Bartholomew County Landfill Gas Utilization- A Service-Based 6S Feasibility Study

Information Booklet

An information packet to discuss how Cummins employees can help with the service-based 6S project.

Project Background/Executive Summary:

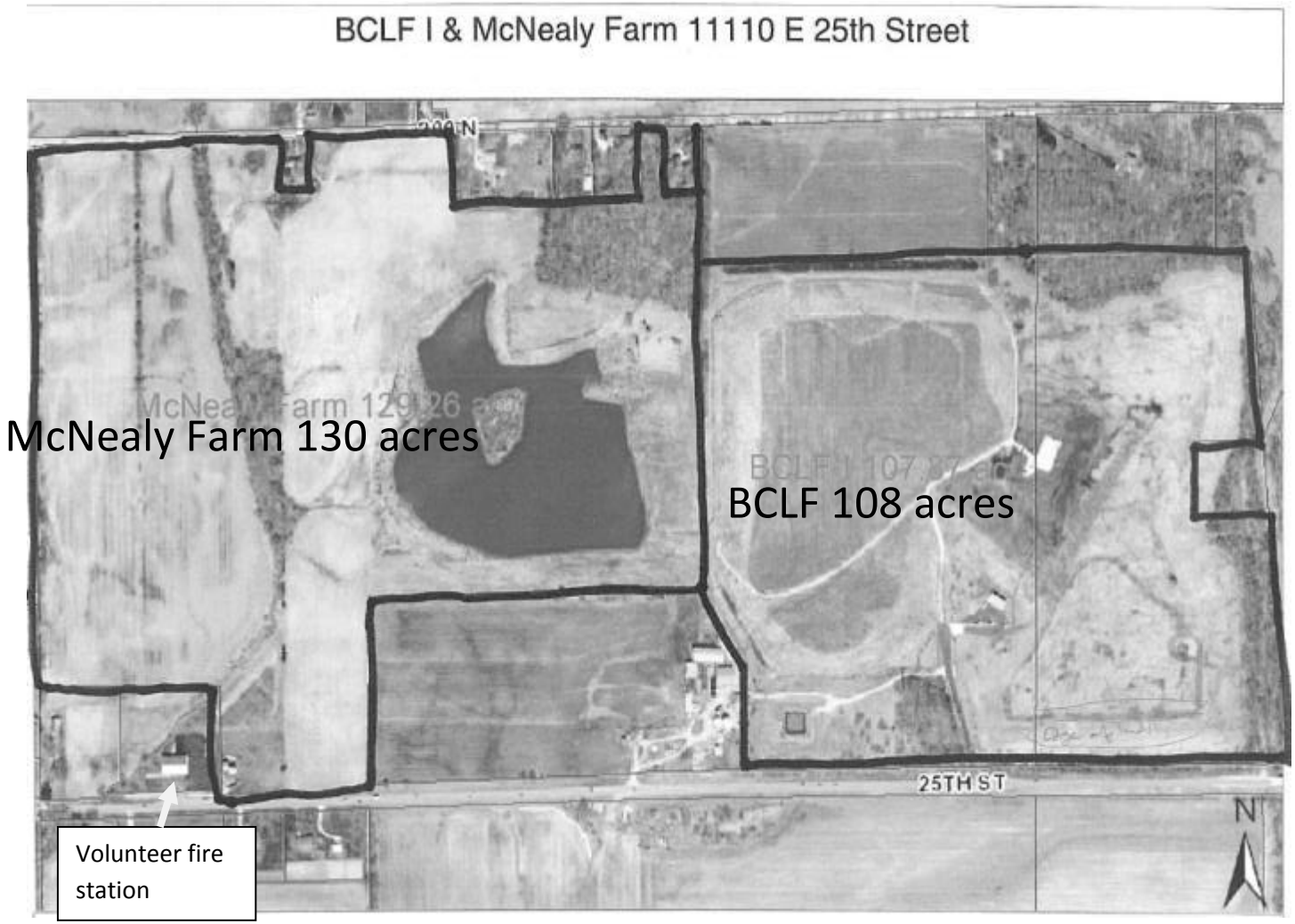
The Cummins State Street Community Involvement Team (CSS CIT) has partnered with the Columbus/Bartholomew Recycling Center to understand ways of providing value to the center. One of the projects that was discussed is a utilization and feasibility study of the Bartholomew County Solid Waste Management District (BCSWMD) landfills in the area. The BCSWMD team currently has a closed, dry tomb landfill (Landfill 1) and an operational landfill that do not utilize the landfill gas being produced at their respective sites (Landfill 2). Instead, the gas is flared off into the atmosphere. The purpose of this project is to come up with conceptual designs on how to use the landfill gas in traditional and non-traditional applications such as heating, power generation, hydroponics, small business ventures, etc.

This booklet serves as an information guide for individuals who would like to contribute ideas to the concept design phase of the 6S project led by Alberth Franco. Submissions can range from a high level idea of how to utilize the gas to a full business/engineering plan of a utilization method. Ideas should be submitted to alberth.franco@cummins.com . We look forward to hearing from you!

6S Core Team

From left to right: Rafael Mistril (Team Member), Heather Siesel (BCSWMD Member), Jim Murray (BCSWMD Team Member), Jill Conway (Team Member), Alberth Franco (Green Belt), Paul Hengesbach (Sponsor), Evan Loxley (Team Member)

Landfill 1 (Petersville Landfill)



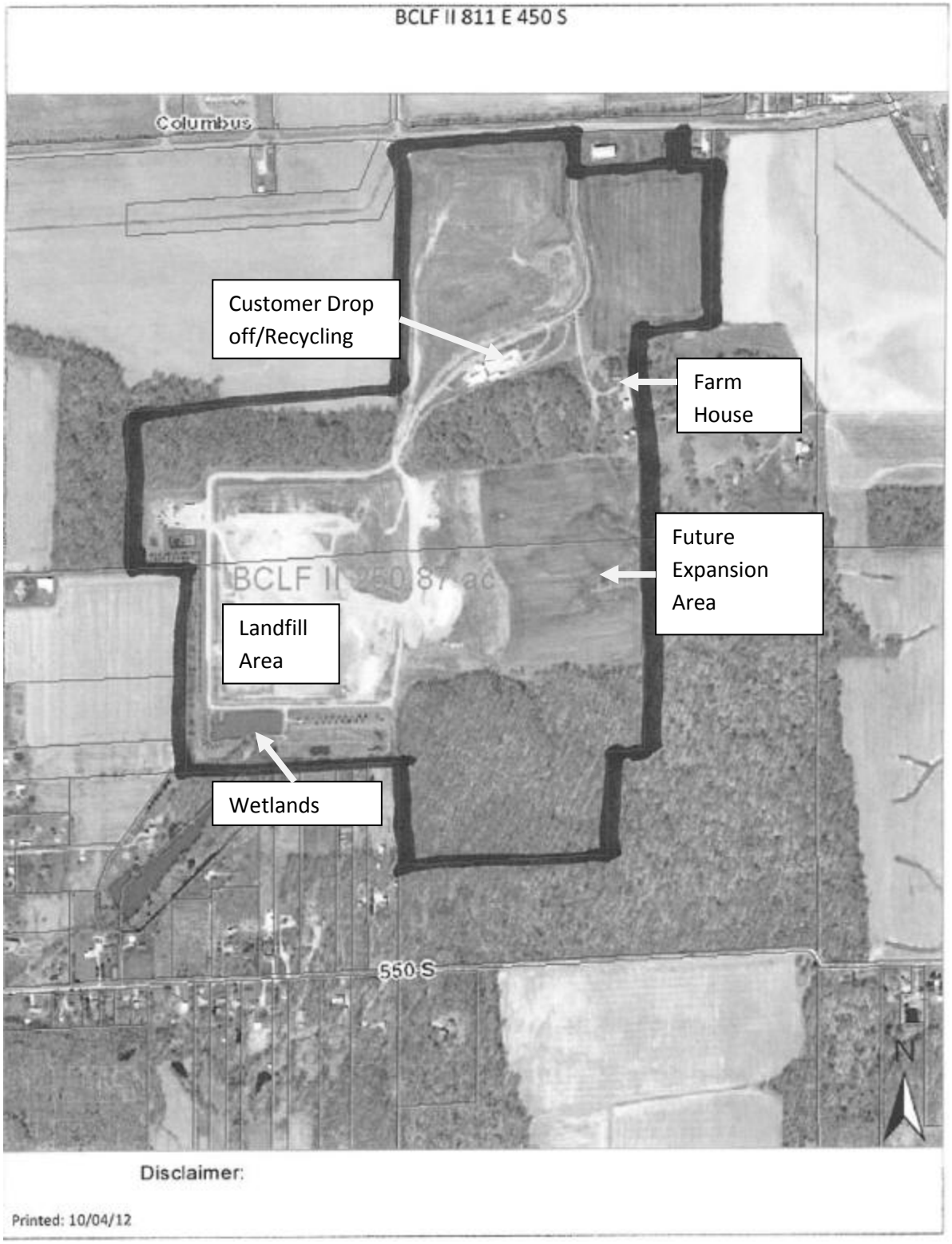
Landfill 1 Quick Facts:

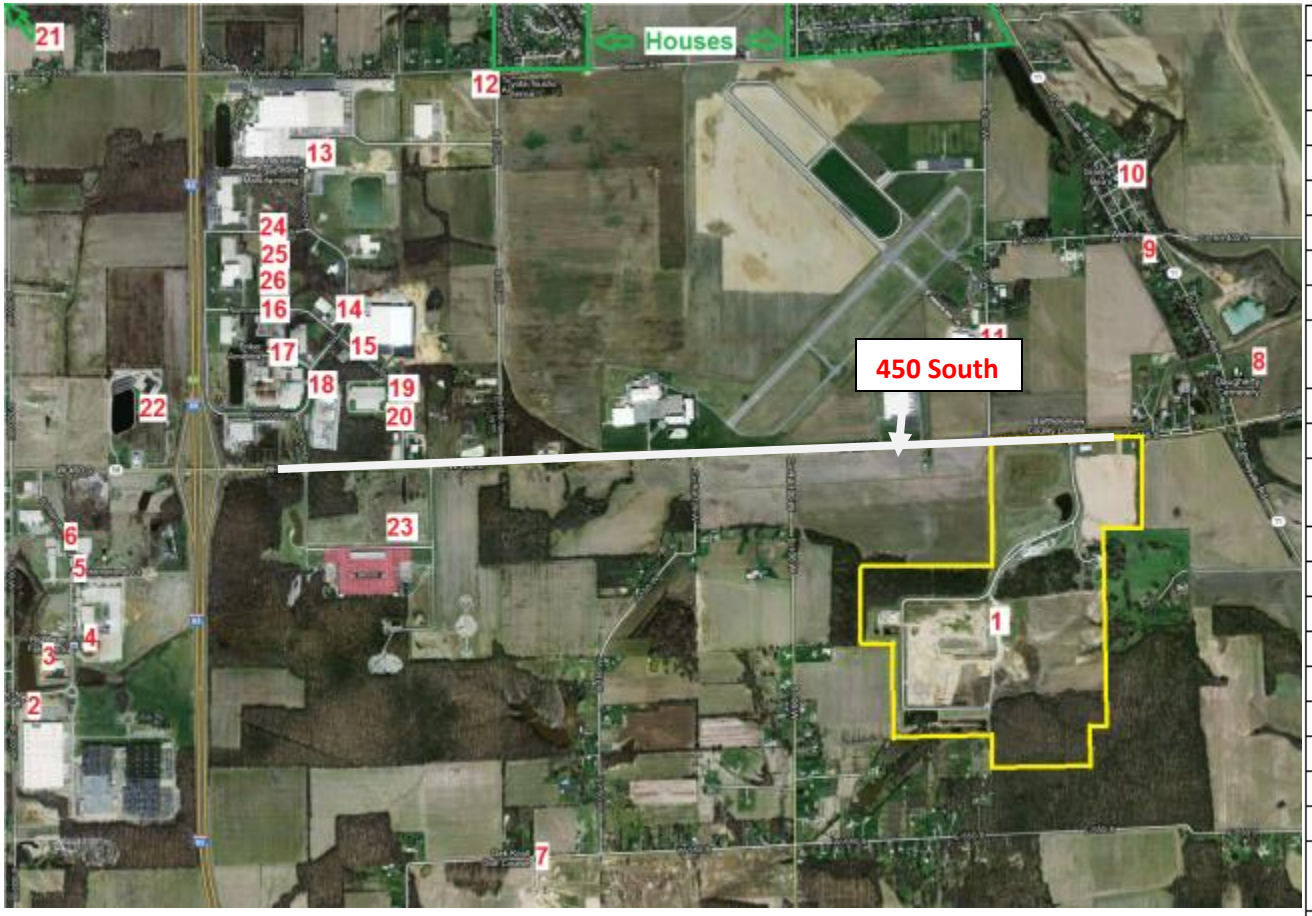
1) Landfill is a closed, dry landfill which means no fluids were allowed to be dumped when it was open. The landfill had a total of 1.89 million tons of waste at closure.
2) Currently, the landfill flares off the gas using solar and battery powered devices.
3) About 15 to 20 years of useful gas, potentially producing up to 60 cfm of 50% methane gas using existing wells along the west side of the site.
4) Water intrusion and rain water that seeps into the landfill is routed to a collection basin to mitigate leachate from seeping into the ground
5) McNealy farm adjacent to the site is owned by BCSWMD and the land area is available to use in any way
    a. BCSMWD would like to see this land as part of the utilization!

Ideas used in similar landfills

1) Small business/Non-profit opportunity
    a. Glass blowing and pottery business project in North Carolina
    b. Heating for green house/hydroponic site
2) Heating of nearby facilities
    a. Fire station nearby
    b. Surrounding farm area
    c. Local businesses
3) Recreational use
    a. City park
    b. Botanical garden
    c. Golf course
    d. Camp site
    e. Other beautification projects that could provide value to the land?

Landfill 2 (Jonesville Landfill)





1	Bartholomew County Landfill
2	NTN Driveshaft Inc
3	Advanced Mold & Eng Inc
4	Rightway Fasteners Inc
5	Bradford Soap Works Inc
6	Anixter Fasteners
7	Oak Knoll Golf Course
8	Daugherty Cemetery
9	Al's Country Diner
10	Granny Bea's Video Game Store
11	Columbus Engineering Inc.
12	Toyota Tsusho America Inc
13	Toyota Industrial Equipment Manufacturing Inc
14	Christopher Stephen Corporation
15	MACtac
16	Impact Forge Group Inc
17	Enkei America Inc
18	Nikkei Mc Aluminum America Inc
19	Precision Tools Services Inc
20	Richardson Molding Inc
21	Indiana Bell Telephone Co 342
22	Cummins Engine Co Oly
23	Cummins Columbus Midrange Engine Plant
24	Claas of America
25	Kaltenbach Inc
26	Tes Division of Chromalloy

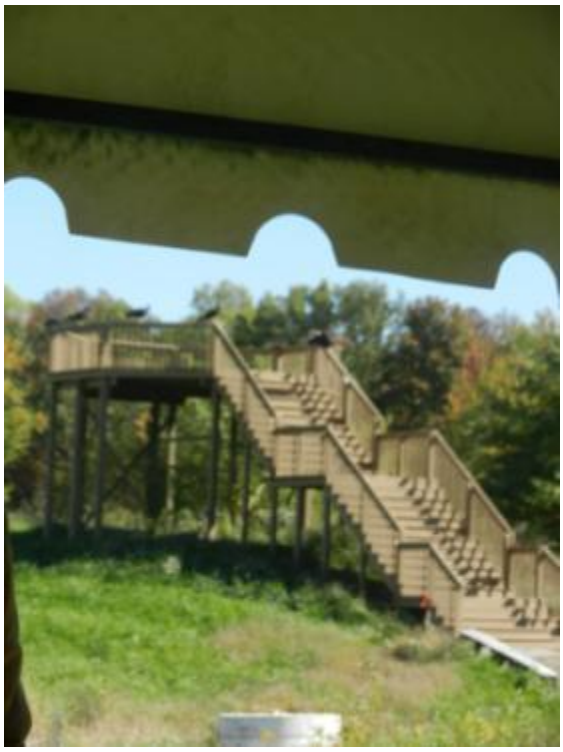
This picture and list depict the landfill in reference to the nearby industrial facilities. The distance between the landfill and CMEP(#23) is approximately 2.5 miles

Jonesville Landfill Quick Facts:

1) Current landfill that takes in 72,000 tons of waste/year and is not expected to close until 2062
    a. Expected to produce approximately 1, 698 million of methane over lifetime
    b. Average of 113 million per year when landfill is capped
    c. Landfill does not accept tires, Freon refrigerants, motor oil, lead batteries or acid from batteries, or yard waste
2) Landfill also has water collection system to prevent leachate from seeping into ground
3) Wetlands area is a feature that has been built in and exists in the enclosed box.
    a. Contains vultures, frogs, turtles, Canadian geese
    b. Tower deck made out of wood for overseeing landfill & wetlands (see Appendix for picture)
4) The landfill geology has 5 different soil types
    a. Bottom ground that is not used for disposal is sand and gravel
    b. Upper area contains more clay
5) Time estimate of having a useable portion of the landfill ready for gas collection is 2-4 years away

Ideas used in similar landfills

1) Power Generation
    a. On-site power generation
    b. Power back to grid
2) Heating application
    a. On-site buildings – Recycling Center, Education Center
    b. Local buildings (CMEP, Toyota, Advanced Mold & Eng Inc)
3) Small business/Non-profit opportunity



Observation Tower at Jonesville Landfill: The deck is used for educational tours for school children.

Landfill pile being crushed and shifted. Landfill is almost at maximum height prior to cap off

Gas flare solar powered device at Landfill 1

The McNealy lake and area. The picture was taken on the landfill side which shows the relation of how close the landfill is to the farm.

Opportunity Statement:

The Cummins vision statement, “Making people’s lives better by unleashing the Power of Cummins” involves the value, Corporate Responsibility. Partnering with BCSWMD adds value to the community because together we can help lower emissions from the landfills, benefit a non-profit organization, and fulfill our corporate vision statement. The landfill project is of particular interest to the CSS CIT team because it has the potential to involve the entirety of Cummins and many members of the community. This includes but is not limited to engineering, finance, technicians, local shops and facilities, and manufacturing plants.

Employees of Cummins and members of the community can participate in the concept design phase of this project by contributing ideas to the 6S team. The ideas should fall under an engineering concept design, business case model, or a combination of both. The engineering concept design would have details such as a system level gas flow diagram, specifications of materials that would be best to use, or a list of factors that should be considered during the design. The business case model would help answer questions such as, “Where does funding come from? How do we make an idea into a sustainable business in the long-term? Is there a way to involve multiple community partners to have the best added value?”

The format can be a simple sketch on paper to a detailed presentation. An example of a simple sketch is shown in the Case Studies section. Please contact Alberth Franco at Alberth.franco@cummins.com if you have any questions.

Case Studies:

Utilization methods for landfill gas vary based on landfill geology, available gas quantity, and financial feasibility. This section showcases some of the successful landfill projects that have been investigated by the 6S team. The intention of this section is to stimulate the creativity process that leads to unique and feasible designs; therefore, please use this section as a guide to the level of detail that can be contributed to 6S team.

Project 1: Energy Exchange Project NC

The Yancey/Mitchell Joint County Landfill was opened in 1972 in an abandoned mica mine and closed in 1994. The average population of these two counties during this period was approximately 28,000. The economy of the area was largely agricultural and forestry based. Some manufacturing was present during this time in the textile, furniture, and light manufacturing. The landfill is about 6 acres in size with a maximum depth of 100 feet. An estimated 300,000 tons of waste are buried in this landfill and covered by a 3-5 foot clay cap.

Landfill Gas Collection System

The landfill gas collection was activated on April 22, 1999. The system includes 8 vertical wells which consist of 4” diameter HDPE plastic pipe and a 24” diameter gravel envelope. Wells range from 30-85 feet deep. The system also contains 2 horizontal wells just below the landfill cap, a condensate collection system and a 5 horse-power blower-flare skid capable of handling approximately 90 cubic feet per minute of landfill gas. The landfill gas currently being collected is about 45-50 cubic feet per minute. The graph (attachment 1) shows the expected landfill gas generation and collection through 2015. It is important to note that the US Environmental Protection Agencies Landfill Methane Outreach Program uses a threshold level of 1 million tons of waste in place as the level of economic feasibility for landfill gas projects. Our landfill is one-third that size.

Glass and Pottery Business Incubator

One of the two major features of the EnergyXchange Renewable Energy Center is a glass and pottery business incubator. This business incubator consists of four buildings. Each of these buildings is a 3,000 square foot prefabricated arch type metal building. These buildings are heated by radiant floor heat and direct waste heat from landfill gas fueled boilers. The glass studio houses two glass blowing tenants. Equipment includes two pot furnaces and a glory hole which are operated at 2,300 degrees Fahrenheit, 24 hours a day, 365 days per year. The pottery studio houses four potters. There are two electric kilns, but also one large landfill gas fired kiln for firing these ceramics. In addition to the studios, the business incubator also includes a business and visitor center which includes a meeting room and a business center which includes individual office space for each artist and access to business machines including fax machine, computers with internet access, copy machine, etc. The fourth building is a gallery where visitors may view, select, and buy glass and pottery produced by the resident artists.

GREENHOUSE COMPLEX

The original home of Project Branch Out includes four 32x100 foot hoop style greenhouses with a double flexible plastic covering. Three of the greenhouses are production greenhouses where native shrubbery seedlings are produced from locally gathered seed. These greenhouses are staffed by a nursery manager and a part-time assistant as well as 2 high school apprentices. A fourth greenhouse is used for a demonstration of hydroponics – a symbiotic combination of indoor aquaculture and hydroponic plant production. These greenhouses are heated by two natural gas boilers which were factory customized to burn 500 btu/cubic foot landfill gas.

Project 2: Columbus, OH Landfill

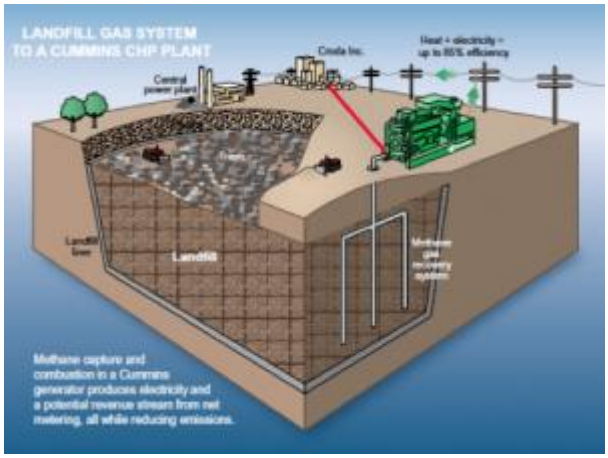
This 23 acre, closed landfill is located in Columbus, OH that was originally a brickyard in the late 19th century. At about the 1950's, the landfill had piping installed and heated a nearby building that had an occupancy of about 5,000 persons. Once the majority of the heating value of the gas was consumed over the landfill life, the piping was closed off. Approximately 30 years from 2010, the pipes had to be replaced in order to meet EPA regulations on landfill gas. After complying with EPA regulations, the landfill was remodeled to be a golf course and local park. The remodeling took about $6M dollars and the majority of the money was procured with a series of grants and county partnership. Currently, the land is being leased to a company as a golf course and the initial investment will break even at approximately 30 years. One of the major reasons this worked out as a viable option was the large vacant land size, scenery of the city, and the lack of sufficient methane for heating or power generation purposes.

Project 3: Cummins Power Generation providing innovative combination of green technologies by Alexandre Daher

Cummins Power Generation designs, builds and maintains on-site power generation systems that can use a variety of alternative fuels. These specially designed low-Btu gas generator sets can run on either natural gas or a variety of other gases. One example is methane that is created in landfills.

We are proud to announce that Cummins Power Generation is a major participant in a $6 million project with Croda Inc., in New Castle, Delaware. The project, which represents an unusual combination of green technologies that can serve as a model globally, uses methane gas from the nearby Cherry Island landfill as fuel for a combined heat and power (CHP) system at the Croda manufacturing facility in New Castle, Delaware.

The groundbreaking ceremony for the project was held on June 7, 2012, with Delaware Governor Jack Markell and Croda President Kevin Gallagher attending. Construction is expected to be finished by September 2012.



A CHP, or cogeneration system, is very efficient. The system provides electricity and captures the heat from the generator that would otherwise be lost. With CHP, up to 85 percent or more of the available energy output from a generator can be used productively. When completed, the Croda system will initially provide enough energy to power 3,500 homes.

How will the landfill CHP system work? Renewable landfill gas, approximately 50 percent methane, is captured by a gas collection system at the Delaware Solid Waste Authority's Cherry Island landfill.

Globally, landfills are the third largest manmade emission source, accounting for about 13% of methane emissions, or the equivalent of over 800 million tons of carbon dioxide annually. Reducing this source of emissions provides a significant environmental benefit.

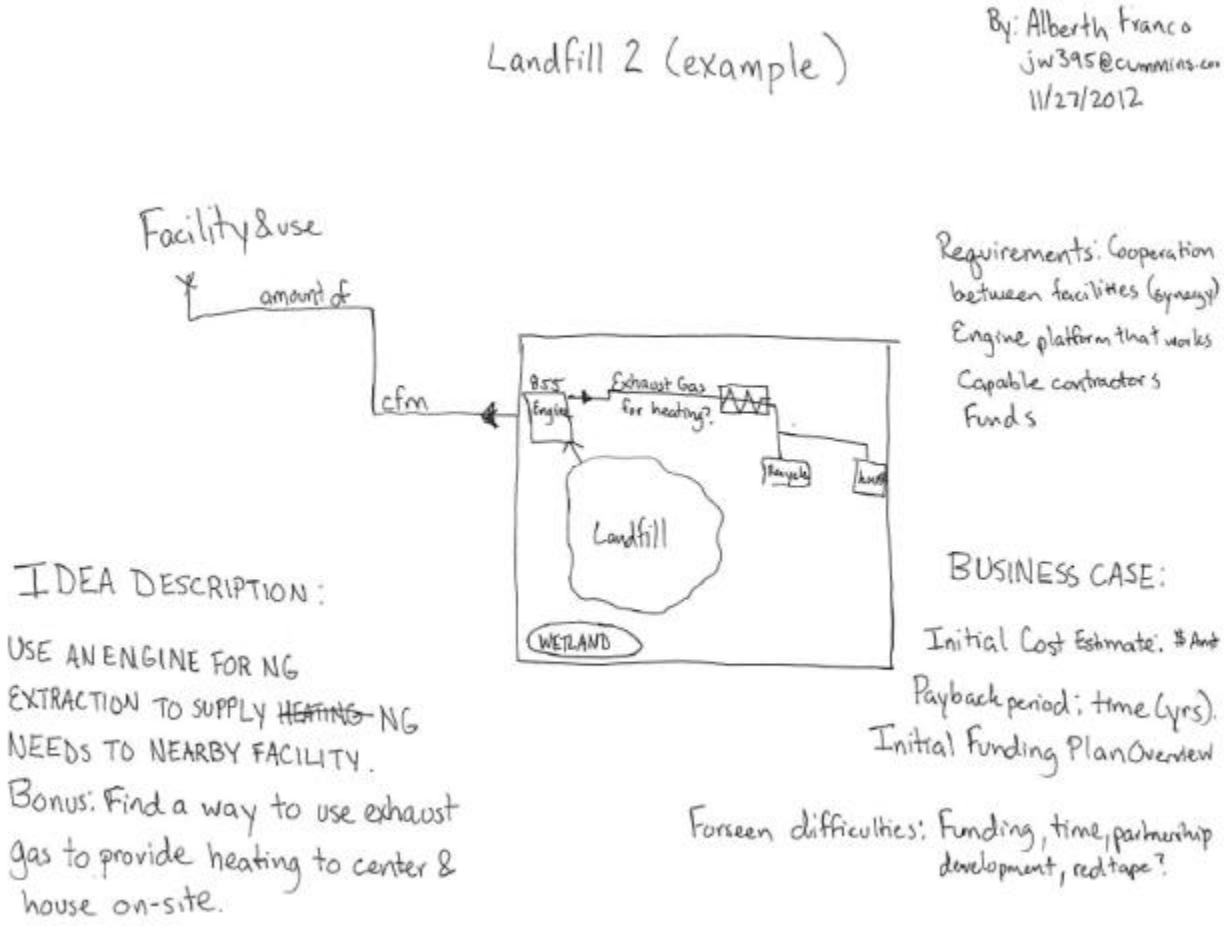
Cummins Power Generation, in partnership with Casella Waste Systems, is installing equipment and a low-pressure gas pipeline to condition and transport the landfill gas to multiple end-use customers. The Croda Atlas Point facility is the first of these industrial users, located just over four miles away. At the plant, Cummins Power Generation has designed and is providing a complete CHP system, which includes two C1100N6C (1100 kWe) Cummins gas generator sets that use the landfill gas as fuel to produce heat as well as electricity.

“We are excited to take a leading role in designing and installing a comprehensive, efficient and green solution for Croda Inc.,” said Donald Gesick, General Manager – Energy Solutions Business. “First, instead of the landfill gas being flared into the atmosphere, the gas will be used directly by Croda, reducing emissions at the landfill and Croda. Second, the innovative CHP solution allows for maximum productive use of the renewable energy by providing power for nearly all of Croda’s electrical needs and reducing their boiler fuel consumption through heat recovery from the generator sets. It’s a real win-win for everyone involved.”

Croda President Kevin Gallagher said, “This endeavor demonstrates our commitment to innovation in renewable energy. It has the potential to eliminate the electricity Croda takes from the regional grid. In fact, we may even be adding renewable energy back to the grid if we do not need it on site.”

In addition to bringing landfill gas and a renewable CHP solution to Croda, Cummins Power Generation is also working on energy solutions with other companies and public entities within a few miles of the landfill to provide clean and sustainable energy that will benefit both the public and private sectors with the remainder of the landfill gas that would otherwise be flared.

Submission Example



This submission was done by the author of the paper as an example to the level of detail the 6S team would like to have. It is not necessary to include all the information or to follow this specific format; instead, this example should serve as a guide to what would assist the team in coming up with the best design concepts. Ideally, a combination of these types of submissions will be combined to develop an even more robust concept. Please remember to include your name and email on the submission, in case the 6S team needs to contact you for more details on your submission.

Acknowledgements:

We would like to thank the Bartholomew County Solid Waste Management team for helping us find information for the background research section of the project.

In addition, we would like to thank the author of the Cummins article, Alexandre Daher, for allowing us to publish the article.