

# Simulation of Cooling Load Reduction Obtained by Shading from Trees Irrigated using a Gray Water System.

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## **Abstract:**

Gray water systems offer water-conservation benefits, however, they are difficult to justify simply for economic reasons since water costs are relatively low in Arizona. Now, if the water harvested from the gray water system is used to water trees that provide shading to the building, the economic situation improves slightly, due to the added shading reducing the cooling load during the summer.

This paper presents an irrigation approach, called the Subterranean Irrigation System (STIS), that is similar to drip irrigation but different in that it discharges the water into canisters buried next to the tree. These canisters provide a point-of-discharge that is not exposed to the external environment or public, and also shields the emitters from rodents and other animals. In addition, this approach decreases evaporation losses and promotes deep-root growth. Consequently, trees grow faster (for the same quantity of water) and are less likely to be uprooted in a windstorm.

The system was installed at ASU Polytechnic and fed with potable water from the regular irrigation system. Seven newly planted trees (Chilean Mesquite) were selected for evaluation. Four of the trees were equipped with the STIS system, (in which the irrigation water was discharged inside the canister) and in the other three control trees, the irrigation water was discharged at the surface, using conventional drip irrigation. On the average, the trees receiving water through the STIS grew 5% faster than the trees receiving water through the conventional method.

Another aspect of this study investigates the impact on cooling load resulting from shading provided by trees. To accomplish this objective, a thermal model of a hypothetical house, surrounded by trees irrigated using the STIS approach is simulated. The thermal model of the house is implemented in TK-Solver. The simulation goes through every hour to determine the required cooling load. The simulation is performed with and without shading from the trees. Actual weather data for Phoenix for the year 1990 is used in the simulation.