Blueprint to implement food waste recycling

The need to identify Large Scale Anaerobic Digestion Sites

**Tag Words:**  Food Waste; Recycling; Biodigesters; Tracking; Food Waste Data

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**Summary**

Waste is a growing problem in the US. Landfills and incinerators are not the only options for waste management. Other methods such as biomass energy conversion are a cleaner and greener alternative. For the sake of future generations, it is imperative to implement food waste recycling in suitable locations as well as recovering energy from that same food waste. This ultimately decreases the waste volume in landfills. The main obstacle we face isn’t in finding or creating the technology to accomplish this, but instead the problem lies in finding and gathering accurate data to find a location for this technology to work at its peak capacity. By obtaining and analyzing current Geographical Information Science food waste data to determine ideal food waste recycling facilities, this proposal has the potential to create efficient waste management and to help recover much needed energy. This is the most critical step of the proposal since the success of the bio digester requires a constant supply of food waste to be introduced so it can generate a constant bio-fuel byproduct. Utilizing Michigan State University’s initiative to map food waste using Geographical Information Systems would solve this issue. This innovative program can be used to analyze specific locations to determine whether a food waste recycling facility with a bio digester is viable.

**Introduction:**

Studies have shown that 1.2 tons of food waste is generated a year per average household. Studies have also shown that this food waste has the potential to be converted into viable energy, which is a commodity that is always in need. Therefore, promotion of food waste recycling is critical for the future of the planet. Landfills and incinerators have been the solution to food waste management; however these methods result in very environmentally unfriendly outcomes. These current methods not only create harmful byproducts, but it is also wasting potential energy we could be recovering to support everyday functions. The food waste can be sorted and put through a bio digester to create biofuel. This process would ultimately decrease the volume of true waste and would also generate valuable energy. In order to accomplish this, accurate data must be collected to identify a location that would be the most effective and efficient for a bio digester. In order to get this up and running, there needs to be an accurate
mapping of food waste generated in each location. Multiple factors must be evaluated to identify a suitable location to yield the most efficient results. The use of Michigan State University’s GIS system would aid in the identification of a viable bio digester enabled food waste recycling locations to promote a greener alternative to current landfill and incineration practices.

With the use of Geographical Information Systems (GIS) we can efficiently use data on food waste to determine biomass energy conversion potential as well as locating the most efficient areas for introducing an anaerobic digester. Michigan State University (MSU) has effectively created such a tool.

In a report titled “Waste Biomass Energy Inventory to Support Renewable Energy Development” authored by Steven Safferman and Steve Miller of Michigan State University the objective and functions of their plan to use GIS to create the Michigan Biomass Inventory is outlined. Safferman and Miller outline the project objectives to be to “Identify sites of residual biomass and land that can produce high energy value biomass, determine gross energy theoretically available from the biomass, estimate energy requirements in processing biomass, calculate the estimated theoretical energy balance so that amount and nature of the available energy can be estimated, and identify constraints that may substantially impact the accuracy of prediction”. In the absence of an estimate for the quantity of food waste, the tool uses relative levels of waste from major producers.

The authors of this report with subsequent implementation of the Michigan Biomass Inventory stress that it is crucial to note that data obtained from this tool has yet to be verified for accuracy and is strictly intended to provide a starting point for centralizing energy conversion technologies and locating areas with high potential energy yield from biomass conversion. Furthermore, the implementation of this tool in Michigan or theoretically in any other state does not replace the need for on-site visits, empirical recording of food waste data, interviews with managers of biomass sources, and consultation with professionals specializing in energy conversion calculations.

In determining the most efficient areas of Michigan to introduce an anaerobic bio-digester, Michigan State University staff visited three different locations to evaluate the utility of the tool and the proposed model. The first site that was evaluated was the Eastern Market area of Michigan. MSU staff produced a map demonstrating a .25-mile radius around Eastern Market demonstrating the main food waste producers and anaerobic digesters within the radius area.
The map identifies biomass sources within the radius such as universities, schools, correctional facilities, CAFO’s, landfills, water treatment plants, food processors, dairy farms, and any other relevant sites within the evaluated area. This particular evaluation determined that there is 1 school, 0 CAFO’s and 22 food processors within the selected area. The amount and nature of the biomass produced in this area was collected and analyzed. This data collection and analysis would support the identification of the most effective area to introduce an anaerobic digester.

MSU staff first met with the operator of a slaughterhouse, a food processor, within the .25-mile radius surrounding Eastern Market. Through interviewing the operator of the slaughterhouse MSU staff was able to determine that between the 3-5 days per week that the slaughterhouse operates, they process approximately 200 animals per day. The animal food waste is discarded in 50-gallon drums, which contain various animal parts. Furthermore, MSU staff also documented that animal waste is picked up every few hours at a cost of $25 per barrel where costs have been as high as $250 per barrel at peak times.

The next biomass source, another food processor, in Eastern Market that was evaluated was Pellerito Foods who is a processor of fresh vegetables. Potatoes account for most of their business while carrots, celery, peppers, and onions are about 10-15% of the business, with an
annual capacity of 25 million pounds annually. The waste produced at this facility is approximately 30-40% of the total raw materials. This waste includes items such as vegetable trimmings, peelings and damaged produce. Additionally, the MSU staff interviewed a local bakery to determine its food waste production potential as well as a local Pepsi Bottling plant. Based on the data, the Researchers concluded that the Eastern Market area had a high potential for biomass energy conversion. However, they recommended further collection and analysis to be performed to have a thorough biowaste assessment.

The process implemented by the MSU researchers and staff can be implemented in any state within the country in order to identify an optimal geographic location for an anaerobic digester to collect as much useful biomass as possible and thereby maximize energy conversion from the process. Environmental Science departments at many universities across the US can implement a similar plan in which they can combine/collate available statistics on food waste in their respective regions along with information provided by operators and owners of biomass sources to centralize the technology and to then optimize the placement of an anaerobic digester. Additionally, this plan could be marketed to the areas that will have the greatest impact, as it was in Michigan. This will raise awareness within the area being evaluated and as in the Michigan case, draw in facility managers and vendors to determine the feasibility of blending biomass from multiple sources at a specific location to produce an optimized source for a conversion technology.

The online Michigan State Biomass Inventory tool can be used as a template to implement the same process in other state. This would identify the areas of high residual biomass, gross energy available from the biomass, estimate energy expenditure for processing biomass, and identify constraints that could impact or alter the process in any significant way. Examining different regions in all states to determine the areas with the highest biomass energy conversion potential can be done in the same way it was in Michigan. By identifying all major biomass sources and energy conversion facilities within the area under evaluation, a marketing plan could be implemented to publicize the resource. Managers and vendors of biomass source facilities would be interested in the project and would cooperate with researchers to determine location for biomass energy conversion. This tool would be only one of the first steps in investigating the potential of a biomass conversion technology. However, as in the case of MSU, interest in the process was necessary even before the tool became available to the public. Public awareness through social media and local government support is crucial for the success for this endeavor.

Furthermore, if biomass inventory can be collected across the country, the locations with the highest conversion potentials could be identified. Once identified, educational campaigns can be launched to encourage the initiation of studies that may ultimately lead to the installation of this technology. Educating the population of alternatives to traditional energy sources should have positive outcomes.

Although the Michigan state tool is copyrighted, the fundamental objective to identify the best potential areas to install anaerobic bio-digesters by mapping locations of biomass using geographic information system data and software can be accomplished through a different avenue using National Geographic’s Field Scope program. The Field Scope program is online
software that enables students, teachers, and scientists to map, analyze, and share geographic data in the pursuit of a solution to a real problem.

This is a pioneering venture in the US because in the past the technology for mapping food waste has been non-existent. In addition the technology for a greener alternative to landfills and incineration have not been actively pursued until recent years. Identification and classification of areas of high food waste generation is the key step towards implementing an efficient and effective biomass conversion facility.

Implementing a Food Waste Recycling Program in NJ and PA

Proposals and theories are all good and fine, however it is the actions of individuals that actually accomplish results. The use of forums, such as Field Scope, where experts and professionals collaborate for a common goal is a key component to the data collection that is necessary for this activity. The Field Scope program would be used to determine whether a location is an appropriate choice. In addition, a group of determined students from various departments across Rutgers University, (the more students we can involve, the better the outcome), as well as with the assistance or at the minimum “blessing” from some Rutgers faculty would be optimal. This group could approach Field Scope to use their online mapping tool to determine the best food waste energy conversion potential locations and to then identify a site to install an anaerobic digester. The resulting outcomes from the use of the Field Scope’s resources can then be marketed on Rutgers’ web sites to involve as many dedicated students and alumni as possible. The participation of the Rutgers faculty who volunteered would add credibility to our efforts. In addition, utilizing the Field Scope tool also adds credibility to our venture. Rather than joining an existing effort it is my proposal to initiate a new one to investigate the ideal area for an anaerobic bio-digester to convert food waste to energy. The following are two viable locations that have been assessed for food waste mapping and bio digestion viability.

New Jersey

The area under theoretical investigation will be a 20-mile radius around the urban city of Newark, New Jersey.

Our first step is to identify producers of food waste within the area under consideration, in this case a 20-mile radius around Newark, NJ. Major producers of food waste that must be mapped include hospitals, universities, dormitories, prisons, food processors, bakeries and butchers, and various industrial plants in the Newark region. Existing recycling facilities in the investigated area must also be identified. Some of the major producers of food waste in the area are medical centers including Newark Beth Israel Hospital (3 Sites with inpatient housing), University of Medicine and Dentistry of New Jersey, Saint Peters Hospital, Children’s Hospital of New Jersey, and St. James hospital. Prisons and detention centers in the area include Northern State Prison, New Jersey Juvenile Intensive Supervision, the Community Corrections Corporation, and Eastern Jersey State Prison. The Newark Office of Sustainability and the
Division of Environmental Health will be notified of our proposal, and we will pursue a request for data to be provided on the industrial size food waste producers in Newark and we will request data on the processing capacity for organic waste at various recycling facilities in the Newark as well. After all major producers and processors of food waste in the Newark are identified it will be necessary to gather any available data on their food waste production through city and state reports, or proprietary reports made internally within various food waste producers. In most cases we expect that such data will not be readily available. For this reason it will become crucial for participants in this investigation to interview managers of the major food waste producers. For example, this would include meeting the Directors of Nutrition or Food and Beverage, and the heads of housekeeping and maintenance of the major hospitals, prisons, and dormitories in the area to obtain a scope of the quantity and nature of food waste being produced at these sites.

It will be critical to gather, as much data was possible through interviews and surveys to have an accurate idea of the quantity and type of food waste being produced in the area that can then be mapped using resources provided by Field Scope. The data as well as media such as photos or videos relevant to the project can be uploaded in to Field Scope to allow open access to the Field Scope community of teachers, students, and citizen scientists for feedback, data sharing, and peer analysis of our efforts.

This process will take time in raising awareness in the State of New Jersey about the ongoing project to gather data to ultimately install an anaerobic digester in New Jersey, but the data the consequent map and analysis of the investigated areas will grow richer with information over time as more food waste producers, operators and managers within the area will participate in providing information on their own production in an effort to reduce their own energy costs and foot print from their businesses. The Field Scope community will provide not only an ideal platform for mapping, sharing and analyzing data on food waste production in New Jersey, but it will publicize the project helping to raise awareness of the effort in the area. Raised awareness will allow better access to data from producers and operators of food waste in the area, as well as increasing the urgency of our agenda among policy makers. If we are to successfully install an anaerobic bio-digester in New Jersey, in the most efficient possible area to do it, we will eventually need this to be on the agenda for the policy makers on the city, state and federal level to fund such a food waste to energy facility. The best way to ultimately build an anaerobic digester with the political and financial support of the government would be to have widespread support and cooperation with the public and the business and organizations involved in the process. In the case of Michigan State’s biomass inventory tool, they had reported that managers and operators of food waste producers and processors had began contacting them expressing support and willingness to cooperate in their effort to track and map food waste. We hope to achieve the same type of cooperation with our food waste producers, as well as with the students and teachers involved in the project, and city departments like the Newark Office of Sustainability and the Division of Environmental Health.

Pennsylvania
The area under theoretical investigation will be a 20-mile radius around the urban city of Pittsburgh, Pennsylvania.

Pennsylvania has taken proactive steps in reducing the amount of discarded food waste that ends up in landfills. The state has multiple composting programs and organizations devoted to composting food waste and food that has expired. Many food companies, agencies, processors, and recycling centers in the state of Pennsylvania are already involved in tracking food waste, mainly to the end of reducing food waste and composting the food waste that is generated.

In order to track food waste in Pennsylvania for the purpose of identifying the most suitable area for an anaerobic digester it would be necessary to identify as many food waste producers and management agencies as possible, followed by thorough interviewing about their gross amount of food waste in order to implement a theoretical plan for installing an anaerobic digester in the area with the highest yield of food waste.

The first step and possibly simplest step in identifying many of the largest food waste producers in the state is to search the Internet and interface with local farms, food agencies, processors, and food waste management companies.

Many businesses in the area are already involved in tracking food waste in order to reduce the amount of food waste discarded and not recycled for energy in clean manner. Brown’s Super Stores should be contacted and interviewed for the purpose of this project. Brown’s Super Stores operates 10 ShopRite’s near Philadelphia. The company has donated food that has not yet expired to food banks and other agencies such as Philabundance to be given away in charity before the food expires. The supermarket chain donated 55 tons of non-expired food. Brown’s super store has reported that an additional 250 tons of food waste (expired food) has been composted this year alone.

The first step is to contact Brown’s Super Stores as well as Philabundance and other food banks to determine the logistics, and average yield that could be expected if we were to collect their spoiled food waste for the purpose of grouping it into an area where an anaerobic bio-digester can be installed. The financial gains from this process can be expanded when a bio-digester is installed for it will produce cheap and clean energy. Brown’s Super Stores also reported that it saved about $20,000 in trash costs. The local community is very much so involved in this process, and we can promote our bio-digester idea through local businesses, colleges (many of which are already involved in this), residents, and the local government.

Pennsylvania is also ahead of the curve in collected residential food waste, a process overlooked almost everywhere else in the country. A company called Bennet Compost in Philadelphia is one of the few companies anywhere in the country that focus on collecting residential food waste.

The next step in our effort to identify the best area in Pennsylvania for a bio-digester is to interface with Bennet compost in order to make arrangements to collect any excess food waste from their services for the purpose of fueling a bio-digester. Currently, Bennet compost
delivers its collected food waste to local gardens and returns excess compost back to its subscribers. We need to contact Bennet Compost as well as meet with their subscribers to discuss the possibility of using their excess food waste for energy conversion in a potential bio-digester.

We would also contact AgRecycle, a company based out of Pittsburgh that has been collecting and composting food waste from sports stadiums, restaurants, and other formidable food waste producers in Pennsylvania. Using existing programs and businesses like AgRecycle, and the others listed above we can simply redirect a stream of composted food waste to a new potential bio-digester. The State of Pennsylvania, with its many composting programs, services, as well as involvement from major food waste producers, and businesses in this field to recycle food waste is very suitable for installing a bio-digester. The support, and widespread involvement to find efficient ways to recycle food waste in ripe in Pennsylvania. This makes it a very progressive and ideal place to introduce the effort to install a bio-digester. As stated above we would be able to yield 250 tons of food waste from Brown’s Super Stores alone. We would contact and interface other supermarket chains, sports arenas, colleges, hospitals, dormitories, prisons, and restaurants to collect more food waste from them, using companies like Bennet Compost and AgRecycle to collect the food waste, and using companies like Brown’s Super Stores to set an example and benchmark for its competitors in reducing its discarded food waste and thereby reducing their own trash costs as many ShopRite’s have. Even if many businesses will selfishly be unconcerned with the environmental impact of their discarded food waste, they can be persuaded to participate solely on the financial gains they can obtain by reducing their trash costs like Brown’s Super Stores did.

Next, we need to contact local colleges, and environmental organizations to gain some further insight about the quantity and location of other large yields of food waste. State College Borough in Pennsylvania offers curbside takeaway of food waste compost for its residents. It is crucial to contact this organization to explain our intentions and preferably expand their services to other Boroughs, utilizing their local sanitation departments to offer curbside takeaway of food waste.

Once we are able to identify major food waste producers and contact them to assure cooperation in our project, as well as contacting companies like Bennet Compost and AgRecycle to expand their food waste collections from residential to also include commercial food waste pick up, we can contact the EPA and local environmental agencies to discuss the possibility and steps involved in constructing a bio-digester in the area. If we can sure up support and cooperation from the existing structure in the state for food waste tracking, collection and recycling we will be far more likely to obtain financing for a bio-digester from government environmental agencies and private financiers. We can also explore the possibility of getting lucrative business that are already involved in food waste tracking and recycling such as Brown’s Super Stores, AgRecycle and Bennet Compost to invest in the installation of an anaerobic bio-digester.

References:


http://www.census.gov

http://www.census.gov/compendia/statab/cats/geography_environment/solid_waste_hazardous_waste_and_superfund


Letters to the Editor

Apr 4
Ed Song
to editorial, bcc: Ethics

Hi Editor of Waste News I would Like to post a editorial on your Princeton patch website. I am a student at Rutgers doing a project about food waste recycling and I would like to promote public awareness about food waste and its potential energy recovery if a facility was established in NJ.

Apr 4
Ed Song
to greta.cuyler, bcc: Ethics, bcc: Harsh

Hi Greta I would Like to post a editorial on your Princeton patch website. I am a student at Rutgers doing a project about food waste recycling and I would like to promote public awareness about food waste and its potential energy recovery if a facility was established in NJ.

Thanks Ed

Both emails attached:

As part of New Jersey’s Energy Master Plan Draft (EMP) of 2011, to elevate renewable energy sources within the state to 22.5% by 2021. To meet the renewable energy portfolio standard (RPS) New Jersey is promoting the use of biomass, solar, and wind energy. In addition, New Jersey expects that new greener methods of energy retrieval and production will manage energy production and expenditure in a fiscally efficient manner. Furthermore, the 2011 EMP draft states that using biomass, solar and wind energy stimulates the economy, creates jobs, protects the environment, and mitigates long-term cumulative impact.

Incentives can be provided to private industry to build biomass to energy conversion infrastructure by tax breaks. Public industry may also partner with the private sector and take advantage of resources and technologies that are available in New Jersey and being utilized elsewhere in North America. This would provide the necessary incentive to a speedy construction by public and or private companies of biomass to energy conversion facilities to generate clean fuel and electricity.

Technologies such as biodigesters have been utilized across North America with clean and renewable energy at inexpensive costs. For instance a landfill in Altamont, California supplies enough renewable fuel to run more than 400 garbage trucks, serving more than 20 towns. Additionally, no new taxes would be instituted upon any prospective biomass to energy converters installed in New Jersey.
It would be prudent for the State to consider subsidizing the sale of part of this biomass to the energy conversion sector instead of other applications. The State should also play a significant role in the management and research of biomass resources and their efficiency.

In New Jersey, the State owns, manages, or influences activities on nearly two million acres of land and water resources, more than three times the extent of the land and water areas comprised by the State’s farms. These vast properties could become major sites for the cultivation and harvesting of biomass feedstocks. If only 10% of these acres were used productively, they could yield 300,000 dry tons of biomass, equal to close to one-third of the total tonnage of feedstocks. Among the areas included in this estimate are wetlands, where invasive plant species like phragmites spread profusely. Under appropriate conditions, such plants could be harvested as feedstocks for making power and fuels. In the future, the State could perhaps also use some wetland areas for the cultivation of algae and duckweed to make "third generation" fuels, ones for which the conversion technologies are still in early research stages today.

State owned, or influenced biomass feedstock’s can be utilized for energy conversion. A study should be conducted to determine how much of the two million state owned, influenced, or regulated acres can be allocated toward biomass harvesting such as weeds and grasses.

The United States government has a food waste calculator on the official website http://www.epa.gov/osw/conserve/materials/organics/food/tools/, they mention about calculating the food waste and also mention about the benefits of reusing the waste foods, as well as they mention about cost that will be utilized in recycling the waste that is present. As per a research, it is found that in the country, reusing the waste is more costly and dumping it, hence people throughout the country prefer dumping the food rather than recycling and using the food as biomass.