ABSTRACT

The benefits to a utility and to the environment of the installation of a large number of solar domestic hot water (SDHW) systems are identified and quantified. The environmental benefits of SDHW systems include reduced energy use, reduced electrical demand, and reduced pollution. Utilities use various forms of power generation to meet the system load, beginning with the plant with the lowest operating costs. Each of these plants incurs a certain cost to the utility and to the environment. Coal, oil, and natural gas plants release varying levels of carbon dioxide, sulfur dioxide, oxides of nitrogen, and particulates. The cost to the environment for these pollutants can be converted into $/ton produced. Using a marginal plant analysis based on a least cost production model, a utility's avoided emissions, avoided costs, and capacity contribution from the installation of many SDHW systems has been evaluated and the impact of many solar systems on the utility has been quantified.

The avoided emissions, capacity contribution, energy and demand savings were evaluated using the power generation schedules, emissions data and annual hourly load profiles from local utilities. It is shown is that power plant maintenance and outage scheduling significantly effect the amount and type of airborne pollutants at the margin during a utility's off-peak periods. SDHW systems are thereby found to be beneficial during both peak periods and periods of scheduled maintenance from an environmental point of view. As a specific example, each six square meter solar water heating system

can save annually: 3559 kWh of the energy, 0.66 kW of peak demand, and over four tons of pollution (7727 # CO_2, 51 # SO_2, 0.11 # N_2O, 17 # NO_X, 0.13 # CH_4, and 1.1 # particulates) for a Wisconsin utility. (Based on 5928 kWh annual energy requirements of a conventional 52 gallon electric system resulting in over six tons of airborne pollutants: 12705 # CO_2, 80.78 # SO_2, 0.180 # N_2O, 28.35 # NO_X, 0.200 # CH_4, 1.820 # particulates.)