

SUCCESS IN THE ENTERPRISE OPERATION OF THE MIRAMAR LANDFILL

A HEARTY "BRAVO ZULU" TO: MARINE CORPS AIR STATION MIRAMAR NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST AND THE CITY OF SAN DIEGO

SUMMARY

Generating money and energy from waste products is worthy of commendation, especially when it is accomplished through cooperation among federal and local governmental agencies and private enterprise. The 2012-2013 San Diego County Grand Jury (Grand Jury) investigated recovery of methane from the City of San Diego's Miramar Landfill and its conversion to electrical energy.

Electricity produced by utilizing this renewable fuel not only supplies Marine Corps Air Station (MCAS) Miramar¹ with up to half of its daily electrical needs, but is also used to provide electrical energy to support landfill operations with the remainder of the generated power sold to the local electric utility. The Metropolitan Biosolids Center (MBC) also utilizes the methane gas recovered from the landfill and a cogeneration plant located at the North City Water Reclamation Facility to provide electrical power for their wastewater treatment operations.

As an outstanding example of the City of San Diego's (City) enterprise initiative, the City is able to significantly lower the cost of electricity needed to run the landfill operations as well as receive royalties from the sale of electricity generated from methane recovery. In keeping with maritime traditions, the Grand Jury applies the term **Bravo Zulu**² to congratulate and compliment MCAS Miramar, the Naval Facilities Engineering Command Southwest (NAVFACS)³, and the City. It is an achievement of outstanding cooperative performance in the operation of the Miramar Landfill enterprise serving to benefit the citizens of San Diego County (County).

PURPOSE

The Grand Jury studied the recovery of methane from the Miramar Landfill to generate electricity for the benefit of MCAS Miramar and the City. The Grand Jury initiated this study in response to Grand Jurors' interest. The purpose of this report is to inform the citizens of the County about the successful partnership of government and private enterprise. We commend the participating entities for harnessing the energy of methane gases produced by decomposition of landfill materials that would otherwise escape into the atmosphere. This results in a significant reduction of dependence on other fossil fuels while bringing revenue to the City.

¹ <http://www.miramar.usmc.mil/index.html>

² <http://www.history.navy.mil/faqs/faq101-2.htm>

³ <http://appsupport.navfac.navy.mil/sslcheck.htm?p=>

PROCEDURE

In this investigation, the Grand Jury visited:

- MBC Plant and MBC Cogeneration Facility (MBC Cogen) at the San Diego Miramar Landfill
- MCAS Miramar
- Environmental Services Department of the City
- North City Water Reclamation Plant and Cogeneration Facility (NC Cogen)

Interviews were conducted with employees from:

- MCAS Miramar Installations & Logistics Public Works Division
- City of San Diego
 - Environmental Services Department, Engineering Division
 - Environmental Services Department, Public Relations Waste Reduction and Disposal Metropolitan Wastewater, Engineering and Program Management Division Public Utilities, Wastewater Operations Branch

BACKGROUND

Initiation of the Miramar Energy Project

In July 1982, the U.S. Congress enacted legislation entitled *Contracts for Energy or Fuel for Military Installations* contained in Section 2922a of U.S. Code Title 10⁴. This legislation enabled creative opportunities for alternate provision of electrical energy to military facilities. It is accomplished through establishment of long-term (10 to 30 years) business arrangements necessary to accomplish these provisions via Power Purchase Agreements (PPAs)⁵.

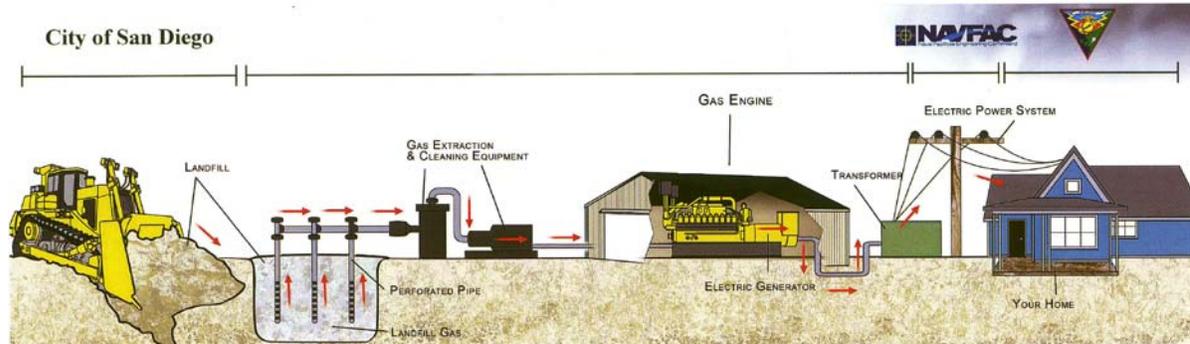
As the first project based on these provisions within the Department of Defense, NAVFACS developed a project to provide an alternative source of electrical energy to MCAS Miramar. This was done by using methane recovered by the City from their Miramar Landfill facility located adjacent to MCAS Miramar. This project was implemented via a \$42.7 million contract awarded to a civilian cogeneration development firm on July 12, 2011.

On June 14, 2012, representatives from the United States Navy, Marine Corps Installations West, the City, and a civilian cogeneration development firm along with other various military and civic officials participated in a ceremony celebrating the completion of a renewable energy facility that provides energy to MCAS Miramar. Two generators burning methane from the landfill were started by pressing a start button for each generator. The generators started and renewable energy began flowing to MCAS Miramar.

⁴ <http://www.law.cornell.edu/uscode/text/10/2922a>

⁵ <http://www.cpuc.ca.gov/PUC/energy/Procurement/Procurement/ppa.htm>

Now that the project is underway, MCAS Miramar routinely receives approximately 45 percent of its base electrical power energy requirements from a renewable (i.e., “green”) energy resource. This comes close to meeting the Secretary of the Navy’s stated energy goal⁶ that 50 percent of shore energy be from renewable energy sources by the year 2020.



Why Use Landfill Methane?

Methane, a fossil fuel and undesirable greenhouse gas, is the primary component of landfill gas produced by naturally occurring biological processes. Municipal Solid Waste (MSW) landfills⁷ are the second largest source of human related methane emissions in the United States. Methane from MSW landfills accounts for approximately 22 percent of total U.S. methane emissions. Landfill gas is created as solid waste decomposes. The landfill gas is composed of approximately 50 percent Methane, 45 percent Carbon Dioxide (CO₂), and small amounts of other organic compounds.

The methane component of Miramar Landfill gas that would otherwise escape to the atmosphere is captured and used as a fuel to generate electricity. Diverting such landfill gas for the generation of electricity away from the atmosphere helps to reduce odors associated with landfill gas emissions. Lowering methane emissions into the atmosphere reduces landfill contributions to local smog and global climate change. If the methane generated by the Miramar Landfill were untapped and uncontrolled, the amount of methane released into the atmosphere would be approximately 33,277 metric tons per month. Capturing and utilizing the gas to make electricity reduces emissions from the landfill by roughly 75 percent.

Producing power from a renewable fuel source, such as a landfill gas, displaces the need to produce the power from traditional fossil-fuel based sources. Based upon the average emissions for conventional electricity production, the entire Miramar facility will produce the same amount of electricity with an estimated reduction of 19,354 tons of carbon dioxide (CO₂)⁸ per year.

The emissions reduction for the entire facility is roughly the equivalent of:

- Planting 4,399 acres of pine trees, or

⁶ http://www.navy.mil/submit/display.asp?story_id=49044

⁷ <http://www.epa.gov/epawaste/nonhaz/municipal/index.htm>

⁸ <http://www.epa.gov/climatechange/ghgemissions/gases/co2.html>

- Removing 3,545 passenger vehicles from the road, or
- Burning 101 railcars of coal, or
- Consuming 2,196,907 gallons of gasoline on our roads.

The Enterprise

The Miramar Landfill consists of approximately 476 acres on the south end of the MCAS Miramar facility that have been approved and constructed for municipal solid waste disposal. The Department of the Navy leases the landfill property to the City of San Diego. All solid waste disposal operations are run by the City.

The overall enterprise system consists of the following facility components:

- Gas collection systems at Miramar Landfill MBC digester at Miramar Landfill
- MBC Cogen 6.4 megawatt (MW) cogeneration system
- NC Cogen 3.8 MW cogeneration system.

The City Public Utilities Department's Energy Section⁹ manages a group of privatized contracts for the design, construction, operation and maintenance of enterprise components. Separate contracts have been given to a civilian cogeneration development firm for landfill gas and digester gas production at the MBC located at Miramar Landfill and the NC Cogen located at the North City Water Reclamation Plant.

A cogeneration development firm installed landfill gas collection systems in the Northwest Phase I and West Phase II sections of the Miramar Landfill. The same cogeneration firm operates and maintains all the landfill gas collection systems that provide fuel to the MBC Cogen, the MBC¹⁰ and North City Cogen. This system includes 273 landfill gas collection wells and two flair/blower stations. Most of the system was installed in 1996 and 1997.

Landfill gas is extracted from the landfill using a series of wells with a vacuum system. The collection system directs the collected gas to a central point where it is processed for use as a fuel. The landfill gas collection and conveyance system has been expanded with the addition of approximately 80 new wells installed in the west Phase II landfill along with lateral headers and condensate lines. Twenty-seven of the new wells provide fuel for the NC Cogen Facility Expansion. Fifty-three of the new wells provide fuel for MCAS Miramar Power Plant (MP2)¹¹.

MBC Cogen for MCAS Miramar

Electricity generated by the MBC Cogen is used to power the Miramar Landfill facility operations and other City operations as well as transmitted to MCAS Miramar for their use as required. The MBC Cogen has four 1,600 KW tandem cogeneration units, each consisting of two 800 KW Hawthorne Power Systems Caterpillar engines connected to one 1,600 KW generator, associated switchgear, and heat recovery systems. The facility

⁹ <http://www.sandiego.gov/publicutilities/>

¹⁰ <http://www.sandiego.gov/mwwd/facilities/metrobiosolids.shtml>

¹¹ <http://www.metrojpa.org/agenda/Miramar%20Landfill%20Plant%20Projects.pdf>

also includes two landfill gas blowers, waste heat exchangers, and engine cooling water radiators. The facility utilizes landfill gas and digester gas with natural gas as a backup fuel.

Generator capacity of 3,200 KW has been installed at the MBC Cogen facility. Power from this facility is allocated to MCAS Miramar. The existing power poles that run from MBC Cogen north to the junction with the north landfill access road were replaced with taller poles. This was to accommodate a second power line for the delivery of the MCAS Miramar power to the north boundary of the Miramar Landfill lease. Existing space in the MBC Cogen facility was utilized to install the two 1600 KW Caterpillar generator sets for the MCAS Miramar Power Plant (MP2). An electric line across MCAS Miramar to the electrical point of connection on the north side of the base was built under a separate Department of the Navy construction contract.

The MBC Cogen produced 48,300 megawatt hours (MWh) of renewable electricity in FY 2012. Of that, 25,000 MWh of electricity was allocated directly to MCAS Miramar. MCAS Miramar's average daily base load is approximately 6 megawatts (MW) and ranges from six to fourteen megawatts daily depending upon the Marine Corps base usage. The remaining energy produced at the MBC Cogen was allocated to the City of San Diego and the local utility power grid.

The Miramar energy production facility supplies MCAS Miramar with up to half of its daily electrical power from two generators powered by renewable energy from methane gas. This power source is independent of the local power grid and would provide MCAS Miramar with an autonomous source of electrical energy during an emergency such as the Cedar Creek Fire¹² or the Blackout of 2011¹³.

MBC at Miramar Landfill

Biosolids are the nutrient rich by-product of wastewater treatment, generated by channeling human waste through treatment plants and collection systems. Biosolids are the end product after treating sewage sludge with anaerobic digestion in combination with heat. MBC is located at the Miramar Landfill, adjacent to MBC Cogen. Materials from the landfill and solids raked from regional sewage treatment plant inflow pipes feed into the MBC treatment facility. Materials received at MBC are dewatered and digested. Methane generated by the digesters is combined with landfill gas to produce electricity. Biosolids produced by this facility are sold as fertilizer and other exploitable products.

North City Cogeneration Facility

The Public Utilities Department's North City Water Reclamation Plant¹⁴ has a renewable energy plant called the NC Cogen. On average, approximately 3 MW of electricity is provided by NC Cogen to the water reclamation plant, with excess power sold to the local power utility through the power grid interface equipment.

¹²<http://www.bing.com/images/search?q=Cedar+Creek+Fire+California&qpv=Cedar+Creek+Fire+California&FORM=IGRE>

¹³ http://en.wikipedia.org/wiki/2011_Southwest_blackout

¹⁴ <http://www.sandiego.gov/mwwd/facilities/northcity.shtml>

During weekly maintenance and summer peak production conditions the electricity demand of the water reclamation plant may exceed the capacity of the cogeneration plant. Also, during times of peak loads, the on-site generators may not provide sufficient energy. There appear to be no plans to supplement existing generation capacity with additional generators.

MBC Cogen at Miramar Landfill supplies its excess methane to North City. This landfill methane is compressed and dried on a refrigeration skid at the West Phase II Miramar Landfill site, then re-transported to NC Cogen. Natural gas can be used as backup fuel, if needed. Additional electricity from the local electrical utility¹⁵ can be purchased if required.

NC Cogen consists of four 950 KW single cogeneration package units. Each unit contains one 950 KW Caterpillar engine connected to a 950 KW generator along with engine cooling water radiators, switch gear, and a landfill gas compressor station. The four existing generators are housed in temporary trailers with no plans at this time to place them in a permanent shelter. The NC Cogen is a 3.8 MW facility and produced 29,000 megawatt hours (MWh) of renewable electricity in FY 2012. NC Cogen has sound attenuation mounds, gates and other devices designed to blend in with the landscaping theme of the NC Cogen facility.

West Phase II of the Miramar Landfill has enough wells to supply 3.2 MW of power allocated to MCAS Miramar and 3.8 MW allocated to North City Cogen. In addition, the facility is able to sell landfill gas to the Public Utilities Department for a city-owned 1.6 MW expansion. The City owned expansion of the facility at North City significantly reduces the need for the plant to purchase power from the local utility during weekly maintenance periods and summer peak conditions. Demand and standby utility charges average \$50,000 per month. The expansion is a significant cost saving to the City.

COST SAVINGS

The Grand Jury is very interested in the overall cost benefits to the City of the landfill gas enterprise. At our request, the City Public Utilities Department provided a detailed estimate of the financial benefit¹⁶ of the use of landfill gas in the MBC Cogen Facility, and at the North City West Water Reclamation Facility.

As described above, a civilian cogeneration development firm owns and operates the MBC Cogen Facility at no cost to the city. The principal customer for the electricity produce from the landfill gas is MCAS Miramar, which pays the firm a contracted rate for the electricity they consume. In turn, the firm pays the City 8 percent royalties on the electricity purchased by MCAS Miramar — **this is projected to provide the City as much as \$220,000 per year in revenue.**

The city also achieves significant cost savings at the MBC through:

¹⁵ <http://www.sdge.com/>

¹⁶ Letter from Assistant Public Utilities Director Dated Oct.8th 2012 to San Diego County Grand Jury Foreman.

- On site generation of electricity which avoids the purchase of electric power from the public utility often at critical peak pricing levels,
- Use of waste heat from the cogeneration facility for on-site heating and hot water use and,
- Use of landfill gas for most of MBC's other natural gas needs, obviating the need to purchase gas from the public utility.

The City estimated this project saved MBC \$1,059,000 in fiscal year 2012.

The civilian cogeneration development firm also owns and operates a 3.8 MW landfill gas Cogen facility at the North City Water Reclamation Plant. The reclamation plant produces reclaimed water in the Advanced Water Purification (AWP) Demonstration Pilot Study and consumes all of the available power from the Cogen facility, paying contracted rates for the power.

The City estimates that the NCWRP avoided costs of \$1,447,100 in fiscal year 2012.

In addition to the above savings, the City of San Diego receives 8% royalties on the electricity the civilian cogeneration development firm sells to the reclamation plant — **this is projected to provide the city as much as \$100,000 per year.**

CONCLUSION

It is increasingly clear that for the foreseeable future our nation, and especially the San Diego region, faces significant issues of climate change, greater environmental sensitivity, and the need to reduce imports of foreign energy supplies. We need every clean, renewable and local energy resource we can find. Methane captured from landfills and wastewater treatment facilities are proving to be a reliable contributor to the solution. Energy is being produced and it is reducing methane emissions into the atmosphere. Energy production using landfill gas is proving to be a profitable enterprise for private industry, the United States Marine Corps and the City of San Diego.

In addition to reducing the dependence of MCAS Miramar on the Southern California electrical grid by using local renewable energy, this enterprise reduces greenhouse gas emissions. The City of San Diego and its citizens reap the financial benefits from this innovative enterprise and have moved toward greater energy independence.

COMMENDATIONS AND CONGRATULATIONS

An outstanding and effective enterprise initiative has been developed at the City of San Diego's Miramar Landfill facility. This project utilizes landfill by-products to produce electrical independence from the local public utility to benefit both the operation of City services and MCAS Miramar at a significantly lowered energy cost. The electrical power independence due to the Miramar Landfill operation is both highly reliable and readily available. This project approach serves to minimize adverse environmental impacts due to reduction of greenhouse gas emissions as well as reduces impacts on the regional electrical supply. This approach not only lowers the City's energy costs but also provides business opportunities and quality jobs to our community.

This enterprise initiative is a successful undertaking between Marine Corps Air Station Miramar, the Naval Facilities Engineering Command Southwest and the City. As an advantage, the City of San Diego benefits and has moved toward greater energy independence.

The Grand Jury applauds the efforts of all parties involved in this joint venture and strongly commends them with a job “**Well Done!**” In keeping with maritime traditions, the Grand Jury applies the term **Bravo Zulu** to congratulate and compliment:

- Marine Corps Air Station Miramar
- Naval Facilities Engineering Command Southwest
- The City and its Public Works staff

for this achievement of outstanding cooperative performance in the development and successful operation of the Miramar Landfill enterprise serving to benefit the citizens of our County.

RESOURCE MATERIALS:

- Various Internet Television Reports from CW6 News, ABC TV 10, Fox 5 News, and KUSI News.
- The U-T San Diego
- Navy.mil website the source for Navy news
- Defense Video & Imagery Distribution System [www.dvidshub.net]
- City of San Diego Environmental Services Department
- City of San Diego Long-Term Resource Management Options Strategic Plan
- Interviews and site visits

APPENDIX – Definitions and Terminology

CO ₂	Carbon dioxide
Cogen	Cogeneration
KWh	Kilowatt hour
MBC	Metropolitan Biosolids Center
MBC Cogen	MBC Cogeneration Facility
MCAS	Marine Corps Air Station
MP2	MCAS Miramar Power Plant
MSW	Municipal Solid Waste
MWh	Megawatt hour
NAVFACS	Naval Facilities Engineering Command Southwest
NC Cogen	North City Water Reclamation Plant and Cogeneration Facility
PPA	Power Purchase Agreement