Construction of municipal utility complexes has to support continuing population growth, economic development, and a widespread of social interest in environmental preservation. Municipalities face challenges in designing, constructing, and operating environmentally sustainable utility complexes, and their primary goal in developing such a complex is to minimize the environmental impact resulting from energy production and waste treatment (both liquid and solid), management, and disposal. However, decision and policy makers lack a system of systems approach that takes into account multiple interdependent systems comprised of the functional system (infrastructure, facilities, operations within the complex...), the economic system, the social/cultural system, and the environmental system (environmental impact on air, water, soil...). This research proposes a decision support system (DSS) with a new methodology using Vensim software and system dynamics methodology to assess the sustainability of a municipal utility complex system. This DSS incorporates 1) multiple interdependent systems, 2) multiple sustainability/performance indices, and 3) composite sustainability index. Engineers, managers, and researchers should benefit from a system of systems perspective, and from the application of a sustainability assessment method that is developed to provide an environmentally-conscious design, construction and management. Although a municipal utility complex is built with synergistic opportunities for integration of processes of a wastewater treatment plant, a resource recovery facility (aka waste-to-energy (WTE) or incineration facility), a material recycling facility (MRF), and a landfill; engineers tend to use the traditional sustainability assessment methods only to assess the life cycle (LCA) of each system's process over time. They might not necessarily incorporate an assessment based on system dynamics of the functional, economic, environmental, and social/cultural systems. Data from a case study is utilized in this dissertation based on the municipal utility complex in Pasco County in the western region of the State of Florida, USA.