RUTGERS ECOCOMPLEX TECHNICAL STATEMENT
Energy Master Plan 2019

Changes in economic and social norms favor more holistic approaches to our current solid waste management practices, particularly in regards to organic wastes that have real value for re-use for low carbon energy generation and as compost/soil amendment materials. Despite concentrated efforts to manage waste by reusing, reducing and recycling, landfilling remains the most predominant (and cost effective) solid waste management method in the US. Landfills currently accept mixed waste, which includes waste paper, food waste, manure, yard trimmings, wood, textiles, plastic, metals, glass, rubber and leather. Approximately, 30% of landfilled waste is considered organic waste.

Landfill gas that is collected is either flared or utilized for clean energy production, including; electricity, heat and transportation fuel. Currently, there are 13 landfills in New Jersey that are utilizing LFG for energy production with 79.1MW capacity. However, landfills are estimated to be the third largest source of anthropogenic methane emissions in the US, because of fugitive emissions and other emissions generated prior to cell closure and gas collection system installation. Current landfill designs and operational practices are generally not capable of collecting the majority of LFG that is quickly generated from the highly putrescible wastes. Hence, there is a growing interest in diverting organics, particularly highly putrescible food wastes, out of landfills to utilize them more efficiently for clean energy production and for compost. Currently, 23 states either ban certain organics, including leaves and grass clippings, or specifically enforce food waste disposal bans at landfills. In addition, large cities such as San Francisco, Seattle, Austin and Portland have banned food waste disposal at landfills. These bans or new approaches to divert organic waste from landfills are expected to become more widespread nationally.

The use of waste for energy and nutrient recovery can result in both avoided emissions and increased revenue. If both recoveries are performed together, the environmental and economic benefits can increase. In landfills, organic material residuals/nutrient are not recovered for beneficial reuse primarily due to the cost and difficulty of separating impurities from mixed MSW prior to disposal. Industrial-scale composting of organic waste does not deliver efficient solutions either, since the aerobic decomposition of the organic waste is not suitable for gas recovery. In addition, the composting process often creates significant odor problems resulting in complaints from the surrounding communities. Sending food waste to animal feeding and large scale industrial composting applications have also been proven to be inefficient approaches.
Neither landfilling nor industrial composting provide optimal reutilization of organic waste, and neither can achieve both energy and nutrient recovery in one process from organic waste. Therefore, there needs to be a transition from the current “Traditional Linear Waste Disposal” approach (Figure 1) to a “Closed-Loop Resource Recovery” approach (Figure 2) to achieve environmental and economic sustainability in the context of “**Circular Carbon Economy**” .

An alternative to direct landfilling and/or composting of organic waste is Anaerobic Digestion (AD) of the food waste. This is an excellent example of the closed-loop process and is considered a better solution for converting food waste into clean energy. It also produces compost-based byproducts, thus extracting the maximum benefits from organic wastes by displacing fossil-based fertilizers. Closed-loop reutilization approaches can position organic waste as a valuable resource for energy generation, nutrient recovery and reduced water consumption. In addition, anaerobic digestion will reduce GHG emissions. This is a very important feature of the AD process, since research shows that landfills emit 18% US methane emissions and manure management is responsible for about 10% of US methane emissions.

Figure 1: Traditional Linear Waste Disposal

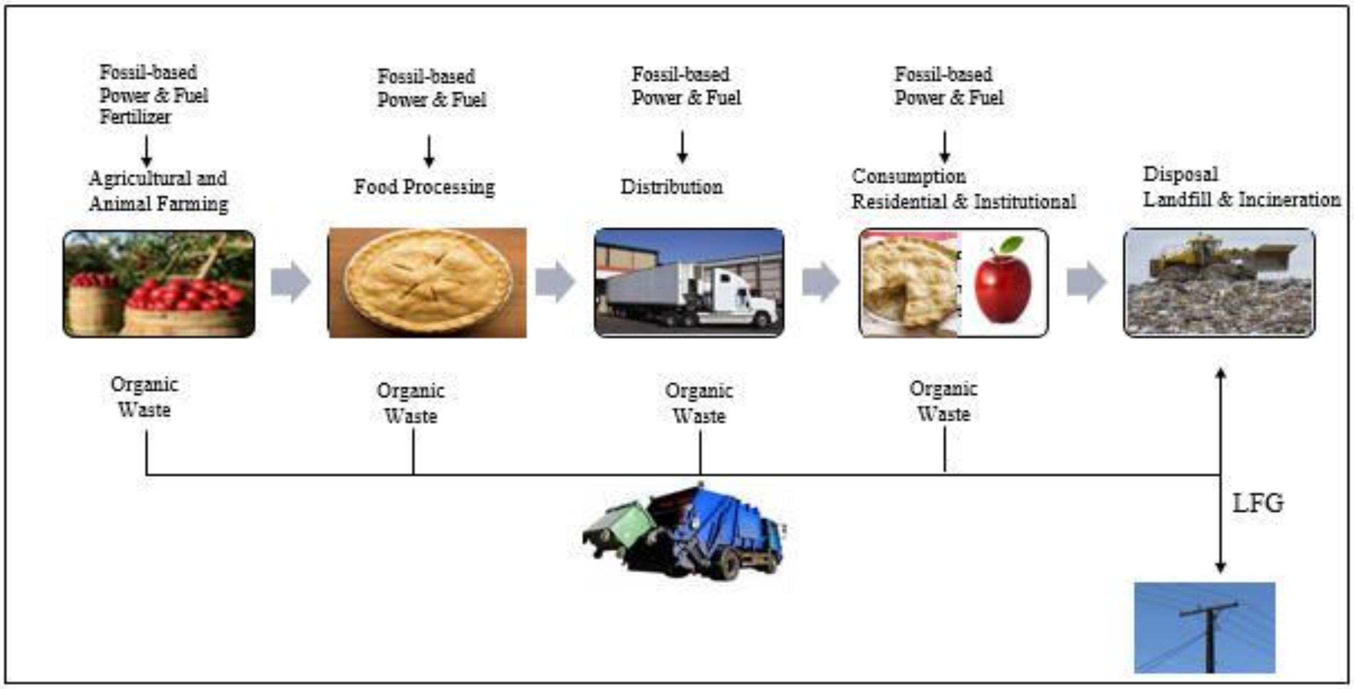
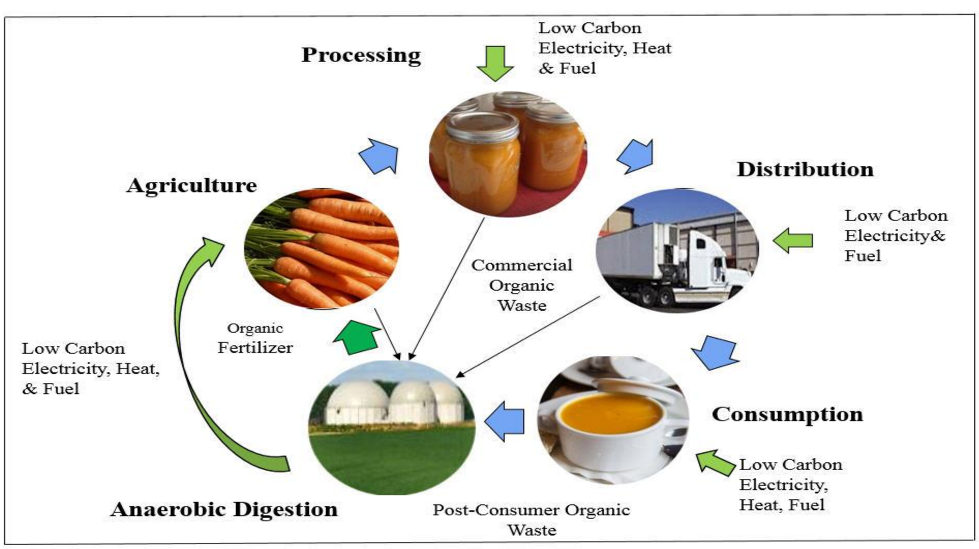


Figure 2. Closed-Loop Resource Recovery



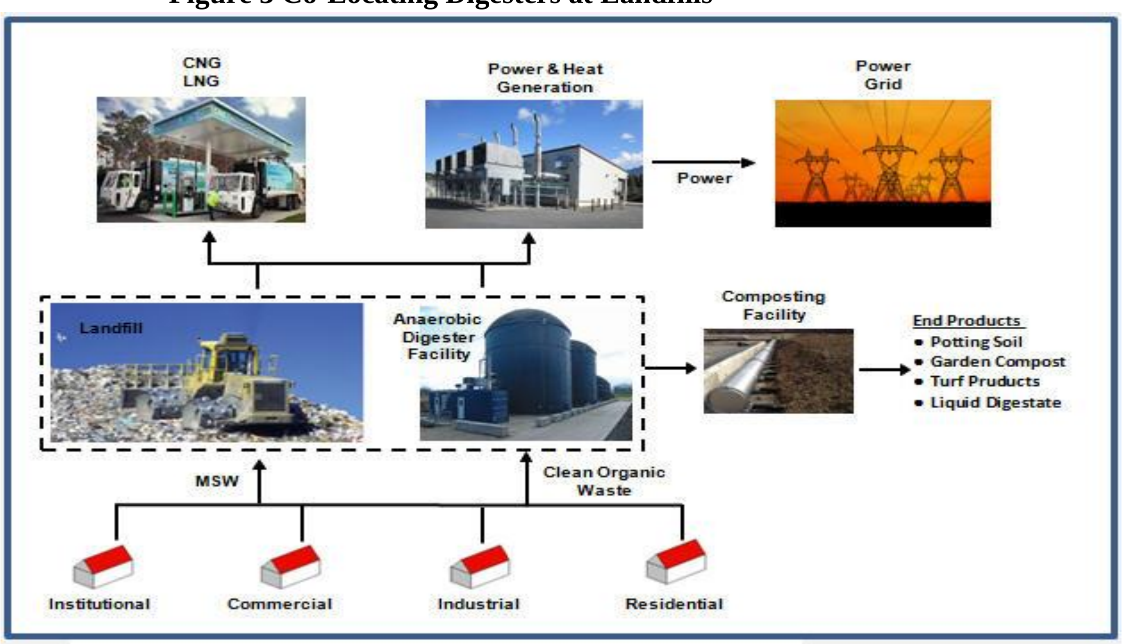
Choosing Locations for Anaerobic Digesters:

AD facilities are currently being planned throughout the US and few in New Jersey to divert organic waste from landfills and to produce biogas and compost-based materials as stand-alone facilities. However, identifying a location that is logistically and technically suitable is difficult due to the high costs for infrastructure development; issues with securing clean organic waste; power generation system installation difficulties; and location-based permitting constraints.

Stand-alone digesters have additional constraints since, in-vessel AD systems can only accept clean and pre-processed waste and the remaining digestate requires an aerobic composting step, adding to the equipment requirements and operational costs. As an alternative to developing stand-alone AD facilities, locating AD facilities at existing landfills should be considered as a sustainable option. Landfills are an important component of solid waste management systems and can serve as excellent locations to host AD facilities, since they have existing waste delivery and management infrastructure and permits.

In addition, landfills that have an installed biogas-to-energy system can easily convert AD generated biogas utilizing existing infrastructure without the need to install additional power generation capabilities, as would be the case with stand-alone AD systems (Figure 3). In addition, farms and wastewater treatment facilities are good alternative sites for co-locating AD digesters.

Figure 3 Co-Locating Digesters at Landfills



Solid waste management systems (SWMS) must proactively adapt to changing social norms, policy requirements, waste composition, and evolving energy systems to sustainably manage solid waste in the future. If the organic waste treatment options for food and other organic waste to low carbon energy applications are successfully demonstrated and assessed, along with detailed environmental footprint, and social and economic cost benefit analyses, then reliable data will be provided to landfill, county, municipal and state decision makers. Overall, SWMS would understand the importance, benefits and risks of available options leading to more informed and sound decision making. This proposed approach can help inform near-term decision making for sustainable closed-loop resource recovery and economic development. In addition, having a working AD infrastructure in place, demonstrating the value of organic waste for clean energy and bio-based fertilizer generation while reducing GHG emissions will provide a very clear and easily understood education opportunity for communities at the local, regional and national levels.

New Jersey has been successful by creating particular renewable energy sectors such as solar energy technology and wind energy technology also is under its way to develop. Considering creating carve-outs by creating small BIORECs incentives may help State's emerging Anaerobic Digestion of organic waste and other sustainable biomass via innovative technologies to low-carbon renewable energy can help New Jersey to mitigate climate change and create "Circular Carbon Economy".

Respectfully,
Serpil Guran Ph.D., Director

Rutgers EcoComplex "Clean Energy Innovation Center"
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