Seismic Considerations and Evaluation Approach for "Isolated" Rooftop PV Arrays

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Abstract

Recently, some photovoltaic (PV) equipment manufacturers have developed and implemented non-anchored or "isolated" PV array support on relatively flat rooftops on large commercial and institutional buildings. This technique saves significant time and expense over conventional PV array installation methods, and has the potential to decrease the risk of roof membrane failure. However, concerns regarding possible seismically-induced horizontal movement and wind uplift of PV arrays surround the introduction of this new technique, which currently is required to be considered as an "alternative means of compliance" for rooftop PV array implementation. The isolated approach explicitly relies upon friction between a PV array and its supporting roof membrane, which in principle is similar to the use of friction in a seismic isolation system.

This paper describes the key seismic considerations related to this innovative method of PV installation on flat or near-flat building rooftops, and presents a rational approach for the evaluation of PV array seismic sliding displacements and determination of corresponding gaps for seismic movement.

Introduction & Background

According to the U.S. Energy Information Administration, the fastest growing component of the US renewable energy sector in 2010 was solar PV arrays. Total shipments of PV modules in 2010 more than doubled compared to total module shipments in 2009, corresponding to a rise in capacity from nearly 1.2 peak gigawatts to more than 2.6 peak gigawatts (Figure 1). This surge in growth was supported in part by a rapid decline in the price of PV cells and modules and by government incentives and policies at the federal, state, and local levels. Solar PV energy has been established as a small but important component of the renewable energy supply in the U.S. Over half of the recent growth in PV energy capacity has taken place in the commercial sector, where many PV arrays are located on large, relatively flat building rooftops.

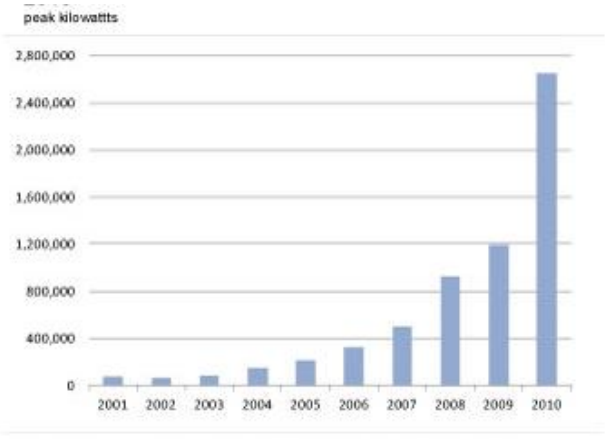

Figure 1: Annual Photovoltaic Shipments, 2001 - 2010

The International Building Code (IBC) and California Building Code (CBC) currently do not explicitly address the seismic requirements for rooftop PV arrays. The conventional method of supporting PV arrays on rooftops is to anchor them to the roof structure or to adhere them to the roof membrane itself to prevent hazards arising from wind