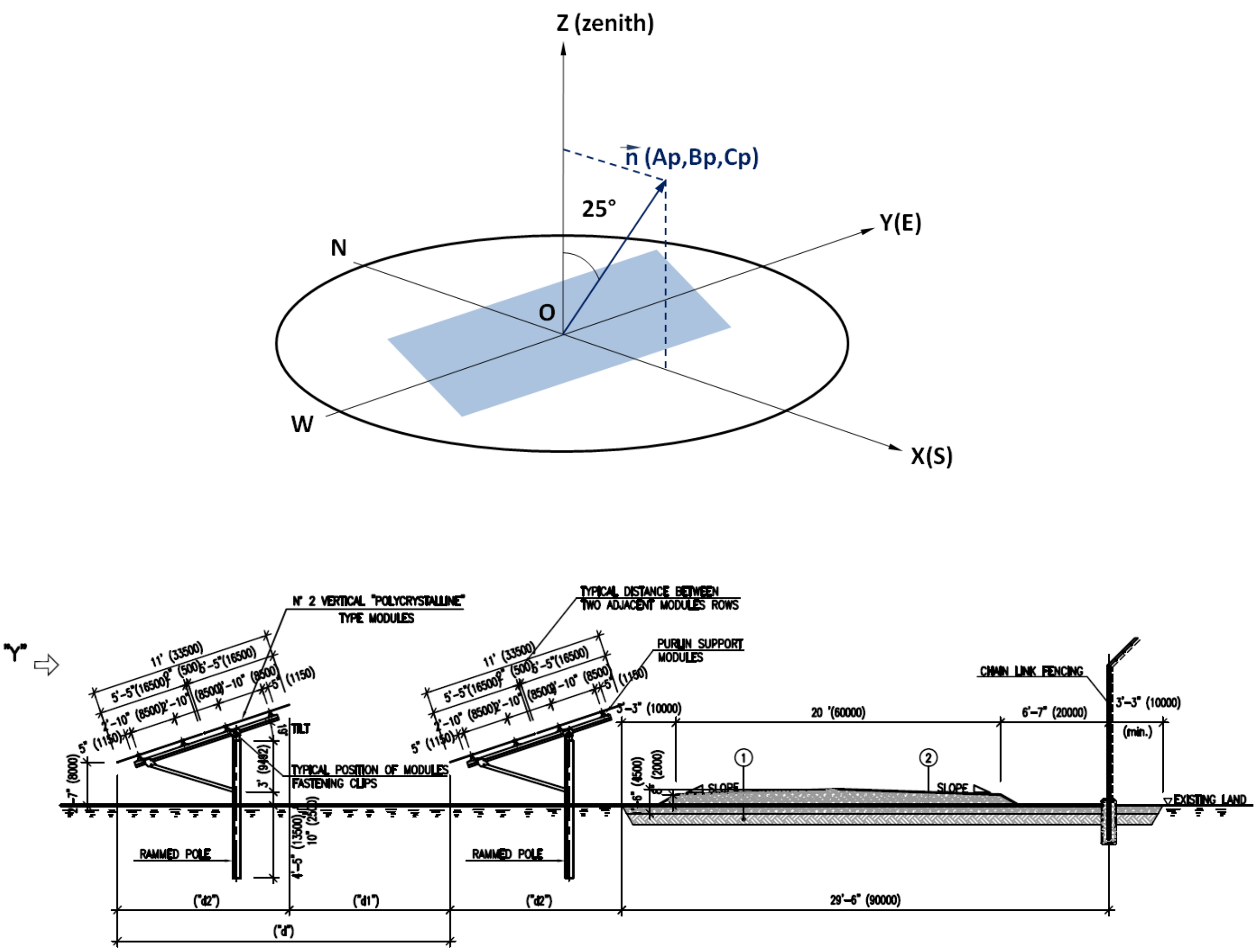

Fig 9. - Reflecting surfaces – Coordinates and typical PV design

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Reflection of sun beams by a given surface can be calculated once the direction of the incident beam and plane orientation is known.

Instantaneous solar beam direction vector s = (A, B, C) and reflecting plane normal vector n = (Ap, Bp, Cp) intersects at the origin, and both defines a new plane in the space. From reflectivity laws, the reflected beam vector r = (Ar, Br, Cr) will be contained in this plane and symmetric to the incident beam with respect to the reflecting surface vector, as shown in the next figures:

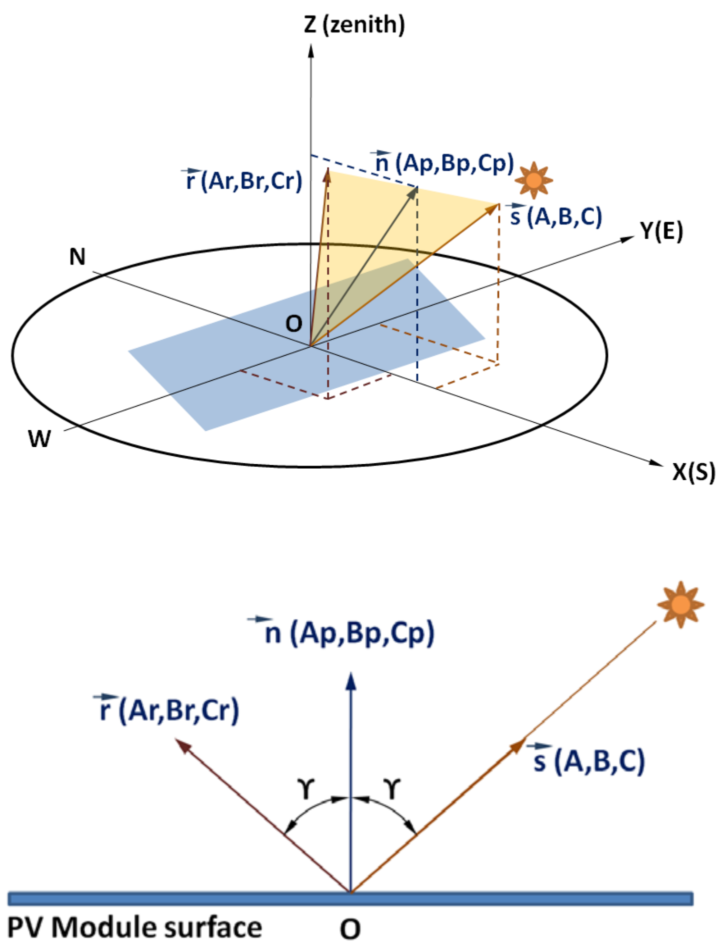

Fig 10. - Reflecting surfaces – Notation for reflected beam vector

A relevant variable in this figure is the incidence angle [ϒ], which measures the angle between the incident sun beam vector and the surface normal. No reflection can occur when the incidence angle is equal or larger than 90°. This situation will occur whenever the sun is behind the PV modules surface. The incidence angle can be calculated as per the dot product of unit vectors [s] and [n]:

$$\cos\gamma = \vec{s}\ \vec{n} = A\,A_p + B\,B_p + \ C\,C_p$$

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The symmetric-reflected vector [r] is calculated as

$$\vec{r} = 2\ \cos\gamma\,\vec{n} - \vec{s}$$

and its Cartesian coordinates given by:

$$A_r = 2\ \cos\gamma\,A_p - A$$
$$B_r = 2\ \cos\gamma\,B_p - B$$
$$C_r = 2\ \cos\gamma\,C_p - C$$

For example, for the equinox day chosen the results for (Ar, Br, Cr) are plotted below in function of the hour of the day. Incidence angle cosine also included.

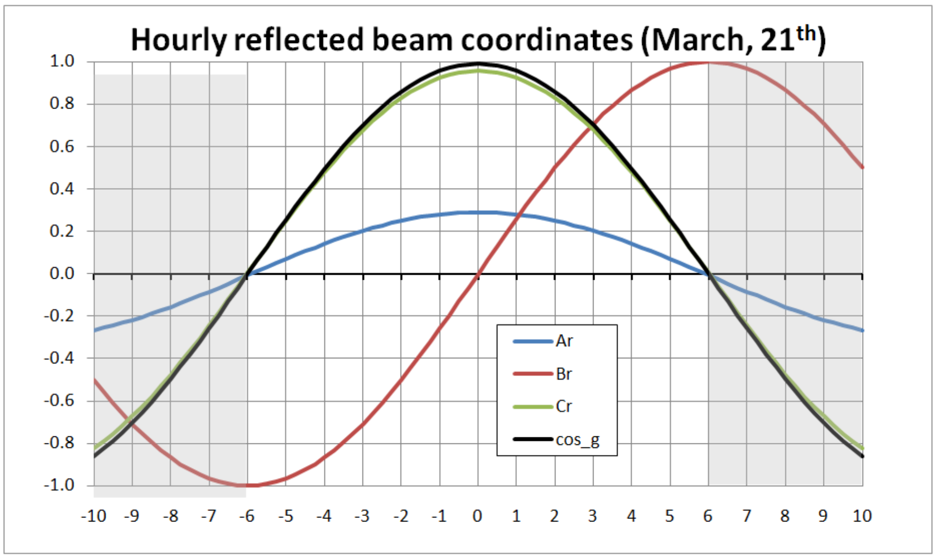

Fig 11. - Reflected vector coordinates and incidence angle

3.4 Reflection equations for horizontal axis trackers

Tracker systems are mechanical devices that continuously change the PV modules orientation with sun position, so to obtain the maximum irradiance at any time during the day. In particular, the horizontal axis trackers are oriented in North-South direction, so the modules attached to the horizontal rotating axis are inclined towards East during sunrise and are rotated towards West as the earth rotates.

Vector coordinates for the reflected beam are the same as described in paragraph 3.3, but in this case the vector perpendicular to the modules is not constant along the day, but rotating with the horizontal tracker axis. Target is to keep the incidence angle as close a zero as possible.

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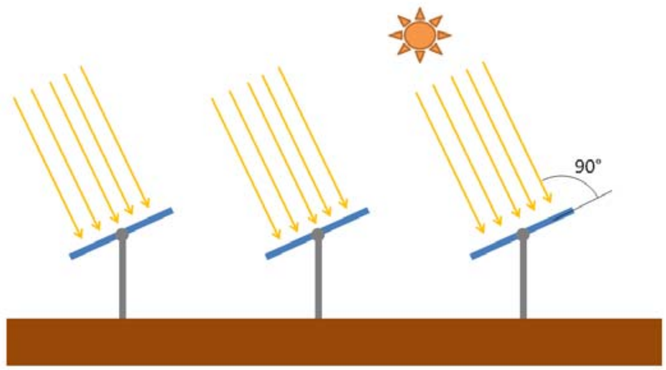

Fig 12.- Tracking angle of horizontal axis trackers

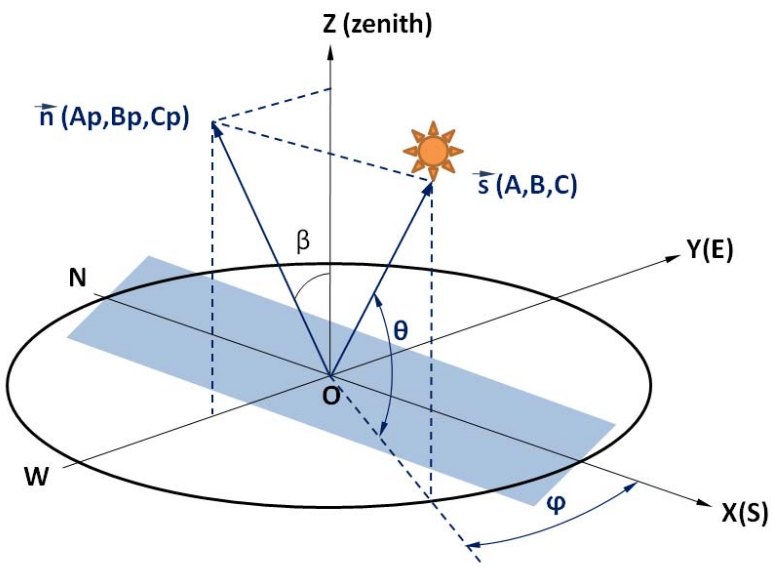

Fig 13.- Normal vector to PV modules in an horizontal axis tracker

Given the instantaneous rotation of the tracker as an angle (β), the normal vector n=(Ap, Bp, Cp) perpendicular to the plane of the modules is

$$A_p = 0$$
$$B_p = -\sin\beta$$
$$C_p = \cos\beta$$

The objective is to track for the minimum incidence angle (γ). This will occur also if the cosine of the incidence angle (γ) is a maximum:

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$$\cos\gamma = \vec{s}\ \vec{n} = A\,A_p + B\,B_p + C\,C_p$$

this can be written as

$$\cos\gamma = -\,B\sin\beta + C\cos\beta$$

The minimum incidence angle occurs when

$$\frac{d\,(\cos\gamma)}{d\beta} = -B\cos\beta - C\sin\beta = 0 \qquad\qquad \tan\beta = -\frac{B}{C}$$

Which describes the rotation angle of the tracker in function of sun position, and hence the coordinates for the vector perpendicular to the plane of the PV modules.

3.4.1 Backtracking

At low sun elevation angles (i.e., sunrise and sunset), the trackers would be fully deployed and mutual shading between successive rows of modules will occur. To avoid this situation, the tracking control system has the so called backtracking algorithm, which defines the tracker rotation angle so to avoid this mutual shading. When the backtracking is active, the tracker will not rotate to follow the sun path, but to avoid mutual shading between rows. This occurs every day early in the morning and late in the evening, and depends on the PV plant geometry, day of the year and latitude.

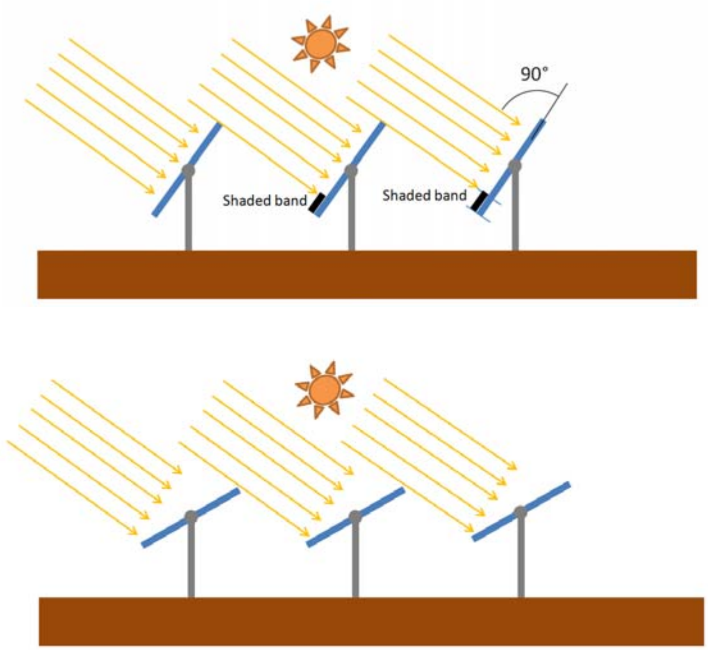

Fig 14.- Above: Mutual shading without backtracking.
Below: Backtrackin corrected incidence angle to avoid mutual shading

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The tracker angle when the backtracking is active is given by the following equation:

$$\tan\theta = \frac{L\ sin\beta}{p - Lcos\beta}$$

Where [L] is the length of the modules (6.46 ft) and [p] is the pitch between tracker rows (19.6 ft). Maximum tracker angle is ±45° for mechanical and constructive reasons.

Fig. 15 shows the tracker angle, together with sun elevation angle for a sample day (March, 21st).

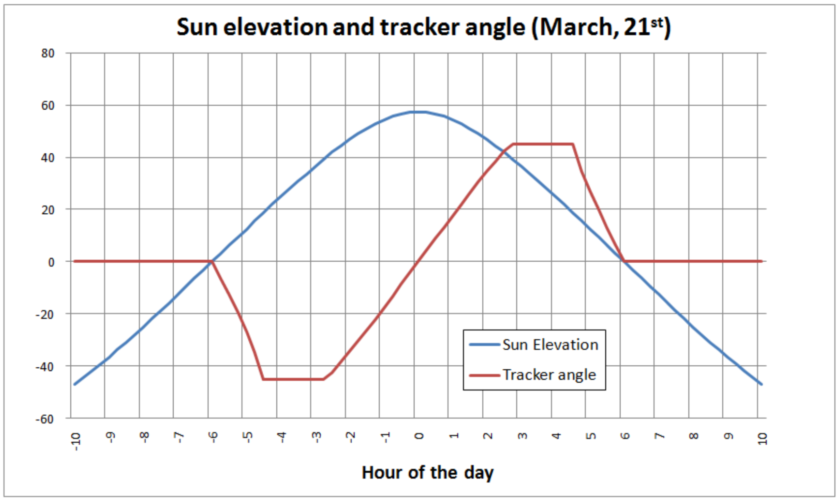

Fig 15.- Tracker angle on a sample day

Cartesian coordinates of the reflected beam, and incidence angle are shown in Fig. 16,

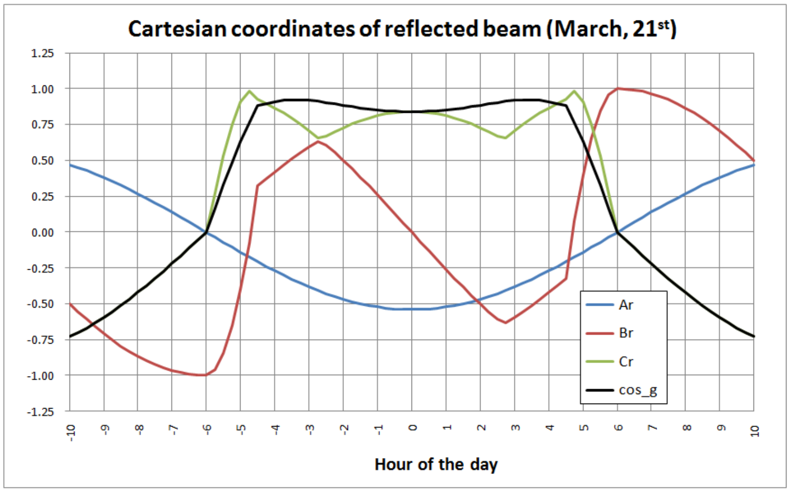

Fig 16.- Cartesian coordinates for reflected beam on a sample day. Incidence angle is very low, thus optimizing irradiance on PV modules with trackers.

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3.5 Two axis tracker systems

PV systems with two axis trackers are also considered as independent reflecting planes. Each reflecting plane is geometrically defined by its perpendicular (normal) unit vector [n]. Notation for Cartesian coordinates of this normal vector is n = (Ap, Bp, Cp) in the reference coordinate system.

Because of the motion given by the two axis trackers holding the reflecting planes, the normal vector orientation changes with time. Actually, a perfect two-axis tracking system would continuously rotate the reflection plane so that the normal vector will always be pointing the sun. That way, the PV modules can collect as much direct irradiance as possible at any time, as shown in Fig. 17. As a consequence, the Cartesian coordinates of the normal vector are the same as for the solar vector. Following the notation descried in previous paragraphs, this can be written as:

$$Ap = A$$
$$Bp = B$$
$$Cp = C$$

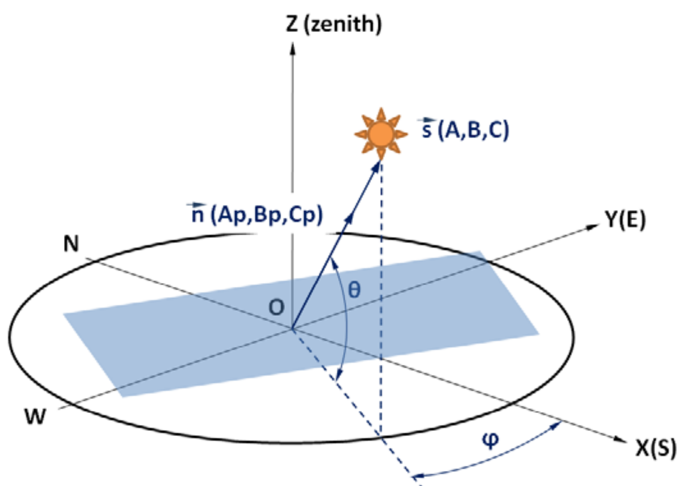

Fig 17.- Reflection surface normal vector coordinates

In practice, two-axis trackers have some tilt angle limitations due to constructive reasons, so a totally vertical position of the reflecting plane is not possible. The PV systems analyzed in this reports have a maximum tilt angle of 85°, as shown in Fig. 18.

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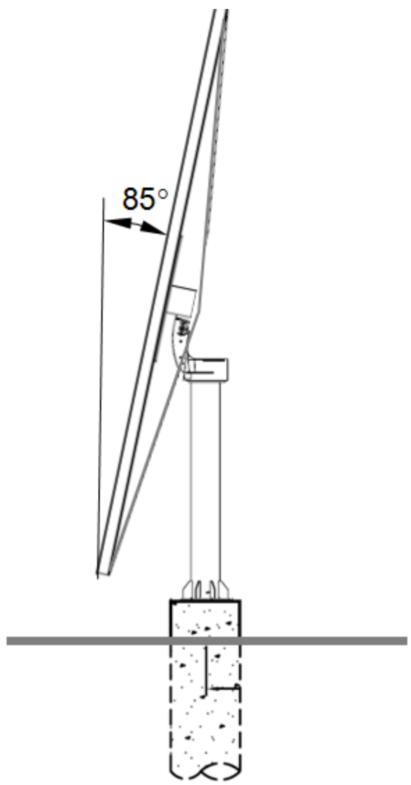
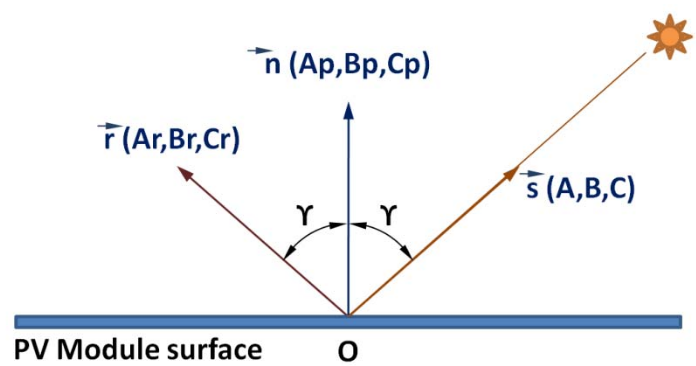


Fig 18.- PV system. Maximum tilt angle

Reflection of sun beams from a given surface can be calculated once the direction of the incident beam and plane orientation is known.

Instantaneous solar beam direction vector s = (A, B, C) and reflecting plane normal vector n = (Ap, Bp, Cp) intersects at the origin, and both defines a new plane in the space. From reflectivity laws, the reflected beam vector r = (Ar, Br, Cr) will be contained in this plane and symmetric to the incident beam with respect to the reflecting surface vector, as shown in Fig. 19:



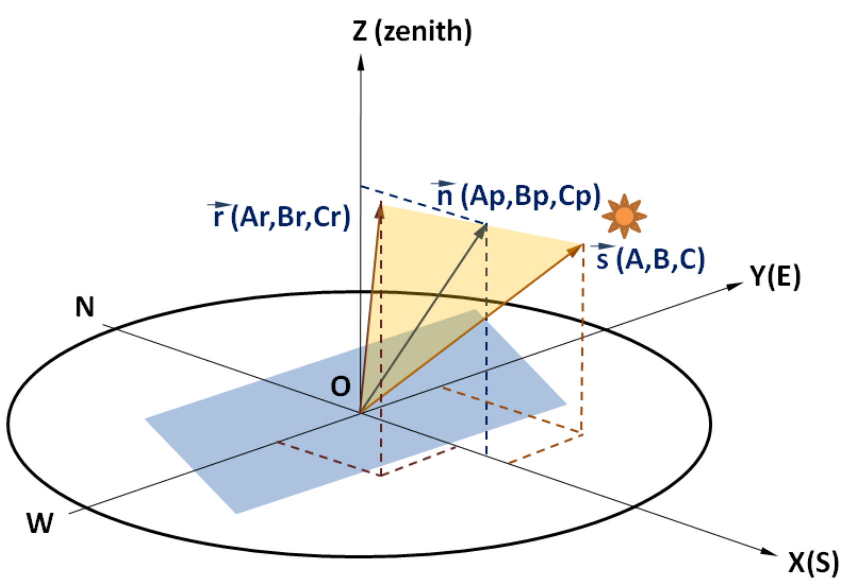


Fig 19.- Reflecting surfaces – Notation for reflected beam vector

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As already stated, the incidence angle can be calculated as per the dot product of unit vectors [s] and [n]:

$$\cos\gamma = \vec{s}\ \vec{n} = A\,A_p + B\,B_p + C\,C_p$$

The symmetric-reflected vector [r] is calculated as

$$\vec{r} = 2\ \cos\gamma\,\vec{n} - \vec{s}$$

and its Cartesian coordinates given by:

$$A_r = 2\ \cos\gamma\,A_p - A$$
$$B_r = 2\ \cos\gamma\,B_p - B$$
$$C_r = 2\ \cos\gamma\,C_p - C$$

For example, for the equinox day chosen the results for (Ar, Br, Cr) are plotted below in function of the hour of the day. Incidence angle cosine also included. Note that the cosine of the incidence angle is equal to “1” for nearly all the day, as expected for double axis trackers.

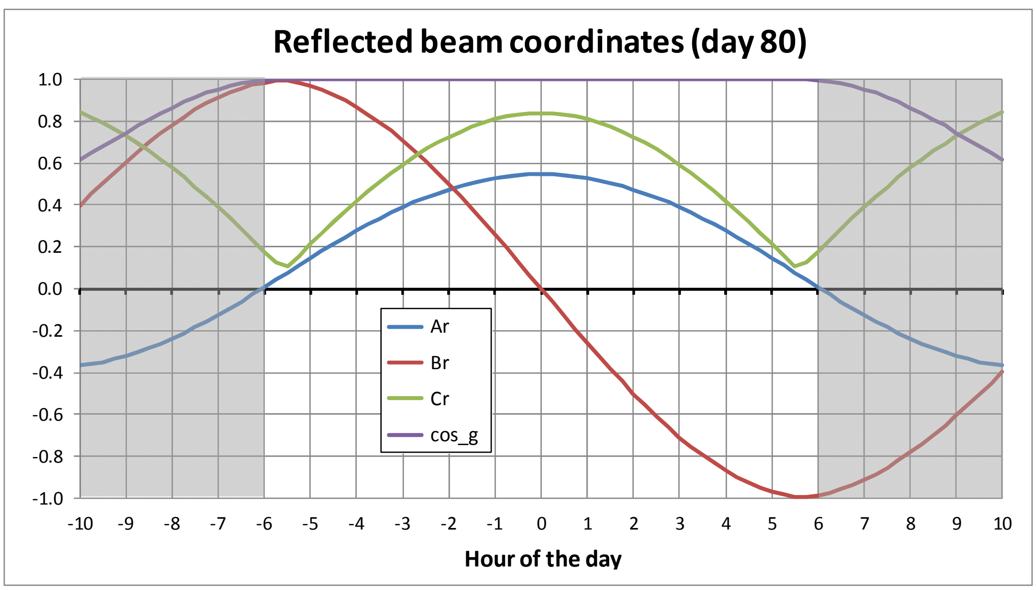

Fig 20. - Reflected beam vector coordinates and incidence angle with two axis trackers

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4 Reflectivity results

To define the location of relevant KVP it is hereby assumed that the traffic roads (paved roads) in the proximity of the cluster parcels follow North-South or East-West directions, except for the south part of *Drew Rd* (S29). In all cases, the imaginary vertical planes containing the roads are called respectively by its road name (i.e., Drew plane, Wixom plane, etc.). These road vertical planes will be considered "projection planes". The geometry is shown in Fig. 21a.

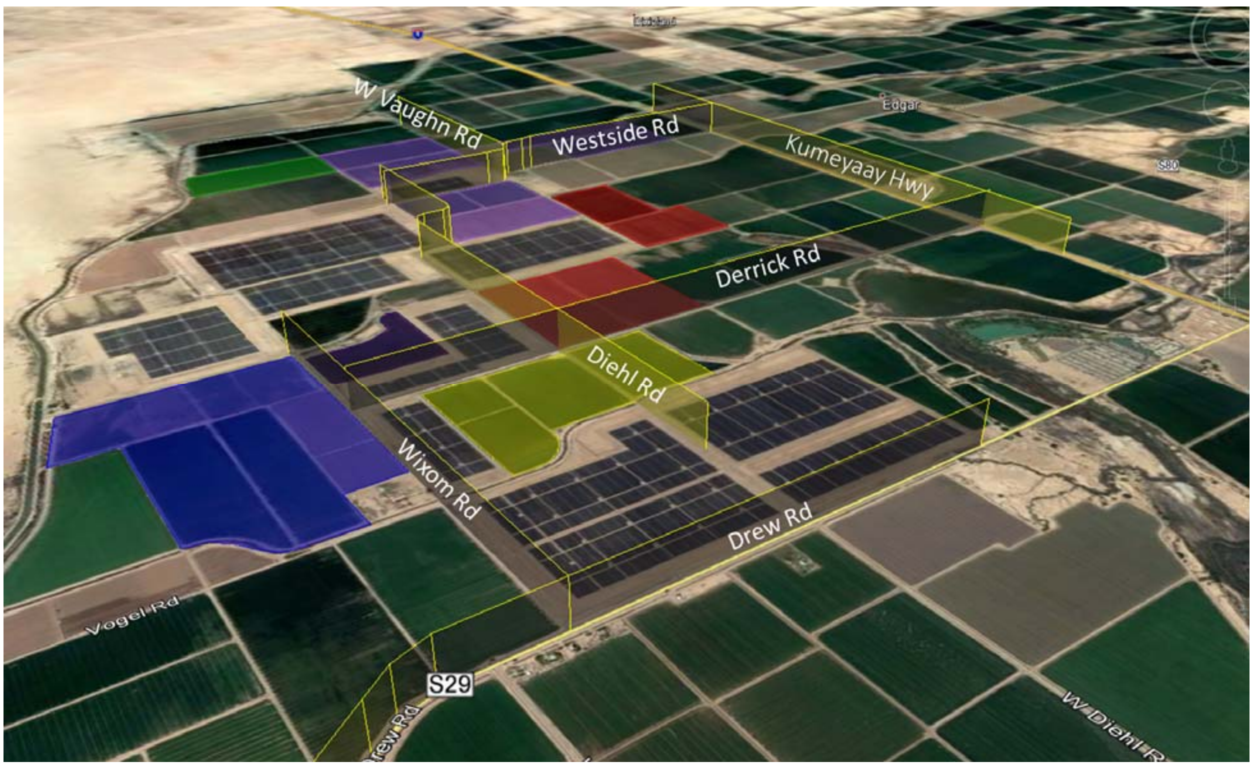

Fig 21a. - Geometry of parcel cluster, surrounding roads, and projection planes

Because of the reflective properties and orientation of the PV modules, a reflected solar beam may intersect one or other projection planes at a certain height from the ground. These will be called "intersection points", as illustrated in Figure 21b.

Because the projection planes contain the respective roadways, there is a risk of glare for traffic on that roadway only if the height of the intersection point is lower than ten feet, being the ten feet threshold the height of the driver eyes in a large size truck. In other words, a glare event might occur if the intersection between the reflected beam and the intersection planes containing the roads occurs at a heigth of less than ten feet.

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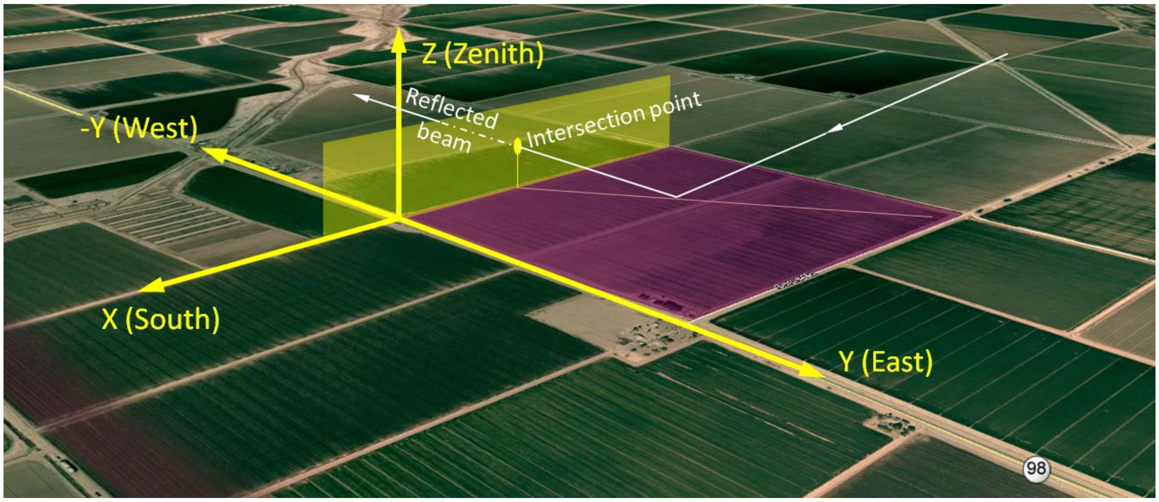

Fig 21b. - Illustration of the "intersection point" concept

Fix tilt supporting structure

The position of the intersection points is different for each hour of the day, the day of the year, and the orientation of the reflecting surface. As an example, Figure 22 shows the reflection of parcels Big Rock 1 and Laurel 1 at 8:30 am on day 90 (i.e., April 1st) projected on the Liebert Road plane. The points in the graph are the intersection points of the reflection of the "Sample Point" shown in Figure 21c at different hours of the selected days, covering a complete year.

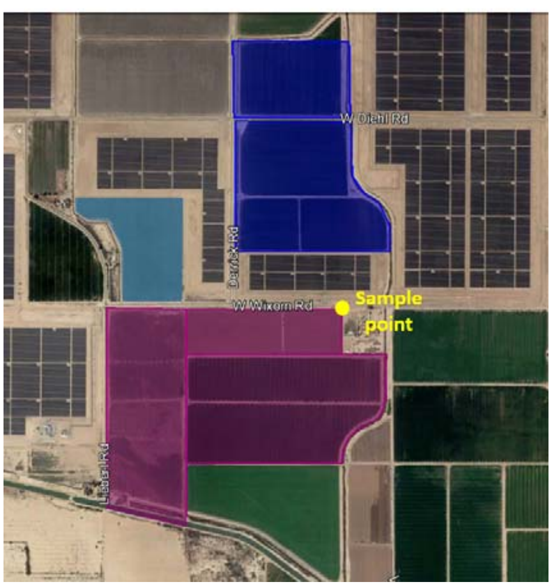

Fig. 21c

The daily paths of the intersection points on the projection planes determines when the projected image of the PV system will be less than 10 ft over ground level. In this case, because of the proximity of the West side of the southern PV system to the Liebert Road, there is risk for potential glare nearly every day of the year early in the mornings.
Because of the same relative position of the PV system with respect to the road, the same conclusion is found for the West side of the northern parcel with respect to the Derrick Road. When evaluating the potential impact in the East side of the northern System (i.e., projection on Drew Road Plane, in N-S direction), it should be noted that there are existing fix-tilt projects already built between this system and the road.

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Therefore, the PV system in these sample parcels would not have a worst impact than the existing one because of the latter being in closer proximity to Drew road.

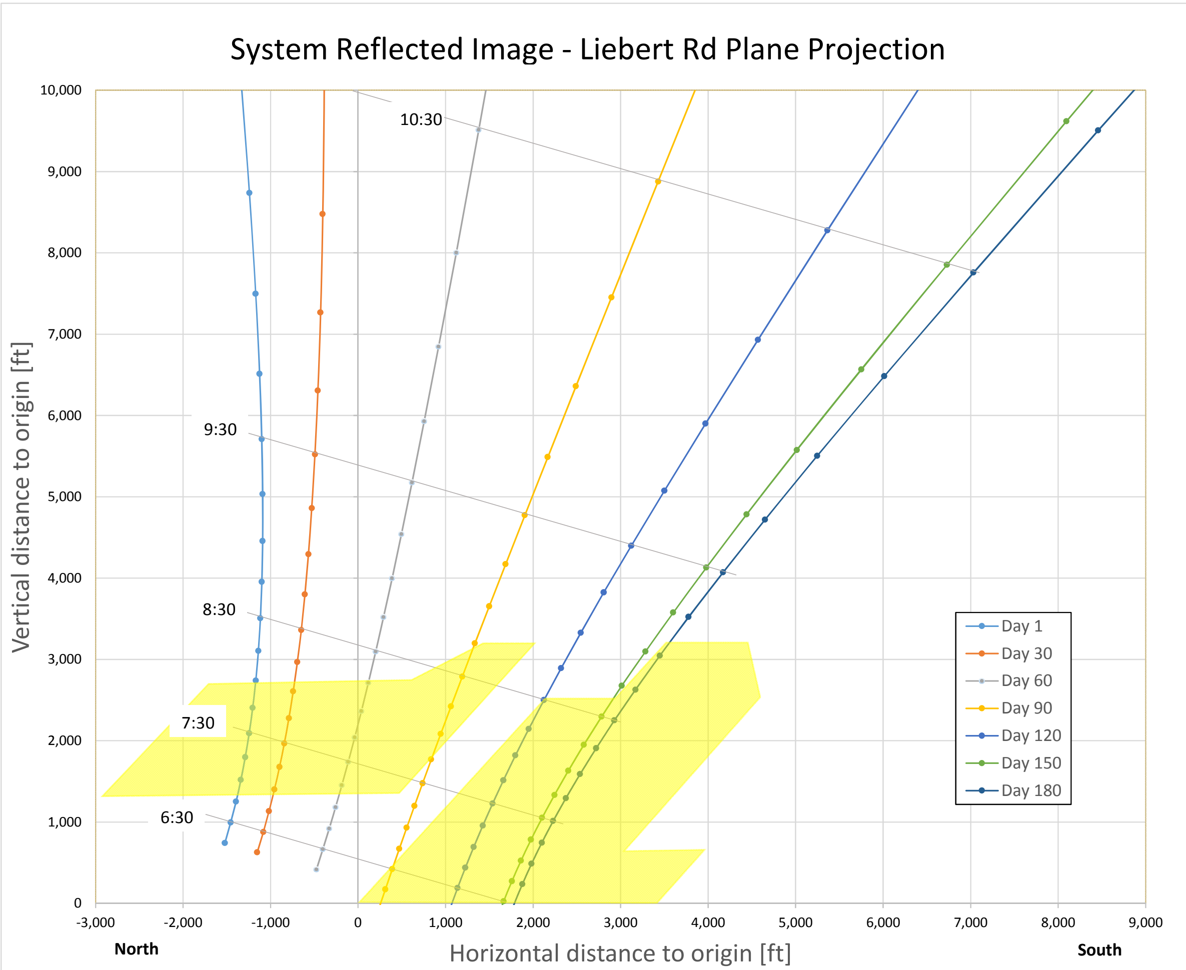

Fig 22. - PV System reflection pattern projected onto the Liebert Road plane on April, 1st at 8:30am. As the project East boundary is close proximity to Liebert Road, potential glare is to occur almost every day in the year at early morning.

A similar analysis is done for the potential impact to the southern stretch of Drew Road, which has an azimuth of 35 degrees with respect to due south. Also in this case, there is potential for glare risk from both PV systems on the southern part of Drew Road. A similar projection diagram is depicted in Figure 23. In this diagram, the trace of the intersection point from the reflection of the North-West corner of the Southern parcel is plotted.

The "*Horizontal distance to Origin*" axis in Figure 23 represents the distance from the reference point in the Drew projection plane (identified as "0" in Figure 24). It can be seen that the intersection points reache ground level at a maximum distance of approx. 3,500 ft from that reference point, in the summer

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solstice. In Figure 24 this distance of 3,500 ft is also indicated, thus the line connecting that point with the origin represents the maximum angle for reflected images at ground level, to occur on summer solstice before sunset. Parallel lines from different parcel corners are also plotted to determine which boundaries of the PV system would have an impact in Drew Road.

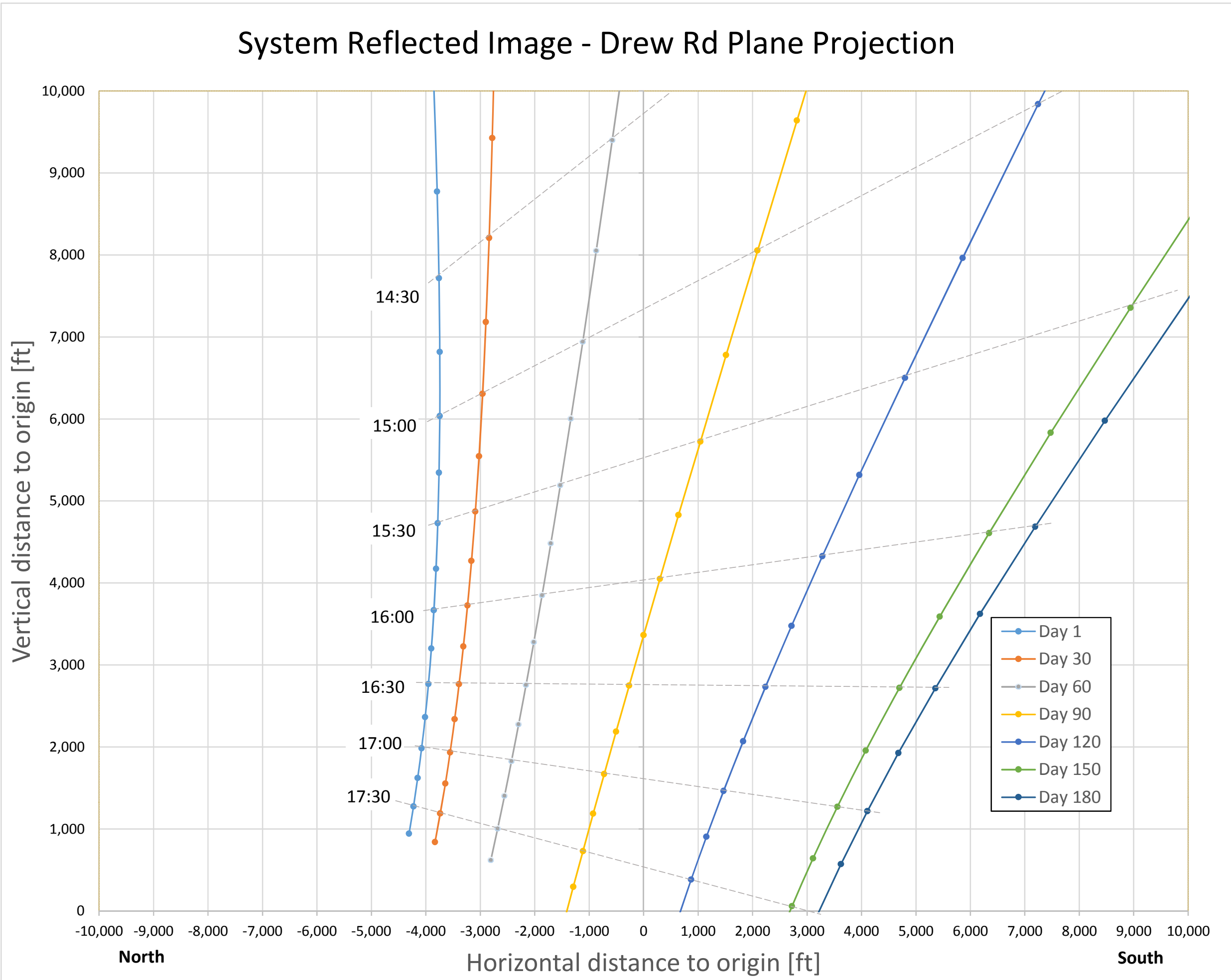

Fig 23. - Single point (origin) reflection pattern projected onto the Drew Road plane. Potential glare is to occur every day between March 21st and September 21st, minutes before sunset.

The glare potential chart in W Diehl Road is depicted in Figure 25. A single point reflection pattern from the closest PV modules to the road is analyzed. A buffer of 100 feet between road centerline and modules has been assumed in calculations. Potential for glare events are found between days 85 and 280 (i.e., March 26th and October 7th), minutes after sunrise and before sunset. The same conclusion is obtained for W Wixom Road, because of geometric similarities.

It shall be noted that the existing PV systems in neighbor parcels pose the same potential for glare events in these roads.

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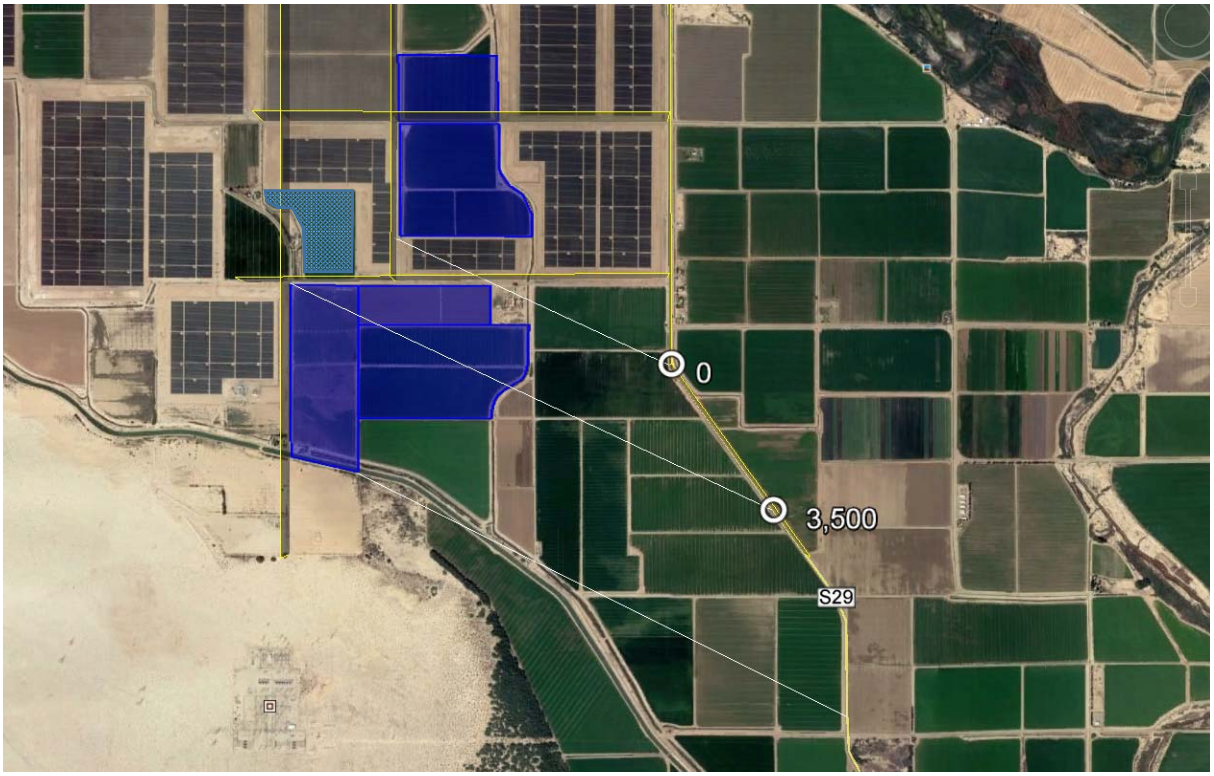

Fig 24 – Potential glare zone at Drew Road

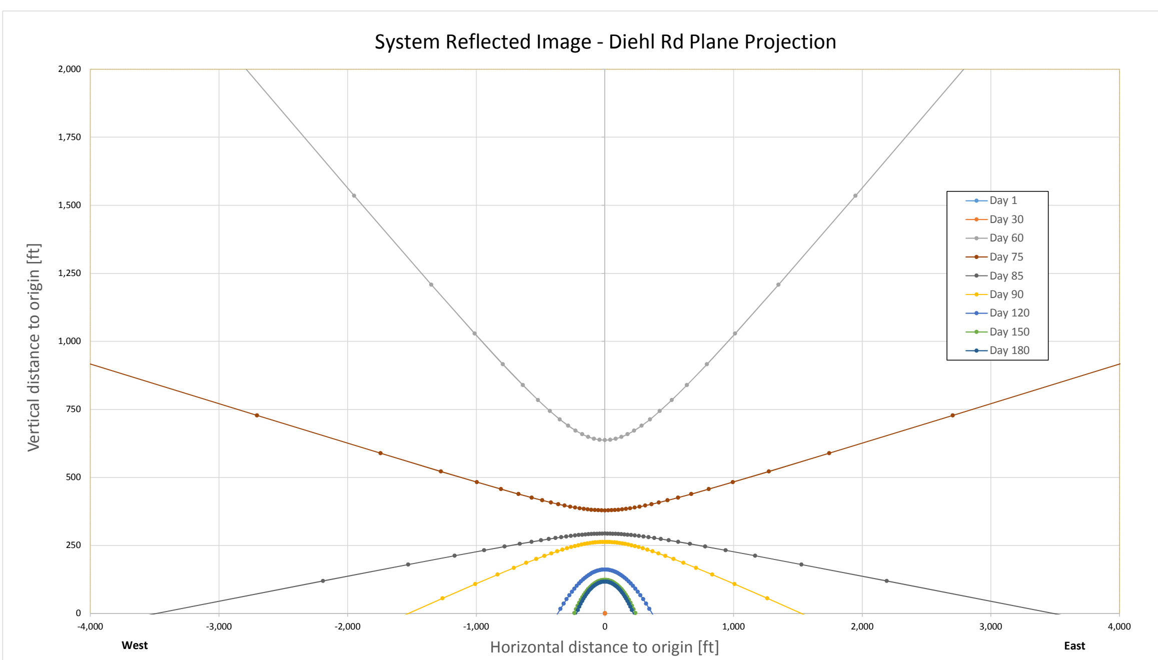

Fig 25. - Single point reflection pattern projected onto the Diehl Road plane. Potential glare is to occur every day between March 26th and October 7th, minutes after sunrise and before sunset.

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The detailed calculations shown above for the selected two sample parcels can be extrapolated to the rest of the parcels with same relative position of roads. This are summarized as follows for relevant (paved) roads:

Wixom Road
With proposed PV systems at both North and South sides. Same impact as in Fig. 25.

W Diehl Road
With proposed PV systems at both North and South sides. Same impact as in Fig. 25.

W Vaughn Rd
With proposed PV systems at both North and South sides. Same impact as in Fig. 25.

Kumeyaay Hwy
No impact.

Westside Road
With proposed PV systems at both East and West sides. Same impact as in Fig. 22 for morning time, and symmetrical impact during afternoons (i.e., almost every day, minutes after sunrise and before sunset).

Derrick Road
With proposed PV systems at both East and West sides. Same impact as in Fig. 22 for morning time, and symmetrical impact during afternoons (i.e., almost every day, minutes after sunrise and before sunset).

One axis tracker supporting structure

Because solar trackers continuously orientate the PV modules towards the sun's position, the risk of reflection at ground level greatly decreases with respect to fix the tilt scenario. The same analysis methodology is applied for this technology. The following graphs show the single point reflection pattern projected into the relevant road planes. As it can be seen in the results graphs, the backtracking algorithm orienting the modules in horizontal position at sunrise and sunset are the only moments in which there is potential for glare events. This potential occurs every day. It shall be noted that –because PV modules will be in horizontal position-, the observer would also be directly facing the sun's disk.

Figure 26 shows the single point projection onto the Liebert Road plane from the sample two parcels. As mentioned, the intersection points reach ground level exactly at sunrise time, when PV modules will be in horizontal position.

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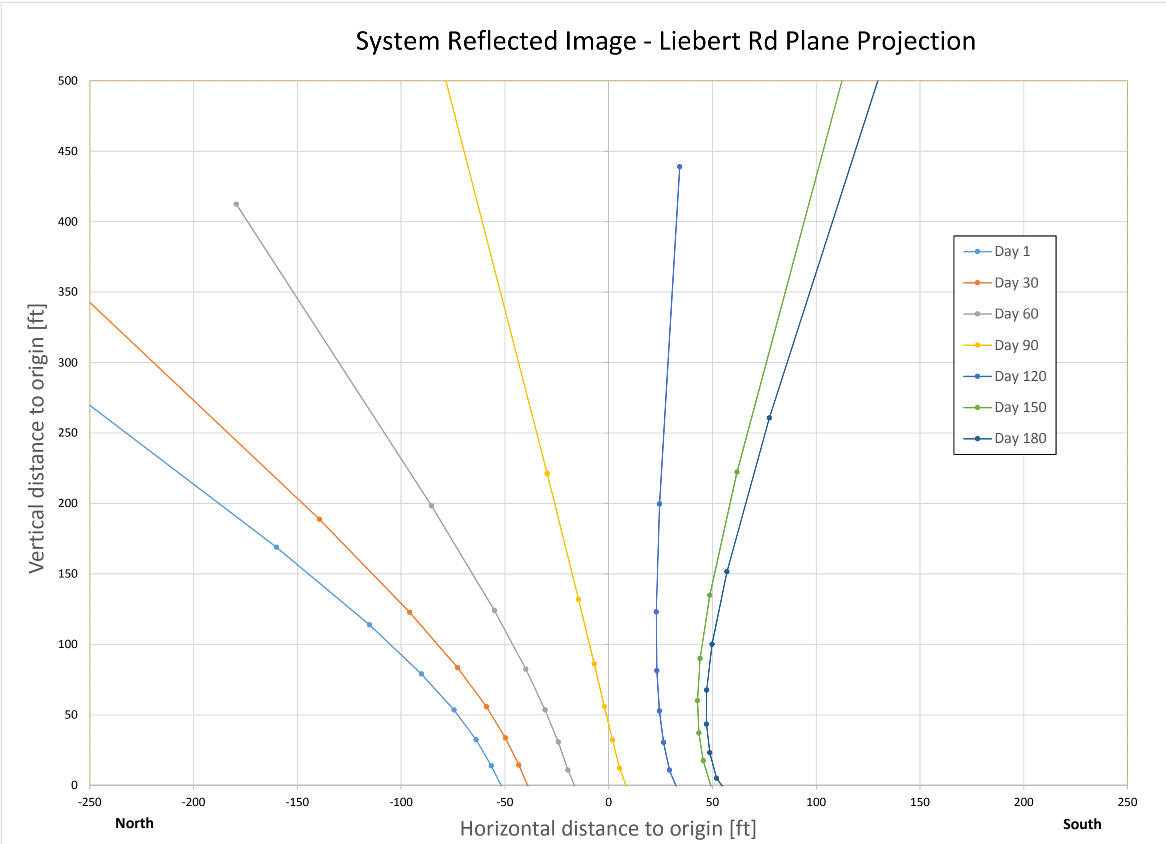

Fig 26. - Single point reflection pattern projected onto Liebert Road plane. Potential glare is to occur every day minutes after sunrise and before sunset, when modules will be in horizontal position because of the backtracking algorithm.

Based on symmetry, the same conclusion is obtained for planes located East of the PV systems (in this case both Derrick Road and Drew Road).

A similar situation if found for roads located North or South of the PV systems. Again, with PV modules in horizontal position for backtracking purposes, there is glare potential between September 21st to March 21st, and similarly for roads located South of the PV systems in the interval between March 21st and September 21st. The results are shown for Diehl Road Plane in Figure 27.

These results can be extrapolated to all parcels in the cluster and corresponding adjacent roads.

As mentioned before, with single axis trackers glare risk at ground level occurs only when modules are in horizontal position because of the backtracking algorithm. In this situation, the observer will be exposed to direct visual to the sun disk simultaneously, so the glare impact (in addition to natural impact) is very small.

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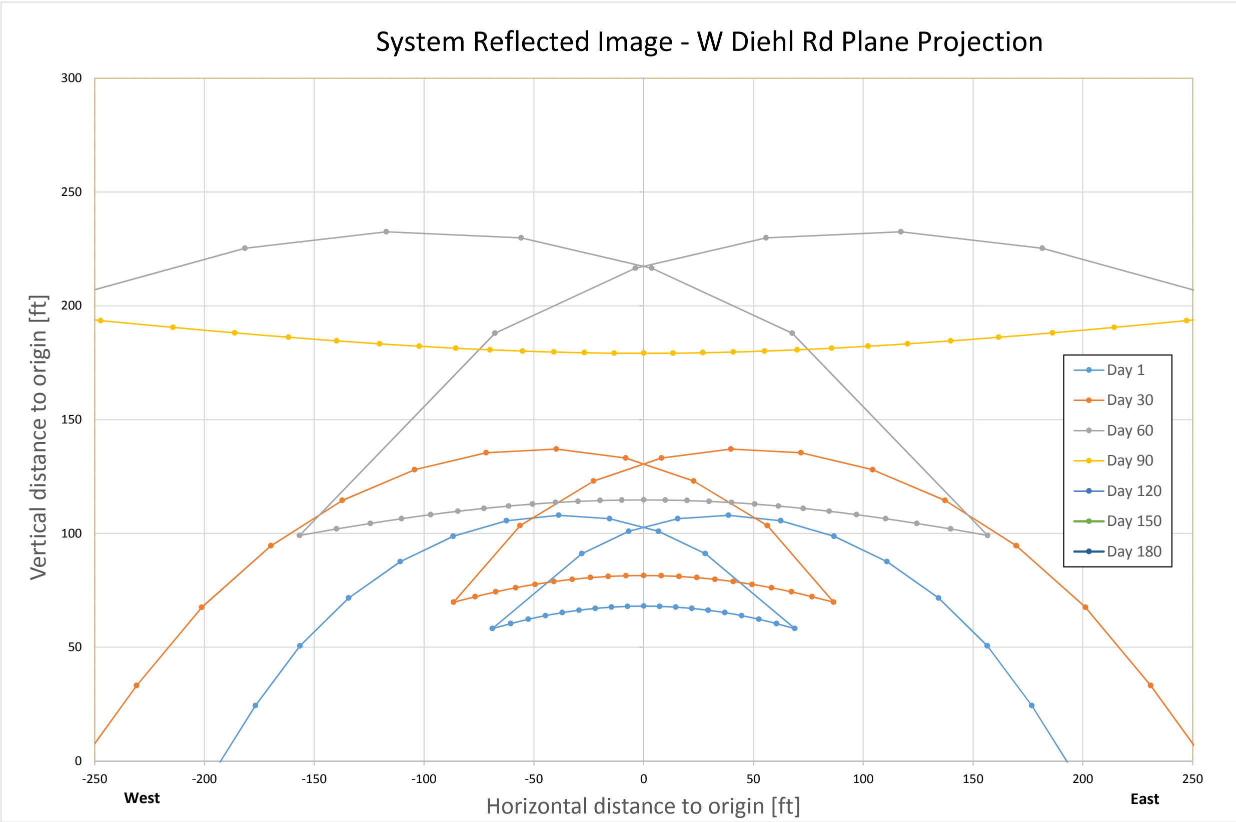

Fig 27. - Single point reflection pattern projected onto W Diehl Road plane. Potential glare is to occur every day minutes after sunrise and before sunset, when modules will be in horizontal position by of the backtracking algorithm, either from the South PV system or from the North system depending on seasonal sun path variation.

Two axis tracker supporting structure

In the case of two axis trackers, with maximum deployment angle limited to 85 degrees at sunrise and sunset, the reflected beam would never intersect the projection planes at ground level. At any other time in the day, the PV modules will be perfectly perpendicular to the sun's position, thus reflected beams will be oriented towards the sun's disc, and never be a risk to ground traffic.

This is illustrated in Figure 28, there the single-point projected beam intersection is plotted for Derrick Road plane (West of the PV systems), after noon time. Symmetrical results would be found for Drew Road plane (East of the PV system) before noon.

As in previous cases, the same result is applicable to all PV systems and adjacent roads.

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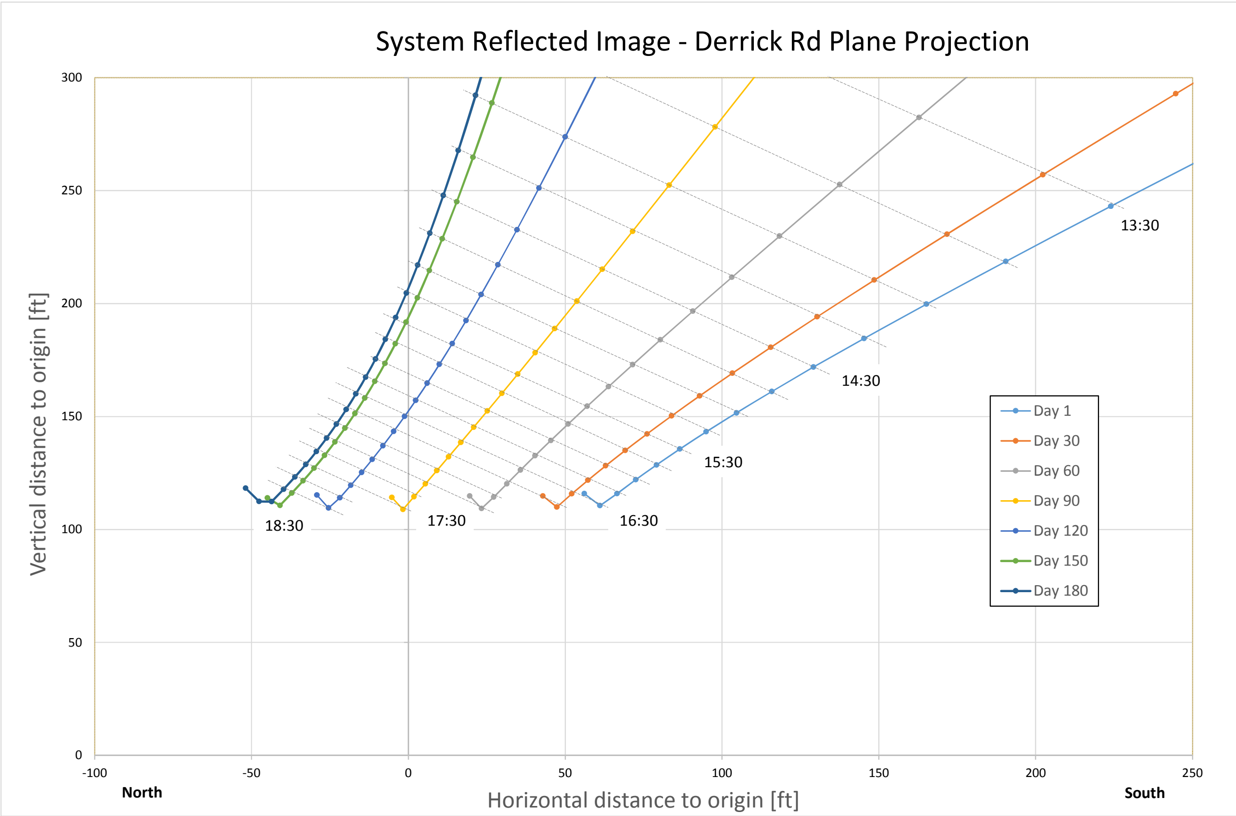

Fig 28. - Single point reflection pattern projected onto W Diehl Road plane. No potential glare is to occur because once the tracker reaches its maximum deployment point (85 degrees) and the sun continues to set at evenings, the reflected beam intersection point moves upwards, thus never reaching the 10ft height limit. Before that moment, the intersection point is perfectly aligned between the sun's position and the tracker.

5 Conclusions

This report analyzes the risk for potential glare events caused by the future Laurel 1, Laurel 2, Laurel 3 and Big Rock 1 photovoltaic systems (Imperial Valley, CA) on adjacent paved public roads.

PV installations are based on flat photovoltaic modules with low reflectivity characteristics. However, the fraction of the incident light that is reflected increases with the incidence angle, being higher when solar elevation is low (sunrise and sunset), thus potentially causing glare/glint events to observers when geometrically aligned with the reflected image of the photovoltaic plant.

To evaluate the glare hazard from the proposed Laurel 1, Laurel 2, Laurel 3 and Big Rock 1 solar projects, a geometric analysis is done to evaluate the occurrences of geometric alignment of the PV plant reflected image with potential observers (KOPs), located at the existing public roads distributed in the proximity of the project sites.

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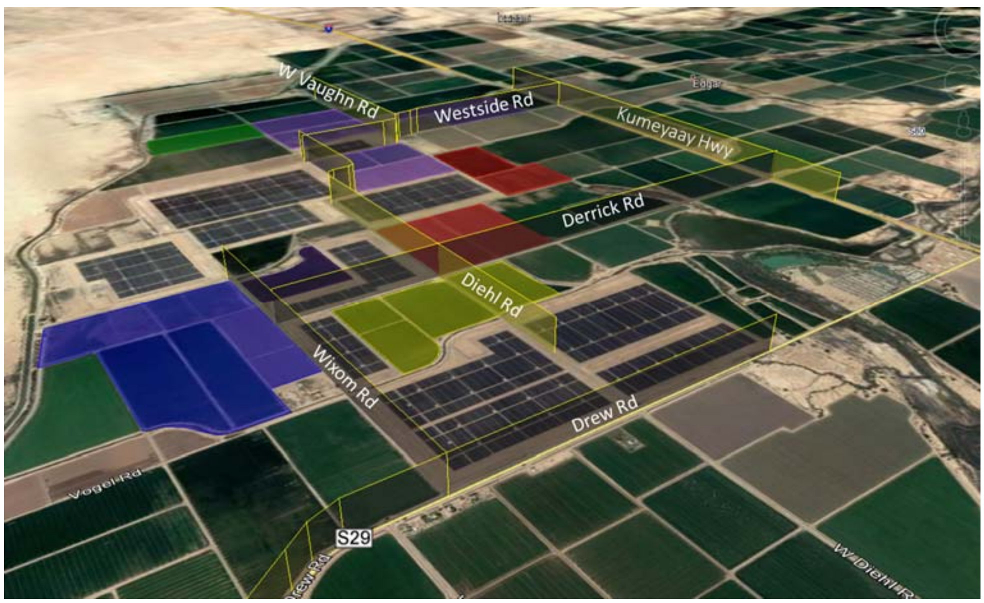
The future supporting structures for the PV modules can be of different technology, namely: fix-tilt structures, single axis tracker structures and two axis tracker structures. As a consequence, the PV module orientations will produce different glare risk events at the KOPs.

The geometric analysis for reflected solar beams has been conducted for a complete year in 15-minute intervals. All mathematical expressions for sun position, KOP's position, orientation of PV modules and reflected sun beams are described and implemented in a computer routine to evaluate the risk of reflected sun beams to reach the potential observers. The results are summarized in the Table below for each of the KOPs and supporting structure typology:



	Fix Tilt	Single Axis Tracker	Double Axis Tracker
Westside Rd	Every day	*	No glare potential
W Vaughn Rd	Between March 26th and October 7th	*	No glare potential
Diehl Rd	Between March 26th and October 7th	*	No glare potential
Derrick Rd	Every day	*	No glare potential
Wixom Rd	Between March 26th and October 7th	*	No glare potential
Kumeyaay Hwy	No glare potential	*	No glare potential
Drew Rd	Between March 26th and October 7th	*	No glare potential

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where the (*) symbol indicates geometric glare risk, but with the observer being directly facing the sun's disk. This is illustrated in the example photo below. For this scenario countermeasures would not be necessary.

If fix-tilt is selected, it is recommended to install fence slats in corresponding parcel's boundaries based on the table above for exposure mitigation purposes as a countermeasure for glare events in which the observers would not be directly facing the sun's disk. The fence height shall be at least 8ft and located in all parcel boundaries, except North sides.

Example: Glare event from fix-tilt system not aligned with sun position.

Example: Glare event from HAS tracker system, aligned with sun position.

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