Energy Systems Engineering for Waste-to-Energy Policy and Decision Making in the Big Data Era

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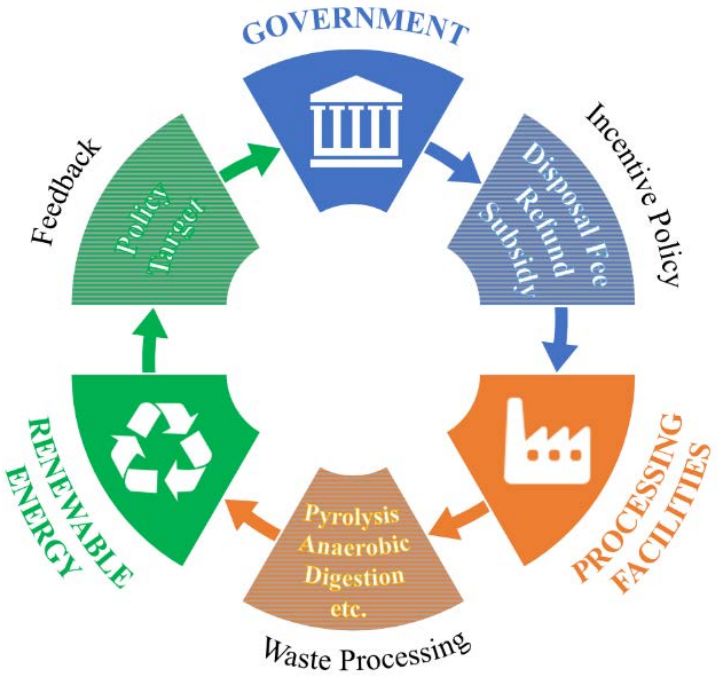
The production of waste is inevitable for any society, and factors such as global industrialization, urbanization and population growth have been boosting the quantity of produced waste. It is a crucial challenge to manage large amount of waste in a sustainable manner, which consequently alleviates the negative environmental impacts from conventional waste treatment methods. To deal with this challenge, waste can be processed as a raw material to produce energy, in the form of heat, electricity and transport fuels, by means of waste-to-energy technologies such as incineration, pyrolysis, thermal gasification and anaerobic digestion. For instance, the dairy waste in New York State can be used to produce over 3.9×10^6 MWh of heat through anaerobic digestion. To facilitate the application of these technologies, government incentive policies could play an important role, since they have a significant influence on the economics of waste-related parties. Therefore, it is imperative for the government to propose effective and efficient waste-to-energy incentive policies, in order to promote the sustainable treatments of waste.



In this project, we will develop a Stackelberg-game-based multi-objective bilevel programming strategy that accounts for the supply and transportation of waste, the location,

capacity and operation of processing facilities, the selection of waste-to-energy technology, the supply and transportation of energy products. The objectives of the government are to minimize the cost of the government and to minimize the total environmental impacts of processed and unprocessed waste, while the objective of the processing facilities is to maximize their economic profits. The key to address this problem is to integrate the techniques of game theory, big-data analytics and the optimization tools. The results of this project will provide insights for the development of waste-to-energy incentive policies, in terms of their corresponding economic and environmental performances.