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Abstract Title: **Hurricane Effects on Roof-mounted Solar Collector Arrays**

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Session 2: Hurricane Related Wind Risks

Hurricane Effects on Roof-mounted Solar Collector Arrays

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ABSTRACT:

Rooftops are an excellent location for solar collector modules. The roofs provide exposure to abundant sun light, offer a secure and robust place for collector module installation located away from public access, and the panels are located in close proximity to the energy user. But the very regions where solar energy is intense and an attractive energy source are also frequently high wind hurricane regions…a "Catch-22" situation. Thus, are solar systems a great survival tool or a huge waste? Do solar collectors provide a green tool for survival in hurricane zones, or are they sources of additional storm driven debris and "riderless surf boards" in the nearby storm surge?

Today there are an estimated 11 million square feet of PV modules installed on both flat and sloped rooftops in the United States.[1] Solar experts working to install arrays on rooftops have found that estimation of wind loads (uplift, side loads and over turning moments) are critical to their satisfactory performance. Although the UL, IEC, and IEEE standards for PV do not address roof-specific issues, such systems must comply with the National Electric Code (NEC) and local building codes, such as the International Building Code (IBC). Eventually mounting systems may be certified by Factory Mutual (FM) or the International Building Code Council (ICC), and, meanwhile, engineers are attempting to determine wind loads on PV arrays using IBC and ASCE recommendations for minimum design loads on buildings (ASCE 7-02). Unfortunately, the unique configuration of some solar systems suggest that they may experience either higher or lower wind loads than predicted by codes.[2] Hence, an alternative approach to determine wind loads using analysis, CFD or laboratory testing is frequently employed.[3]

Computational Fluid Dynamics (CFD) can provide a flexible and cost-effective tool to select promising configurations from alternative design strategies, which can be subsequently tested in detail either in the laboratory of the field. This paper reports the results of a series of calculations that created CFD simulations of selected direct force measurement tests obtained during wind tunnel experiments to refine computational algorithms and evaluate the use of CFD to predict aerodynamic loading on individual PV tiles within tile arrays. Only static loading produced by a steady horizontal wind was considered for this exercise.

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[1] O'Brien, C., "Roof-mounted Solar Photovoltaic Arrays: Technical Issues for the Roofing Industry," Interface, Trade Journal of RCI, Inc., March 2006, 13-22.

[2] Healey, H.M., "Florida's Winds Create Installation Problems for Solar Water Heating and Photovoltaic Modules on Buildings", Introduction to Solar Energy, Florida Alternative Energy Corporation, http://www.flaenergy.com/pic2r.htm, 2009, 2 pages.

[3] Neff, D.E. and Meroney, R.N., Wind Performance of Photovoltaic Arrays, Final Report, Wind Engineering and Fluids Laboratory, Colorado State University, 2003, 181 pp.