CHAPTER

SEVEN

CONCLUSIONS AND RECOMMENDATIONS{ TC "CONCLUSIONS AND RECOMMENDATIONS" \l 1 }

7.1 Conclusions{ TC "7.1 Conclusions" \l 2 }

UTC systems are simulated using a simple energy balance model which is described in Chapter 2. The model calculates the energy savings that would actually appear on a heating bill, as discussed in Section 2.5. A UTC system on a building with a low balance temperature has a relatively low energy savings.

Annual simulations are performed with the TRNSYS component subroutine described in Chapter 3. The UTC system model is validated with data from laboratory experiments and monitored installations. As discussed in Section 4.1, the model accurately predicts the active solar gain and reduced wall loss, but the recaptured wall loss is under predicted.

Several parametric studies are performed to determine the effect of various parameters on the performance of UTC systems. The effect of climate on the energy savings of UTC systems is explored in Section 4.3. The most important climatic variable is the amount of solar radiation during operation. The average ambient temperature during operation is not an important factor. However, the amount of time that the ambient temperature is below the summer bypass set temperature is a significant climatic variable because it affects the operating time of the UTC system. The summer bypass set temperature also affects the operating time of the system. As discussed in Section 4.4, increasing the bypass temperature increases the energy savings but also increases the overheating of the building. The effect of automatically opening the bypass damper

at night is examined in Section 4.5. The energy savings of UTC systems is increased with automatic nighttime bypass except where the south wall is poorly insulated.

An economic analysis of UTC systems is based on the P_1, P_2 method of life cycle savings. A method for optimizing the collector area based on maximum life cycle savings is presented in Section 5.3. A statewide impact study is presented in Chapter 6. There is no substantial statewide economic potential for UTC systems on existing buidings in Wisconsin in the commercial, agricultural, and industrial sectors. The reason for this conclusion is that UTC systems on existing buildings can only compete with electric heating, and electric heating is not widely used in buildings which are well-suited for UTC systems. In the residential sector, UTC systems are economically feasible for existing large apartment buildings with electric heating. UTC systems should also be considered for new buildings because a low first cost allows them to compete with gas and oil heating.

7.2 Recommendations for Further Work{ TC "7.2 Recommendations for Further Work" \l 2 }

Experimental work is necessary to generate a pressure drop correlation for the UTC system including the plenum. The total pressure drop depends on several parameters, including collector plate porosity, approach velocity, collector height, plenum depth, and air temperature rise. An accurate pressure drop correlation would allow the additional fan power required by the UTC system to be included in the energy savings calculation.

As mentioned in Section 4.1, the UTC system model under predicts the recaptured wall loss. Experimental work is necessary to produce a convection correlation which would remedy this problem. However, the recaptured wall loss is not a large part of the energy savings. The pressure drop work is more important.