

The Design and Optimization of Residential Fixed-Panel Photovoltaic Systems under the TVA Green Power Switch Program

J. Douglas Sterrett¹, Michael Cody Cain²

Abstract: Photovoltaic energy systems that are tied to the local power grid represent a cost effective sustainable alternative for residential customers. It is interesting to note that many residential customers could install a solar energy system that significantly reduces, or eliminates, the amount of energy they purchase from the utility for less than the cost of a new mid-priced automobile. The obvious question becomes why do we see so many new automobiles and so few residential solar energy installations? There are many answers to this question but the authors are convinced that the primary reason is ease or difficulty of financing. Products such as automobiles are easily financed because they are modular and the lending institutions have confidence in the retained value of the product.

An optimal design for a modular fixed-panel residential photovoltaic (PV) energy systems that meets the financing criteria discussed above will be discussed. The system analyses were performed using solar insolation data for West Tennessee and utilize recent advances in small-scale grid-tie inverter technologies. Previous work focused single and dual-axis tracking but it has been determined that fixed systems offer the optimum financial return.

These residential systems were designed to operate under the Tennessee Valley Authority (TVA) Green Power Switch Program. Under this program photovoltaic energy is purchased by TVA at a \$0.12 premium above the customer's normal energy cost for contract duration of ten years. The authors believe that these highly modular plug-and-play designs when coupled with the TVA Green Power Switch Program and federal tax incentives will result in residential solar energy systems that are financially attractive to both the consumer and lending institutions. Data will be presented that shows it is possible to install such a residential system that requires minimal capital outlay and results in a positive cash flow for the life of the system.

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Authors:

J. Douglas Sterrett, Ph.D. is currently professor of mechanical engineering at the University of Tennessee at Martin. He supports applied undergraduate research in area of sustainable energy and currently serves on the board of directors of the Tennessee Solar Energy Association. He served as Dean of the College of Engineering and Natural Sciences from January 2000 – January 2009.

Michael Cody Cain² is currently a senior engineering student at the University of Tennessee at Martin with a specialty in electrical engineering.

^{1&2} University of Tennessee at Martin, 101 EPS Bldg, Martin, TN 38238, dsterret@utm.edu