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Summary of Results for the Aerodynamic Testing of Trinity Solar® Solar Panel

A 3 ft x 5 ft solar panel mounted on a triangular frame was tested in the 6ft x 6ft Virginia Tech Stability Wind Tunnel on February 18, 2010 and Mar 12, 2010. The tests were performed for Trinity Solar® (800 US Highway 9 South, Freehold, NJ 07728).

The purpose of the test was to determine if the solar panel with the support structure could withstand up to 120 mph wind without any vertical or horizontal displacement and establish the lbs per sq ft of ballast required at that wind speed.

The support structure (seen in Figure 1) consists of a square triangle whose resting on its hypotenuse. The angle of incidence of the panes was fixed at 10 degrees.

The overall weight of the solar panel module (panel+structure) is 68lbs (30lbs for the panel and 38lbs for the structure). The structure weight includes a 6lbs rear deflector panel.

The module has been tested for three configurations for a head wind (where the solar panel faced the flow), a side wind (where the panel structure was yawed by 90 degrees) and a rear wind (where the panel structure was yawed by 180 degrees).

A stretch of roofing material (used on commercial building roofs) was installed on the floor of the tunnel test-section to better simulate the full scale conditions.

Head wind results

Testing of the solar panel structure in the original configuration showed that the presence of the rear deflector panel did not result in any significant lifting force. However, the associated drag was such that 48lbs of ballast could not prevent the module from sliding downstream at only 60 mph.

The addition of a front dam (Figure 2) to prevent the flow from entering the module below the solar panel stabilized the module so that a minimum of 18lbs of ballast was required to withstand 120mph.

With the addition of the front dam, the Trinity Solar® solar panel module can withstand 120mph head wind as long as a minimum overall weight per surface area of 4.51 psf is used.

Side wind results

The solar panel structure (without rear panel) was tested for side wind resistance by rotating it 90 degrees compared to the head wind configuration shown in Figure 1).

A side deflector seen in Figure 3 was mounted on the wind-facing side of the module. In such configuration, the module required only 18lbs of ballast to stay immobile (this corresponds to an overall weight per unit area of 4.51psf).

Rear wind results

In the rear wind configurations (where the model is rotated 180 degrees compared to the head wind configuration seen in Figure 1), and the angle of the deflector was greater than the recommended 5 degrees, the required ballast exceeded 4.51psf and was unacceptable.

As we suggested in our Summary of February 18, 2010, to minimize the ballast weight the angle of the rear deflector should be 5 degrees. It should be noted that the rear deflector should be necessary only for the first row of panels subjected to rear wind, as any subsequent row will see a drastically reduced wind load.

Conclusions

In front and side wind configurations, the Trinity Solar® solar panel module can withstand 120mph wind as long as the overall weight per unit area is at least 4.51psf and that a front dam and side deflector are used.

In rear wind configuration, a weight per unit area of 20.2psf per panel will allow the module to withstand up to 100mph. It should be noted that this weight distribution should be necessary only for the first row of panels subjected to the rear wind, as any subsequent row will see a drastically reduced wind load.

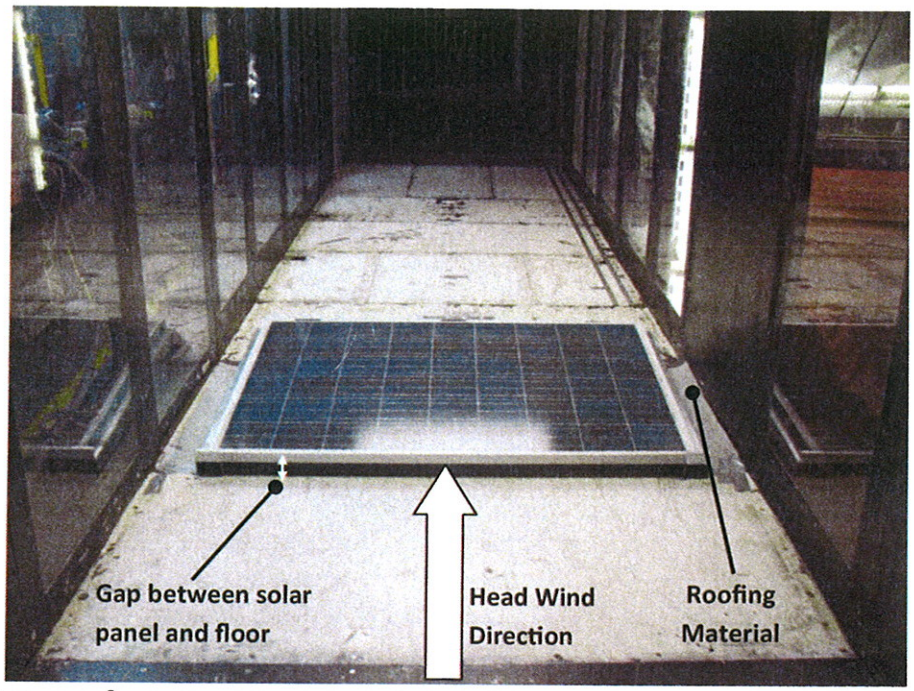

Figure 1: Trinity Solar® Solar Panel Module in the Stability Wind Tunnel test section. Head wind configuration, no front dam.

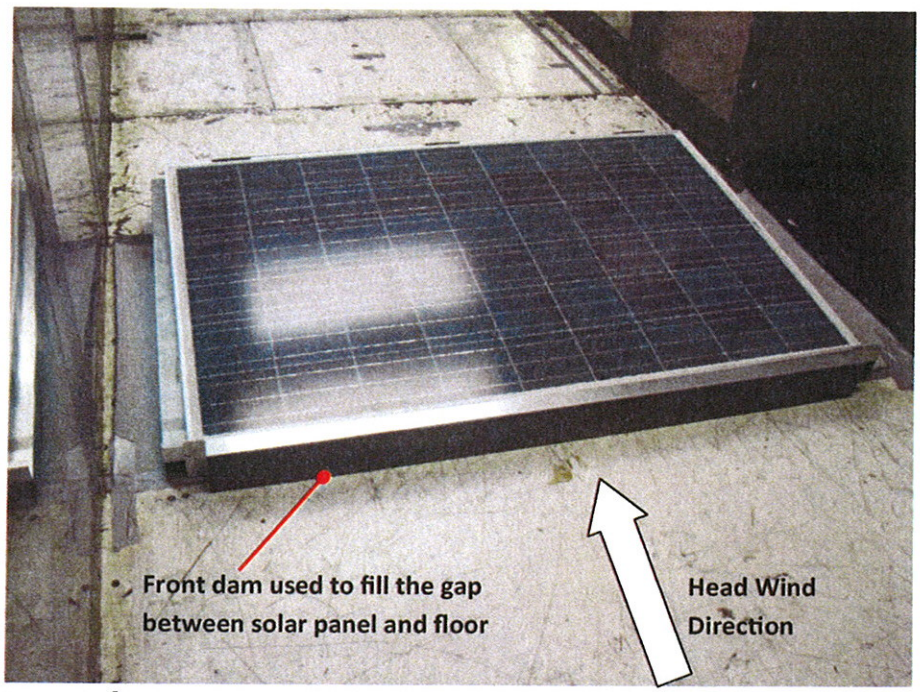

Figure 2: Trinity Solar® Solar Panel Module in the Stability Wind Tunnel test section. Head wind configuration with front dam.

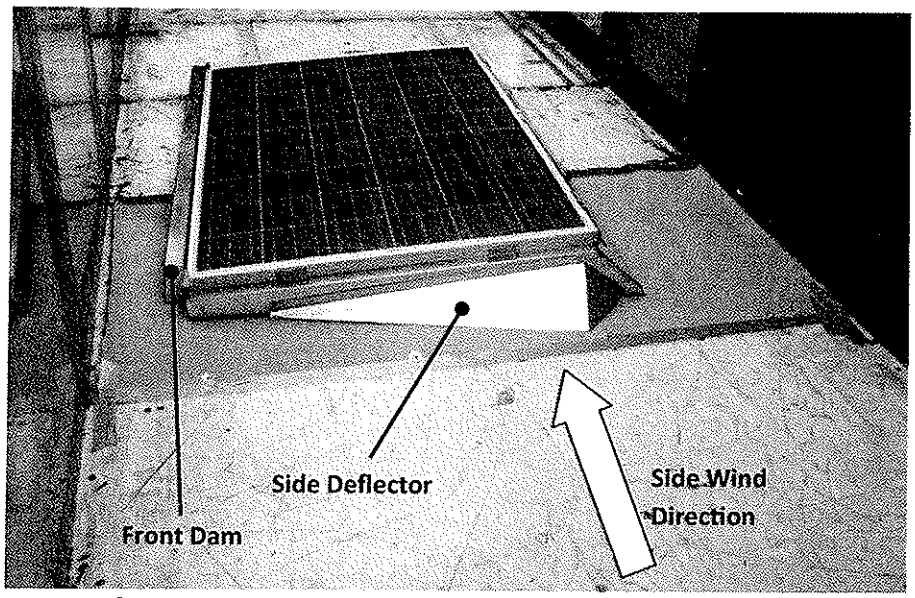

Figure 3: Trinity Solar® Solar Panel Module in the Stability Wind Tunnel test section. Side wind configuration with side deflector.