

Decision Support System for the Operation of a 250 kW Microturbine Installed at Rutgers
EcoComplex Research and Demonstration Greenhouse

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Abstract: A Decision Support System (DSS) was developed to manage the use of supplemental lighting at Rutgers EcoComplex research and demonstration greenhouse located in Burlington County Resource Recovery Complex, NJ. The supplemental lighting system is powered by the electricity generated by an on-site 250 kW landfill gas-fired microturbine. The approximately 220 kW of available power (30 kW are required for the operation of the microturbine and fuel conditioning system, the so called parasitic losses) is used in the greenhouse mainly for supplemental lighting; otherwise it is exported to the grid through PJM (Regional Transmission Organization, RTO, that coordinates the wholesale electricity market in all or parts of 13 states, including NJ, and the District of Columbia). The cost associated with supplemental lighting becomes a big expense for tomato growers in the northeast of the USA, particularly during winter months, when light is the principal limiting factor for greenhouse tomatoes in this region. Managing the use of supplemental lighting to achieve the grower's goals while minimizing the cost of electricity is a challenging task for a greenhouse operator due to the changing price of electricity and because the present crop needs are based on past and prediction values of different environmental factors that have an effect on the crop development, among them: Photosynthetically Active Radiation (PAR), carbon dioxide concentration, nutrients, temperature, relative humidity. Five years (2000-2004) of hourly weather and electricity price data were used to test (by simulation) the effectiveness of the DSS at achieving the harvest and yield targets while optimizing the use of electricity. The DSS can be implemented at any location within the PJM geographic region and relies on historic weather data from the National Solar Radiation Database (NSRDB) available for 1,455 stations throughout the United States, and on past and prediction values of electricity prices data available from the RTO.