CHAPTER
SEVEN

CONCLUSIONS & RECOMMENDATIONS

7.1 Conclusions

Using an average hot water draw profile (derived from WATISM), an energy rate controlled zip heater can effectively represent diversified electric demand in both conventional and solar DHW systems. Zip heater modeling (with the average hot water draw profile) eliminates the need for a large number of representative individual customer hot water draw profiles. For two-tank solar DHW system configurations, the auxiliary energy requirements represent an upper limit to system energy demands due to the addition of a constant standby loss term.

The average weekday hot water draw of a typical family of four is seventy gallons. Since over one third of Wisconsin residential customers do not have access to natural gas, solar-electric DHW systems have good replacement potential in Wisconsin. Over two thirds of Wisconsin residential customers are single family households. All but one (Dairyland Power Cooperative) Wisconsin utilities are summer peaking utilities, due to high electric air conditioning loads on hot sunny days. Solar DHW systems have significant peak demand reducing potential in the summer.

Three differently sized systems of one and two-tank configurations with either thirty watt pumps or photovoltaic pumps were analyzed. A least cost production model and hourly weather and utility load data (for 1991) were used for the utility impacts analysis. The marginal emission reduction, avoided generation costs, energy savings, peak demand reduction, and contribution to utility capacity were evaluated for a typical electrical DHW systems, twelve solar-electric DHW systems, a typical natural gas DHW system, and six solar-gas DHW systems.

Solar DHW systems are found to be economically feasible from both a supply-side utility perspective and a customer monthly bill analysis. Photovoltaic pumps do not appear to be as cost effective as thirty watt pumps from either perspective, due to high initial costs. However, single-tank SDHW systems consistently performed better and were more economically attractive from both cost perspectives. Issues about hot water run outs associated with decreased storage volume were not addressed.

Based on the before mentioned analyses and assumptions, solar DHW systems have significant economic and environmental potential in the state of Wisconsin.

7.2 Recommendations

Similar detailed analyses for all utilities in the country would be most beneficial to determine the impacts of SDHW nationwide. Hourly weather (temperature and radiation) and hourly utility load and dispatch information are necessary for accurate analyses. The need for an all inclusive database of this information (including weather data), similar to the Federal Energy Regulatory Commission (FERC) database is paramount. Much of the utility and economic analyses were performed using Microsoft Excel for the Macintosh. Manipulation of data in this format proved to be very time consuming. Automation of the utility and economic analysis would be very beneficial. TRNSYS has the capability to perform such tasks. A complete TRNSYS "front-end" program to evaluate solar DHW system impact on a utility (with minimal computation time) would be ideal. These recommendations are currently being acted upon by a new graduate student at the UW-Solar Energy Laboratory, in conjunction with the U.S. Department of Energy and the Solar Energy Industries Association.