2012 Applications must be submitted to SWANA no later than Friday, April 13, 2012

*** PLEASE NOTE THAT ENTRY REQUIREMENTS HAVE CHANGED ***

Application Checklist  (Please make sure the following items are included in your submittal packet)

- Completed release statement (this page), to be scanned and included in digital submission
- Check (made payable to SWANA) or credit card payment for nomination fee (in U.S. dollars) via Excellence Award Nominations
- At least 2 pictures of your operation (may be included in nomination text)
- One copy of your award submittal uploaded using your purchased 2012 SWANA Excellence Awards Application Uploading Instructions
- If you would like to mail your submission, please contact Jesse Maxwell, Program Coordinator, at jmaxwell@swana.org or (240) 494-2237.

Release Statement:  I certify that the information provided in this application is accurate and correct to the best of my knowledge. SWANA reserves the right to publish the enclosed information. Nominations become the property of SWANA. My signature gives SWANA the right to reprint or make available for purchase any portion of this submittal.

Signature:  

Date:  4/20/12
Nomination Packet for
2012 Landfill Gas Utilization Excellence Award
City of Santa Clara All Purpose Landfill
Gas to Energy Plant

Prepared for
Solid Waste Association of North America

April 20, 2012
Prepared for

Solid Waste Association of North America

April 20, 2012

Nomination Packet for

2012 Landfill Gas Utilization Excellence Award

City of Santa Clara All Purpose Landfill

Gas to Energy Plant

Presented by
Ameresco Inc.
111 Speen Street, Suite 410
Framingham, MA 01701
T: (508) 661.2200 • F: (508) 661.2201
Table of Contents

Executive Summary ____________________________________________________________ 1
Section 1: Design & Construction ____________________________ 2
Section 2: Environmental Controls ______________________________________________ 4
Section 3: Regulatory Compliance ______________________________________________ 5
Section 4: Planning, Operations & Financial Management ____________________________ 6
Section 5: Utilization of Equipment / Systems and Technologies ________________________ 9
Section 6: Public Acceptance, Appearance and Aesthetics _____________________________ 11
Section 7: Innovation and Creativity _____________________________________________ 12

2012 Nomination Packet for Landfill Gas Utilization Excellence Award – Ameresco Santa Clara Gas to Energy Plant

Solid Waste Association of North America April 20, 2012
Executive Summary

After the previous landfill gas-to-energy (LFGTE) developer abandoned its plant, the City of Santa Clara, California was left with very few options to utilize the renewable energy resource at its All Purpose Landfill (Landfill). What made this beneficial project particularly challenging was that the Landfill was closed, had a declining gas curve, exhibited low methane content, and was located in a tough regulatory jurisdiction.

Beginning in 1986, the City of Santa Clara successfully utilized the landfill gas (LFG) generated in its Landfill to produce electricity. Some 19 years later, the Landfill was no longer producing sufficient gas for the electrical generation equipment to operate economically. Instead of continuing to operate an uneconomical power plant, the 2.5 MW reciprocating engine-generator was shut down on November 1, 2005.

In 2006, the City began searching for a renewable energy alternative. The Ameresco team explored the feasibility of designing a new electrical generation facility at the existing plant location to take advantage of the flared renewable energy resource. The City’s partnership with Ameresco to design, build, own, and operate a new LFGTE plant at the Landfill enabled a new project to commence without any cash outlay from the City. Silicon Valley Power (SVP), Santa Clara’s electric utility, agreed to purchase the green power from Ameresco for its area customers.
Section 1: Design & Construction

The new generation facility is a reuse of a closed landfill that had a LFGTE project operating in the 1990s. Originally, the City envisioned Ameresco building the new generation plant in the existing building that had housed the original generation plant. Ameresco inspected the building and decided it would be cost- and schedule-prohibitive to use the building to house the new generation plant equipment. Instead, Ameresco designed a skid-based plant that could fit in the yard behind the existing building, but a geotechnical review showed that the soil conditions in the area behind the building were not stable enough to support the new plant equipment.

In the end, the plant was designed to be built in the yard in front of the building, which had much better soil characteristics and made access to the new plant equipment easier for operational and maintenance activities. In addition to the tough regulatory environment and the poor gas quality issues, Ameresco faced the challenge of investing in an LFGTE facility based on a declining gas curve typical of a closed landfill. However, the amount of LFG actually utilized by the new generation equipment has been better than forecasted by the theoretical gas curve through careful tuning and operation of the LFG collection system by Golder Associates Inc. (Golder), the City’s LFG contractor.

Building the new generation facility outside of the building required all of the equipment to be “outdoor” rated, but freed the project from costly building retrofits, ventilation, and other issues. Ameresco was able to take full advantage of a modular design, keep site work to a minimum, and...
install skid-mounted equipment so the facility could be moved easily at a later date when reduced gas flow from the closed landfill makes the project no longer viable. The gas turbine generators are a state-of-the-art design and have the lowest emissions of any generating unit in California. In addition, they are California Air Resources Board (CARB) 2008 Certified for Landfill Gas. Each 250kW Flex Turbine™ produces less than 9 ppm of nitrogen oxide emissions (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs) on landfill gas.

The Santa Clara project was a challenge for Ameresco and the City because of the landfill’s low gas production, small footprint, age, and strict air quality standards. In order to utilize the LFG beneficially, the City and Ameresco cooperated to the community’s benefit.

The facility plan was designed to operate on a declining fuel curve. In the future, the modular turbines will be removed one by one to match LFG production. When the gas declines to the point that the facility is no longer economical to operate, the plant area will be returned to the City for storage use and the equipment relocated to another site.
Section 2: Environmental Controls

Ameresco neither operates the Landfill gas system nor owns the site; therefore, Ameresco does not monitor groundwater or leachate or use groundwater protection materials. The generation facility periodically tests the gas supplied for heat value and treats it to remove water and trace impurities (e.g., siloxanes, etc.) that might contribute to wear and maintenance on the gas turbines.

Ameresco’s Santa Clara LFGTE facility uses the waste gas from the City’s landfill in a beneficial way as a renewable energy fuel source. Using renewable fuels eliminates emissions from typical biogas controls and flares, and the electricity generated displaces conventional (“brown”) power and its air pollutant and greenhouse gas emissions. This generation facility has gone through rigorous air permitting processes and meets health and welfare air quality standards.

The physical footprint of the Santa Clara plant is less than an acre, and it is located on land owned by the City. With a net positive air impact and no water use, this plant leaves almost no mark on the environment and simply serves as a better way to utilize an otherwise wasted energy resource.
Section 3: Regulatory Compliance

The facility makes use of the waste gas from the Landfill and is a vital component of the City’s commitment to developing sustainable energy solutions for the City and its electricity providers. Output from the project enhances the renewable energy portfolio of the local electric utility, Silicon Valley Power (SVP), who purchases the green power. The State of California has mandated that 33% of California retail electricity sales must come from renewable energy sources by December 2020.

No awards letters or facility inspection data have been submitted.

The facility holds an air permit from the Bay Area Air Quality Management District (BAAQMD), has complied with all requirements, and has been certified as meeting the requirements of CARB, the regulatory organization overseeing methane emission from municipal landfills. Each 250kW Flex Turbine™ produces less than 9ppm of NOx, CO, and VOCs and is CARB certified for landfill gas operations. The oil used in the gas turbines is managed in accordance with all environmental requirements.
Section 4: Planning, Operations & Financial Management

The new generation plant is an automated power plant that utilizes state-of-the-art industrial programmable logic controls (PLCs) and instrumentation to allow for an “un-manned” operation. The plant control system utilizes remote monitoring of the equipment operating parameters by Ameresco operations staff at nearby facilities, and automated notification of equipment alarms for operator inspection and corrective actions. The City currently contracts with Golder to operate the landfill’s gas collection system and flare, and Ameresco coordinates closely to support this effort.

The new plant equipment consists of three (3) FlexEnergy small gas turbines that have a combined gross power output rating of 750 kilowatts (kW) and are expected to result with a net generation amount of approximately 5,000 MWh per year. This includes the ambient impact on the turbine output, planned and unplanned outages for maintenance activities, and approximately 13% of the gross output for plant parasitic loads including gas compression, dehydration, and conditioning. The maintenance costs for the plant are primarily associated with required turbine maintenance functions, and secondarily associated with the media replacement required for the siloxane removal system.

Although there is room for expansion, the landfill is closed and the gas quantity is declining, so future expansion is not planned for the site.

Ameresco highly values the health and safety of employees, contractors, customers and communities. All elements of the Environmental Health and Safety Program have been adopted in order to protect and advance the company’s essential interests worldwide and to fulfill our commitment to people and the environment. Protecting and responsibly managing natural resources is critical to the quality of life in the areas we serve, the environment and Ameresco’s long-term business.

No financial goal, work task, client deliverable, or schedule demand is worth an injury or environmental compromise, and there were no such incidents during the design, build, or operations phases of the Santa Clara LFGTE site. It is the responsibility of every Ameresco employee, supplier,
contractor, partner and vendor to strive at all times, on every work assignment, to work safely and correctly.

Ameresco believes that good health, safety, and environmental performance are fundamental prerequisites and are paramount to continually meeting our goal of performing and providing world-class energy innovations and applied technologies worldwide; therefore, it must be resourced accordingly.

To this end, Ameresco has committed itself to achieving the following goals for the safety governance of the Santa Clara LFGTE site:

- Zero accidents
- Achieving and maintaining total compliance
- Utilizing integrated safety management within all activities
- Maintaining a safe and healthy work environment
- Being a good steward of our environment
- Achieving “world-class” safety performance and recognition

Ameresco is committed to meeting or exceeding 100% compliance with all established safety and health regulations. We have implemented policies, procedures, training, and self-assessments to ensure compliance with the following:

- OSHA 29 CFR 1926 – Construction Standards;
- US Dept. of Energy - 10 CFR 851 – Worker Safety & Health Standards; and
- US Department of Transportation 49 CFR 199

The Ameresco Safety and Health Program incorporates an Integrated Safety Management System (ISMS) approach to ensure the compliance and quality of our program related to our stated program goals and objectives. Our ISMS approach is based on the following five core functions:

- Define the scope of work;
- Analyse the hazards;
- Develop and implement controls;
- Perform the work safely; and
- Provide feedback for improvement
At a minimum, all employees receive a new-hire safety orientation, task specific, and annual refresher safety training. Our LFG plant operators and managers are required to complete and renew the DOT Required Operator courses. All employees are provided with a monthly schedule of safety training courses with required tasks or assignments to be completed. All managers and supervisors are required to complete the Safety Leadership course.

Ameresco has an established web-based compliance training program which contains over 78 separate safety training courses designed to meet or exceed OSHA/EPA/DOT requirements. Our online courses are also tailored to meet international standards, as required. Each Ameresco employee is issued a unique user ID and password that provides unlimited 24/7 access to the online compliance training system from any location.

The Ameresco Santa Clara LFGTE site is an unmanned plant and uses operators from the eight Ameresco owned and operated LFGTE plants in the Bay Area to respond to events and perform routine maintenance. All of these Ameresco employees are trained in accordance with the company’s health and safety regulations. In this sense, the Santa Clara site is safer than other plants because of the limited exposure to risk during routine operation and maintenance.

**Ameresco Safety Statistics**

<table>
<thead>
<tr>
<th>Year</th>
<th>Recordable Incidence Injury Rate</th>
<th>Lost Work Days Rate</th>
<th>Experience Modification Rating</th>
<th>Man-Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0.00</td>
<td>0.00</td>
<td>0.80</td>
<td>1,037,261</td>
</tr>
<tr>
<td>2011</td>
<td>0.00</td>
<td>0.00</td>
<td>0.80</td>
<td>1,279,386</td>
</tr>
</tbody>
</table>

**Note:** Ameresco has had 0 fatalities in business history.

Additionally, Ameresco has received the following safety awards:

- 2009 National Safety Council “Occupational Excellence Achievement Award”
- 2009 National Safety Council “Industry Leader Award”
- 2008 Navy Star Safety Award
Section 5: Utilization of Equipment / Systems and Technologies

The gas cleanup at Santa Clara is accomplished by dehydration and activated carbon adsorption for siloxane removal. The dehydration skid utilizes mechanical refrigeration to lower the LFG temperature to 40°F to achieve a low dew point and condense water vapor. The mechanical refrigeration cooling is provided by a high efficiency commercial grade York chiller. After dehydration, siloxanes are removed from the gas in a “fixed bed” activated carbon adsorption removal system comprised of four vessels that are piped to allow for both series and parallel operation. The gas is compressed to the required pressure by a single variable frequency drive (VFD) driven LeRoi screw compressor.

The plant consists of three 250 kW gas turbines generating 750 kW. The FlexEnergy MT250 turbine was selected because its fuel requirement closely matched the available LFG characteristics and the plant could easily be downsized as the amount of LFG declined over time. The MT250 turbine was also chosen because of its ability to utilize LFG with methane content lower than 40% and still meet stringent air quality requirements. The project is anticipated to have adequate gas flow to operate the three gas turbines for a minimum of five years. When necessary, individual turbines can be taken off-line and the remaining MT250 turbines can continue to operate, while conventional equipment would have struggled with the low gas flow and quality.

Figure 3: Diagram of the FlexEnergy MT250 turbine utilized at the Santa Clara site.
The electricity sold to SVP is equivalent to powering more than 477 homes or planting nearly 996 acres of pine trees, according to calculations provided by U.S. EPA.

The Santa Clara site is unmanned, and Ameresco relies on FlexEnergy to perform turbine maintenance. Operators from nearby Ameresco owned and operated LFGTE plants work together to perform the maintenance on the balance of the equipment.
Section 6: Public Acceptance, Appearance and Aesthetics

The Ameresco LFGTE plant was designed to fit in the yard space of the previous LFGTE plant. The facility is fenced with landscaping and has mature trees planted in earlier years. The equipment is quiet, and the trees and fence surrounding the plant make the facility unnoticeable to the casual eye. The public drives by the facility regularly, unaware that the facility continues to generate power from the closed landfill within a developed area of the City.

The project has a high on-line time; as such, it has provided reliable base load power to SVP. The relationship established with SVP has created other green energy opportunities for SVP and Ameresco. Ameresco also provides SVP with access to a website that allows SVP and other interested parties to monitor the basic performance of the Santa Clara site.

The Landfill functions as a BMX bike track and a popular local golf course.
Section 7: 
Innovation and Creativity

This project was developed on a closed landfill with a declining gas curve with poor quality LFG. In order to make the project viable, a number of cost-saving measures were required. The Landfill’s flare is not tied into the project, but is operated manually by the Landfill when the gas plant is down. Due to the small amount of gas available, the flare and plant cannot run at the same time. The FlexEnergy turbines have challenging turndown capabilities, which create operational difficulty with the declining gas curve and the need to match the fuel requirement of the plant with the gas production of the Landfill. Ameresco worked with the City and equipment suppliers to develop an operating philosophy that will address this future issue. Eliminating the need to operate the City’s blower also reduced overall project costs. Due to the low amount of vacuum needed, the compressor is actually used to pull the vacuum on the LFG well field.

The Ameresco Santa Clara LFGTE project was designed as a test platform for fixed bed siloxane removal media. The four vessels that make up the system are plumbed such that all four tanks can be run in series or as two parallel sets of series tanks. This configuration allows for tests to be conducted on new and experimental media without putting the turbines at risk to siloxane exposure. The vessels were also fitted with highly accurate scales in an effort to determine if weight could be used to determine the loading rate of the siloxane on the carbon. This has led to some interesting proprietary discoveries about loading rates and the behavior of different media types.

The FlexEnergy turbines are innovative. These small modular turbines use a recuperator to capture exhaust heat, thereby increasing energy efficiency. The turbines also have an unusually low emissions profile that allows them to be CARB certified, a key driver in the selection of FlexEnergy’s gas turbines by Ameresco. The engines also run on lower BTU gas than reciprocating engines and can operate on LFG with as little as 30% methane, another requirement of working with a closed and declining LFG curve.
This project was abandoned by a previous LFGTE developer and left the City of Santa Clara with few options to utilize its LFG resource beneficially. Nonetheless, Ameresco found a way to beneficially utilize this LFG resource from a very small, closed landfill with a quickly declining gas curve and poor quality LFG. By providing the City of Santa Clara with a solution that could utilize stranded, low quality gas and also meet strict emissions regulations, Ameresco helped the aging facility to continue generating power and revenue many years following peak gas production. These challenges were very difficult to overcome, but ultimately a viable LFGTE project was created. These project limitations affected nearly every aspect of the site, from the vacuum side dehydration to the outdoor switchgear and control system. By necessity, the Santa Clara LFGTE project was collaboration between the City of Santa Clara, SVP and Ameresco, which all worked closely to ensure the City was able to meet its goal of obtaining beneficial use from its LFG resource in a safe and environmentally responsible manner.

Figure 4: The turbines were selected for their ability to utilize LFG with methane content lower than 40%, while still meeting stringent air quality requirements.
Landfill Gas Management Case Study

Santa Clara Converts Low Concentration Landfill Gas to Clean Energy

David Staub and Michael T. Bakas

Landfills are an excellent source of methane-rich gas that can be used to generate renewable power. Methane is produced at a landfill as trash decomposes and can be used as fuel for a gas generator to produce electricity. Since 1986, the City of Santa Clara had successfully done this, and had been able to export power to a local utility. However, over time, gas production at a closed landfill began to decline, and the original solution had to be taken offline.

In 2006, the City of Santa Clara started the process to identify a replacement energy solution. Santa Clara and Ameresco’s (Framingham, MA) team investigated the potential for a new power project at the same landfill to make use of the naturally occurring methane gas that was still being produced at the site and generate renewable energy in the process. The City then partnered with Ameresco, Inc. to design, build, own and operate a new landfill gas-to-energy plant at the closed Santa Clara All Purpose Landfill.

A Practical Solution

The old 2.5 MW reciprocating engine had been shut down in the 1990s due to the decline of adequate gas flow from the aging site. While the landfill continued to produce some gas, there was not enough to run the original large platform engine and the gas was once again flared to meet environmental requirements. In order to keep the flare burning, it required supplemental natural gas because the landfill gas stream was too low in concentration. The City was seeking a new practical solution for the remaining landfill gas, rather than have it continue as an expense and waste stream.

To eliminate the need for the City to put up capital required for the project, the City of Santa Clara entered into a contract with Ameresco, one of the largest independent energy solutions companies in North America, to design, build, own and operate the innovative system. In turn, the City’s electric utility, Silicon Valley Power, purchases the renewable energy resource from Ameresco for its customers. This project lets the City once again use a waste stream as a resource without burdening the City with capital costs and project risk. The new plant provides a long-term resource of renewable energy that meets the stringent California Air Quality standards.

Designed to be flexible even on landfills from which the flow or concentration of methane is too low for conventional technology, Ameresco’s landfill gas-to-energy plant that uses the FLEXENERGY FLEX TURBINE™ MT250 IS CAPABLE OF CONTINUOUSLY GENERATING ELECTRICITY.
Challenges Solved

This project had many of the challenges that older and/or smaller landfills face, including low gas production and tighter air quality standards for electrical generation. The Ameresco solution for Santa Clara enabled the City to continue using the landfill gas from their closed landfill in a beneficial way for the City and rate payers of its electrical utility. This project, along with many others that Ameresco has successfully completed in California, helps support the state's ambitious goal of 33 percent renewable generation by the year 2020 and create a more sustainable environment.

The new plant consists of three microturbines generating 750 kW. As an independent provider of energy solutions, Ameresco solicited for both equipment and services to meet its new efficient design. Ameresco’s engineering team selected FlexEnergy Inc.’s (Irvine, CA) Flex Turbine™ MT250 as the best solution, as it is able to operate with low gas flow and low levels of methane. The 750 kW project comprising of three 250 kW gas turbines was commissioned during the fall of 2009. Projections indicate that the gas flow of 400 cubic feet per minute at 40 percent methane gas will be sufficient to run the three gas turbines for at least five years. “After review of available products, Ameresco found that the Flex Turbine™ MT250 features a simple, powerful single-shaft design with a synchronous generator to provide continuous, clean energy,” said Joe Perry, CEO, FlexEnergy. “The ability of the Flex Turbine™ MT250 to operate on low Btu fuel enables an aging facility such as Santa Clara’s All Purpose Landfill to continue generating power many years even when gas production begins to decline.”

The 750 kW per hour of green energy currently produced by the innovative system is exported to Silicon Valley Power and provides power for more than 477 homes. Using calculations provided by U.S. EPA, Ameresco Santa Clara reduces emissions of greenhouse gas equivalent to planting nearly 996 acres of pine or fir forest and saves the equivalent of approximately half a million gallons of gasoline annually.

Powering Homes

Designed to be flexible even on landfills from which the flow or concentration of methane is too low for conventional technology, Ameresco’s landfill gas-to-energy plant that uses the FlexEnergy Flex Turbine™ MT250 is capable of continuing to generate electricity. In the case of a Santa Clara, CA closed municipal landfill, electricity is now being sold back to Silicon Valley Power to power more than 477 homes with clean renewable base load energy.

David Staub is Superintendent of Solid Waste and Storm Drains, in charge of the closed All Purpose Landfill and the City of Santa Clara solid waste program (including garbage, recycling, greenwaste and hazardous waste) as well as the storm drain program (including the urban runoff pollution prevention program). He has been with the City of Santa Clara since 1995. David can be reached at (408) 615-3086.

Michael Bakas is Senior Vice President, Renewable Energy of Ameresco, an energy efficiency and renewable energy company. Michael has more than 20 years of experience in the energy industry and has been at the forefront of the strategic development of renewable energy assets in both technology and stature. He directs Ameresco’s Renewable Energy Group, which is primarily responsible for the development and operation of renewable energy generation assets both domestically and internationally. He has been key in fostering and supporting legislation that promotes the use of renewable resources. Michael can be reach at (508) 661-2200. For more, visit www.ameresco.com.
CONTACTS:

Ameresco Inc.
111 Speen Street, Suite 410
Framingham, MA 01701
T: 508.661.2200 • F: 508.661.2201

Name of contact person in the firm:
James Bier, Senior Project Developer
T: 209.610.4318