2018 Excellence Award Entry
Landfill Gas and Biogas

Seneca Landfill CNG Fueling Station
Jackson Township, Butler County, Pennsylvania
Population: 4,000
Cost per household for the project: $0
Approximate budget: $2.5 million

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Executive Summary
Where others see a liability, the Vogel family saw an opportunity. Between 2017-2018, Seneca Landfill, Inc. constructed a fast-fill compressed natural gas (CNG) facility at their municipal waste landfill in Evans City, Pennsylvania. They are the first company in Pennsylvania to capture the landfill gas they generate, refine it into natural gas, and then compress it into CNG fuel used by the same vehicles that collect the waste that is deposited into the landfill. The CNG station will also be open to the public, which will make the opportunity for fleet conversion to CNG for local haulers and other fleet operators in the area more viable. This CNG facility represents much more than a filling station, it represents just another example of the Vogel family's investment in their community and commitment to sustainability and protecting the environment by reducing greenhouse gas emissions and our dependence on natural resources for energy.

System History
Seneca Landfill, Inc. is owned by the Vogel family and is a fully owned subsidiary of Vogel Holding, Inc. (http://www.vogelholdinginc.com/), which operates a diverse group of waste service companies. The family owned enterprise has been in the waste disposal and recycling business for sixty years. The combined Vogel companies employ over 600 people. They are the largest independent disposal/recycling company in western Pennsylvania.

The idea for the CNG station came from the Vogel’s desire to be fully integrated and self-sustainable, while also achieving economic and environmental benefits. Seneca Landfill has been operating a permitted subtitle-D municipal solid waste facility in Pennsylvania since 1995. The majority of the municipal waste received is delivered to the facility by vehicles owned and operated by Vogel hauling companies. Seneca Landfill is centrally located to all the Vogel hauling companies which operate a fleet of approximately 220 trucks, 28 of those being CNG trucks. The goal has been to continue the process of fleet conversion from gas and diesel fuel to CNG; but insufficient availability of CNG fueling stations was causing lost time for existing CNG trucks having to travel long distances to fuel, with some running out of fuel prior to the end of the day. Locating a fueling station at the landfill will accelerate this conversion process and will also increase transportation range and efficiencies for the existing CNG vehicles since many of the trucks visit the landfill on a daily basis.

Additionally, increased availability of CNG fueling sites is essential to incentivize other fleet owners to consider conversion of diesel trucks to CNG. This project provides both public and private entities with a publicly accessible central CNG fueling station. The waste industry as well as other commercial fleets, such as delivery trucks, school buses, municipal service vehicles, etc., are well into converting their fleets toward CNG vehicles to reduce their overall carbon footprint. Unfortunately, smaller, mostly local haulers, have difficulty making the conversion to CNG because the economics to both convert
their vehicles and provide the required CNG fueling stations are not economically justified for their smaller business. A CNG fueling station at Seneca Landfill for both public and private use will provide the opportunity for smaller, local haulers to convert their fleet vehicles from diesel to CNG and utilize an established CNG fueling station, thus making the opportunity for fleet conversion to CNG for local haulers and other fleet operators in the area more viable.

An added benefit will result since the compressed gas going into these vehicles will be from renewable landfill biogas produced at the Seneca Landfill facility, with only back-up supply from other sources (e.g. People’s Gas). The landfill gas is currently recovered through a system of landfill gas extraction wells populated throughout the landfill. The gas is processed through a variety of systems removing contaminants and moisture with the methane leaving the plant as clean biogas. The biogas produced maintains a sufficiently high BTU (heating value) that consistently meets the minimum 970 BTU/SCF requirements for injection into the commercial natural gas distribution system. Moreover, its low moisture content makes it ideal CNG for transportation fuel. The siting of a CNG fueling station at the landfill will close the loop and allow Seneca Landfill to provide energy to power the vehicles that deliver materials to the landfill and enable the ultimate recovery of an alternative and clean energy source from what was once categorically considered waste.

**Project Timeline**
Construction of the facility began in October 2017 and was completed in January 2018. Construction during this time of year was very challenging and keeping the schedule flexible to account for inclement weather was crucial. Utilizing local construction crews gave the necessary flexibility to adjust scheduling as needed. As of April 2018, the facility is actively fueling intercompany waste vehicles utilizing biogas from Seneca Landfill. The facility is expected to open to the public over the next few months.

**Design and Construction of the Facility**

The CNG Fueling Station is located in an industrial area on the 700-acre Seneca Landfill property at 421 Hartmann Road in Jackson Township, Butler County, Pennsylvania. The footprint is approximately 2 acres near the entrance to Seneca Landfill, and includes the compressor equipment, the electrical equipment, and the canopy area which contains the fueling tanks.

The location is ideal because of its ease of public access. The identified location is accessible from the main facility entrance road with easy ingress and egress to Hartmann Road. The fueling station site at the Seneca facility is approximately 2 miles east of exit 88 on Interstate 79. The location can be reached by regional north and south bound traffic for fueling. It can service local residential consumers as well as possible commercial fleets such as bulk commodities transport trucks, delivery vans, school buses, and other fleet vehicles.

The fueling station is proximate to the existing Seneca Landfill biogas high BTU processing plant (Lego-V) and can be connected to the existing natural gas distribution/transmission pipe where it crosses the proposed site. This will enable vehicles to be fueled directly with clean and renewable biogas with no additional costs, i.e. a closed loop.

General specifications of the facility include: 2000-amp electrical service, two (2) - 250 horsepower compressor/process skids, 2600 gge of stored CNG / 4 public fuel dispensers / point of sale systems, automated/remote control systems, and the ability to refuel mobile CNG storage for transportation via virtual pipeline.
The specific components of Seneca’s CNG facility are as follows:

### Compression
- **TWO (2) CNG2250-4Q-CL CNG Compressors**
  - Motor: WEG or equal 250 HP 1800 RPM 460 VAC motors Compressor: Ariel JGQ-2 8” & 4-3/8” & 3-5/8” & 1-3/4” x 3.0” Stroke
  - Operating Range: 50-115 psig (inlet/suction pressure) 415-735 scfm 4500 PSIG outlet pressure
  - Includes Enclosure with 2000 watt oil heater Winter Package, light kit, non-organic compressor lubricant, operations display/control interface, compressor inlet ESD valve, common relief stack, blown down vessel, NFPA and full compliance internal gas detection; soft starts; gas actuated valves

### Gas Dryer
- **ONE (1) PSB NG-SRD DUAL TOWER NATURAL GAS DRYER**
  - Model No. NG SRD 15-3- DDP
  - Dual vessel with semi-automatic operator initiated regeneration
  - 20-100 psig min (Option dependent)
  - 2 lbs / mmcf inlet water content 200 or 500 scfm @ max 45-120 psig

### Site Control
- **SITE CONTROLLER**
  - Adds Site Control Capability both local and remotely
  - Adds Lead/Lag capability to compressors
  - Adds Remote monitoring (SCADA) & data logging capabilities
  - Includes Ethernet connectivity for remote PLC access
  - 3/4” GAS ACTUATED PRIORITY VALVE PANEL W/ SLOW FILL OPTION
  - Configured for 3-Bank Cascade System
  - 3/4” Gas Actuated Valves

### Storage
- **THREE (3) CP INDUSTRIES ASME CNG STORAGE TUBES**
  - 20” OD x 1.303” MW x 23’ 0” Long; 5500 psi MAWP; 36,621 scf CNG @ 5000 psig
- **THREE (3) FIBA ASME CNG STORAGE TUBES**
  - 20” OD x 1.303” MW x 23’ 0” Long; 5500 psi MAWP; 36,621 scf CNG @ 5000 psig

### Dispensing
- **TWO (2) KRAUS OPTIMA DUAL HOSE HIGH FLOW DISPENSERS**
  - Includes internal card reader (CRIND)
  - Housed in High cabinet retail dispenser micro motions measurement and PA Dept of Weight and Measures Certs (NIST)
  - Programmable display in GGE, local programmable ability, CNGV approved nozzles and breakaways for 3600 psig fast fill, nozzle disconnect vent to canopy
  - Internal POS hardware included and mounted in dispenser body
  - Purge Fan Blower & Enclosure
  - Dispenser 1 with CT 5000 Nozzles on both hoses
  - Dispenser 2 with CT 1000 Nozzles on 1 hose and CT5000 nozzle 1 hose
  - Kraus Model # HAM 3DCOG-P63CA1353501

The high pressure storage vessels are one of the most unique features of the system as they can be mounted to trailers and transported to other locations for mobile refueling, in essence creating a “virtual pipeline.” Currently our sister company, Vogel Disposal Service, Inc., operates a slow-fill CNG facility at their location in Mars, PA. Their natural gas is supplied by a public utility. The mobile storage vessels open up an opportunity for Seneca to supply them with the CNG produced from the landfill biogas and will give us the ability to further internalize our fueling costs.
Seneca Landfill utilized InsightFuel as the General Contractor and Mechanical Contractor for the project. InsightFuel retained O-Ring CNG (whose owner, Robert H. Beatty, is also an owner of InsightFuel) as a technical advisor to the project, as the civil contractor, and to perform all final functional tests of the installed station. InsightFuel also retained a certified and experienced electrical contractor to install the transformer, ESD and communications system, and hook up all station equipment. InsightFuel makes every effort to source all materials domestically from North America, USA, and then the Tri-state area. Specifically for this project, all site labor came from Pennsylvania-based contractors and subcontractors, with the exception of two of the crew who reside in Ohio. 100% of the machinery and equipment is North-American sourced, with major components manufactured in Pennsylvania, Ohio (80%), Texas, New York, and California. 7% was manufactured in Canada (using parts produced in the USA). Insight Fuel / O-Ring has participated in the design, construction, consulting, subcontracting, supplying components, project management, and maintenance of over 150 major alternative fuel projects in North America.

**Environmental Controls and Regulatory Compliance**

This project will promote the utilization of alternative renewable fuels (landfill derived biogas) as opposed to conventional diesel fuel to power a fleet of garbage vehicles and reduce the reliance on foreign and domestic oil. Compared to diesel, renewable natural gas has 27% lower carbon dioxide emissions, 80% lower greenhouse gas emissions, and 95% lower NOx emissions.

Converting approximately 22 existing diesel fueled vehicles to CNG will reduce the greenhouse gas emissions by approximately 515 metric tons per year. This number is expected to increase as more local haulers are able to convert a greater number of their fleet vehicles to CNG because of an accessible CNG fueling station.

To put the environmental benefit into perspective, consider the following. The annual greenhouse gas emissions from the conversion of 22 diesel fueled garbage trucks will be reduced by the following percentages through conversion to CNG:

- Carbon monoxide (CO) by 70-90 percent
- Non-methane organic gas (NMOG) by 50-75 percent
- Nitrogen Oxides (NOx) by 75-95 percent
- Carbon Dioxide (CO2) by 20-30 percent

This is equivalent to the planting of 13,202 trees, removing 109 additional cars from the roadway and recycling 185 tons of waste instead of landfilling!

The CNG fueling station is located within the Seneca Landfill permit boundary and constructed stormwater controls. Seneca Landfill is inspected and monitored by the Pennsylvania Department of Environmental Protection (PADEP) and Bureau of Mines. While no state permits were required for construction or operation of the CNG station, Seneca Landfill kept the PADEP informed of the site’s progress during regular inspections and biweekly update calls. Seneca Landfill complied with the local municipality’s building code requirements for structural and electrical and obtained all necessary permits.
Additionally, the site is under the jurisdiction of the Bureau of Labor & Industry and passed an initial inspection.

The site is managed by an experienced general manager, a professional engineer, and has its own environmental and safety compliance staff. The landfill also employs supplemental professional guidance from multiple consulting engineering firms to ensure that appropriate skill sets are available to supplement staff resources.

Seneca Landfill was awarded an Alternative and Clean Energy Grant from the Pennsylvania Department of Community and Economy Development to partially fund this project. Grants are only issued to companies in good standing and without major compliance issues.

**Performance, Economics and Cost Effectiveness**

Not only does natural gas provide a proven technology to lower emissions impacts, it provides an operating cost advantage to fleets as a stable, low-cost fleet fuel and by eliminating the need for costly emission control systems as are required on diesel vehicles.

Southwestern Butler County (project site location) has seen a net exodus of manufacturing facilities over the past two decades. Some rebound can be contributed to economic development provided by the energy sector. However, measurable continuity is often subject to the variances of the boom and bust cycles of the energy industry. This project represents a modest economic development in alternative energy that can be sustained outside the erratic liquid fuels energy paradigm. By producing a consistent supply of alternative and clean energy at the Seneca Landfill facility, it demonstrates that energy self-sufficiency is attainable and sustainable.

In a measurable way, this project removes dependence on oil-based automotive fuels that are derived from fossil fuels. By providing convenient alternative energy fueling options, Seneca Landfill envisions the future sale of small vehicles using CNG and the conversion of more local garbage fleets to CNG, thus expanding local reliance on natural gas and reducing the reliance on fossil fuels. Various possible users that are currently being explored include both Vogel Disposal's current fleet of garbage vehicles and local hauler's garbage vehicle fleets, both existing and proposed.

This energy is directly supplied to the CNG Fueling Station located at the Seneca Landfill, which is located proximate to the Lego-V plant and power CNG vehicles with clean gas derived from renewable landfill biogas. The physical presence of a fueling station at the Seneca Landfill engenders interest and feasibility for additional companies to implement CNG conversion plans. This can include trucking companies, school bus and truck delivery fleets to have local source for fueling. Given the landfill's strategic location to Marcellus and Utica drilling activity, the availability of CNG can incentivize segments of the oil and gas service business to convert water delivery trucks to CNG or blended fueling. It will also provide a fueling point for fracking contractors who seek to upgrade their fleets of specialized pumps and equipment to run on CNG or a blended mix greatly diminishing the NOX and VOC emissions at drill sites. A clear extension of economic shift is fueling Vogel company trucks and other fleets with landfill biogas processed at the Seneca Landfill BTU plant. This decreases the dependency on the current fossil fuel paradigm with the production of a consistent supply of
alternative and clean energy at the Seneca facility and completes a cycle demonstrating that energy self-sufficiency is attainable and sustainable. It is conceivable that with the CNG site at the landfill it is possible to consider a spinoff test conversion of construction equipment at the landfill site to CNG from diesel fuel.

It is estimated that the CNG Fast-Fill Fueling Station will supply a truck fleet (both private and public) of approximately 50 garbage vehicles each week, 22 of which will be newly converted CNG vehicles. The 22 vehicles that currently run on liquid fuel use approximately 189,000 gallons of diesel annually (based on an annual usage of 8,600 gallons per vehicle). This demand will be converted from diesel to compressed natural gas. The diesel gallon equivalent for compressed natural gas, from the US National Institute of Standards and Technology, is 126.7 cubic feet. By converting 22 additional vehicles over to CNG, this will increase the reliance on domestically available natural gas to power both public and private garbage vehicle fleets and reduce the reliance on foreign oil. In summary, this CNG fueling station will deliver approximately 23.9 million cubic feet of CNG annually. It is anticipated other fleet users will be incentivized to consider conversion of vehicles to CNG with the location of additional stations such as the proposed fueling station at Seneca Landfill.

In addition to the fuel savings that will be recognized, Seneca Landfill can also claim credits under the Environmental Protection Agency’s Renewable Fuel Standard for the biogas used at the CNG station, which provides a large economic incentive.

The system will be maintained per the manufacturer’s specifications to ensure regular operation. In the event of a service interruption due to equipment malfunction or natural disasters, the facility could still operate for a while on the CNG stored on-site in the ASME storage tubes. Depending on the nature of the interruption, the station could also operate with a back-up source of natural gas purchased from the public utility.

**Worker Health and Safety**

The first step in planning this facility was a joint meeting between operations and safety personnel to discuss the unique safety concerns surrounding this project. The general contractor for this project has extensive experience with building and operating CNG fueling stations. The proceeding site plan shows the locations of emergency stops and fire extinguishers. Personnel that will be operating and/or maintaining the fuel pumps received one-on-one training. Additionally, they will receive an annual refresher on emergency response/spill procedures.

Piping work associated with the natural gas tie-in was overseen by a contracted third party engineering firm familiar with the Seneca Landfill pipeline and the Pipeline and Hazardous Materials Safety Administration’s (PHMSA) regulations. Per their recommendations, the pipe used to transport natural gas from the gas meter to the compressors was upgraded to steel in lieu of high density polyethylene (HDPE) which increases the safety factor.
Public Acceptance, Appearance and Aesthetics

Seneca Landfill is actively engaged in community outreach through regular conversations with our host municipal officials, neighbors, and regulators. We maintain a blog on our websites where we post updates on projects and events and accommodate tours for groups of various interested parties. Most recently, the project was toured by the Regional Director of the PADEP’s Northwest Regional Office. We measure our customer service by the feedback we receive, and so far this project has only received positive feedback from regulators and residents alike.

Seneca Landfill has entered into agreements with our host municipalities (Jackson and Lancaster Townships) and committed to paying $5,000 towards each municipality’s purchase of their first CNG vehicle for their municipal fleets in the hopes of incentivizing their conversion to this sustainable fuel. In addition, the cost per unit for the host municipalities to fuel their vehicles at the Seneca CNG Station will be reduced by 20%.

We continue to convert our fleet to CNG vehicles, recently purchasing our first CNG tractors that haul trailer loads of waste from our transfer facilities, Tri-County Industries, Inc. and Valley Waste Service, Inc., to Seneca Landfill. These 2 companies were recently awarded Alternative Fuels Incentive Grants (AFIG) by PADEP to fund the installation of CNG fueling stations at the locations in Grove City and Beaver Falls, PA, respectively. These facilities are still in the planning stage. We are passionate about promoting the use of this clean, alternative energy and changing the public’s negative perception of landfills and are leading by example.