Docket Optical System - Fwd: Observations on the Potential for Glare form the VV2 Solar Array

From: John Kessler
To: Docket Optical System
Date: 9/24/2007 11:07 AM
Subject: Fwd: Observations on the Potential for Glare form the VV2 Solar Array
CC: David Flores; Eileen Allen; Eric Knight; Jim Adams; Mark Hamblin; Shaelyn Strattan
Attachments: David Flores; Eileen Allen; Eric Knight; Jim Adams; Mark Hamblin; Shaelyn Strattan

Dear Docket Staff:

Please docket both the email and the attached document to Victorville 2 (07-AFC-1).

Thank you,

John

John S. Kessler
CEC - Project Manager
Office: 916-654-4679
Cell: 530-306-5920
Fax: 916-654-4421

>>> "Barnett, Tom" <tbarnett@inlandenergy.com> 9/24/2007 10:38 AM >>>

John:

I am forwarding an e-mail I just received from Peter Soderquist, the SCLA Director; as I indicated in previous phone calls, he was the first to bring the subject issue up two years ago and to want full assurance that it would not impact his airport operations. Although he had previously performed flyovers of the SEGS plants north of SCLA to satisfy himself that there was no issue, he readily volunteered to do it again just to verify his earlier observations. In the forwarded e-mail he confirms that glare from solar arrays is not an issue for aviation.

I have also attached our write-up summarizing the engineering aspects of the solar array that, by design, virtually eliminate direct reflections of the sun as a distraction to aviation.

Please let me know if you have any questions or require further information.

Tom

Thomas M. Barnett

Executive Vice President

Inland Energy, Inc.

Ofc: 949-856-2200

Cell: 949-466-7317

From: Peter Soderquist [mailto:PSoderquist@CI.VICTORVILLE.CA.US]
Sent: Friday, September 21, 2007 8:19 AM
To: Barnett, Tom
Subject: Solar Array at Victorville 2

Tom,

Hearing that there might be a light/glare issue with the solar panels at Victorville 2, I thought I would take the time to fly up there and take some pictures of it so you can see what it looks like from a pilot's perspective.

Before coming to work yesterday, I took a flight (and camera) up to the solar array located on the northwest corner of SR-395 and I-58. My intent was to show you what these fields look like from the air. (They look like water.)

When I called Sport Radar (the array is inside restricted airspace), I was advised that R-2508 was hot and was therefore unable to go in for the pictures. Not one to give up, I went over to a similar array on the west side of Barstow-Daggett Airport. There, I took some pictures. I'll get them printed and send them down to you.

I'm going to make another attempt at the array at SR-395 and I-58 this afternoon. If unsuccessful, let me say for the record that I have flown over/near this array several times. I have flown over/near the array in Barstow numerous times. While the arrays are easily noticeable (conveniently noticeable for pilotage purposes), there is no offending glare. This is my personal experience. It would probably be appropriate for me to also note that I have not heard of any problems regarding this from other pilots arriving/departing VCV.

When I returned I asked our Tower Manager, Wayne Taylor if he had heard any reports of glare from those panels. He had not. Moreover, Wayne contacted Edwards Tower and was advised that they have received no reports of glare or problems associated with the solar panel array in the area of SR-395 and I-58.

Hope this helps.

Peter

Docket Optical System - Revised VV2 Solar Glare Analysis

From: "Barnett, Tom"
T "John Kessler"
Date: 9/25/2007 11:18 AM
Subject: Revised VV2 Solar Glare Analysis
CC: "Head, Sara" , "Bachrach, Arrie" , "Cadreau, Allen" , "Penna, Tony" ,
Attachments: "Head, Sara" , "Bachrach, Arrie" , "Cadreau, Allen" , "Penna, Tony" ,

John:

I am re-forwarding the e-mail I received from Peter Soderquist, the SCLA Director; as I indicated in previous phone calls, he was the first to bring the subject issue up two years ago and to want full assurance that it would not impact his airport operations. Although he had previously performed flyovers of the SEGS plants north of SCLA to satisfy himself that there was no issue, he readily volunteered to do it again just to verify his earlier observations. In the forwarded e-mail he confirms that glare from solar arrays is not an issue for aviation.

I have also attached our revised write-up summarizing the engineering aspects of the solar array that, by design, virtually eliminate direct reflections of the sun as a distraction to aviation.

Please let me know if you have any questions or require further information.

Tom

Thomas M. Barnett
Executive Vice President
Inland Energy, Inc.
Ofc: 949-856-2200
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Parabolic Trough Mirror Design

Prevents Escape of Reflected Incident Rays

The design of VV2's single axis solar collector essentially prevents the escape of incident rays that directly strike the surface of the mirror. This is accomplished by the fundamental physics of the parabolic reflector as shown at Figure A in EXHIBIT 1 (attached). All rays entering the parabolic reflector are concentrated at single point (the focal point), located ½ the distance of the arc's radius, shown as Fp in Figure A. A Parabolic Trough Mirror type solar array is engineered so as to place the Heat Collection Element (HCE) precisely at the Fp (see also Figure B, on the attached EXHIBIT 1).

The solar array will track the East to West movement of the sun with an accuracy of 0.1 degrees. The concentrated area of the sun's reflected incident rays will be magnitudes smaller than the 70MM diameter of the HCE. The HCE positioned in this direct line of sight with the sun will block or absorb all entering direct incident or reflected incident rays. As a result, aircraft flying over the array will generally not be exposed to reflected incident rays of sunlight -- in other words, the sun itself (or any portions thereof) will not appear to pilots as a reflection in a mirror.

It is important to note that the HCE is encased in glass and will be a minor source of reflection as described below (this is generally what accounts for the "glittering" effect of parabolic trough solar arrays, often described as similar to flying over a body of water):

1) The HCE is designed to absorb and collect incident rays reflecting off the parabolic mirror but, of course, some incident rays will strike the HCE directly as it is located in front of the mirror. As a result, there will be some reflections from the glass coating the HCE; however, these reflections will be minor as the HCEs are designed to absorb sunlight, not reflect it.

2) The reflected incident rays of the sun will generally be directed to the lower portion of the HCE glass encasement by design and will produce a glow from the reflected scattered beams as they enter the collector. If an aircraft were positioned at exactly the right angle above the array, this "glow" phenomenon could be visible along the entire length of the collector element for an individual row of mirrors. However, there are no reflected incident rays of sunlight associated with this glow and the brilliance/intensity of the light is much less by comparison to reflected sunlight.

In summary

Based on practical experience and the laws of physics, solar arrays using the parabolic trough mirror design do not produce significant glare or reflection that would pose a distraction to aviation. The fundamental reason for this conclusioncan be found in the design of the parabolic trough mirror. The focal point created by the parabolic mirror will not allow any concentrated rays to escape the solar field. As a result, descriptions by pilots over flying a solar thermal facility (SEGS) indicate that, with regard to reflective glare, the general appearance of the array from the air is similar to flying over a body of water (see for example, the attached e-mail from Peter Soderquist of SCLA describing a recent overflight of the existing SEGS plants).

EXHIBIT 1: Parabolic reflectivity

Fp = Focal Point = A point located ½ the distance of the arc's radius

C = Center of Arc

Incident Ray = Separate and continuous bombardment of sunlight

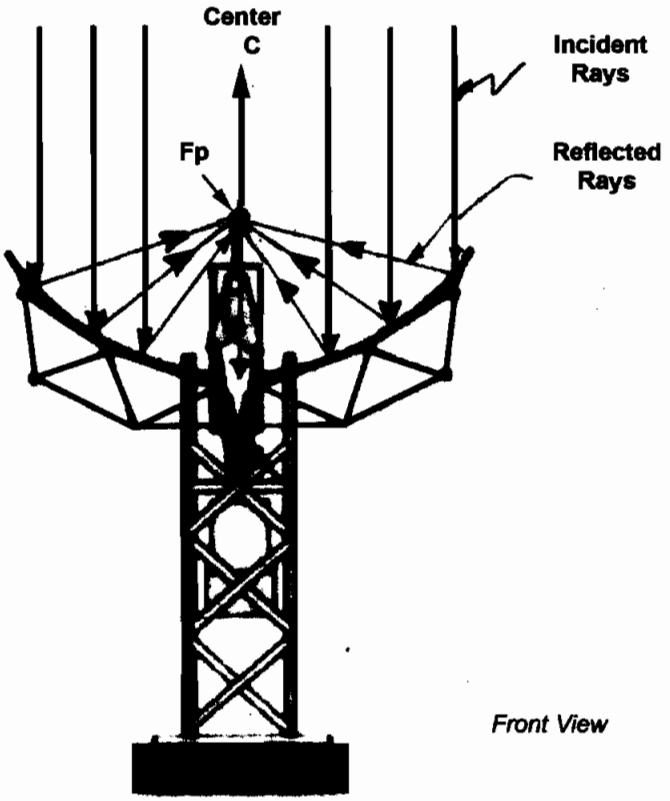

Figure A

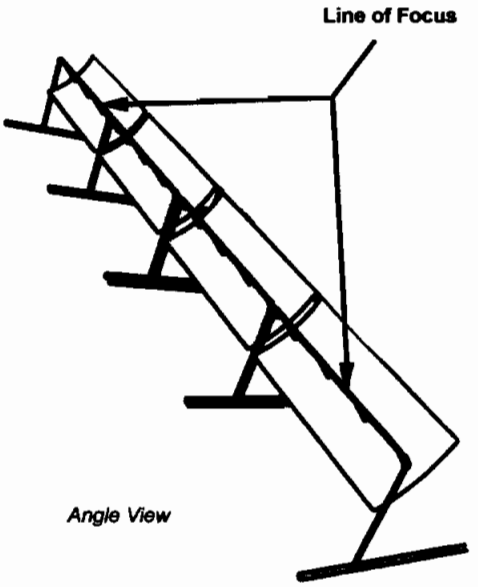

Figure B

A parabolic reflective surface (Figure A) will precisely direct an Incident Ray of light (Ir) to a focal point (Fp) ½ the distance from the center (C) of the arc. There is a "line of focus" (Figure B) created by the parabolic trough that will travel the full length of the mirror.