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American Recovery and Reinvestment Act Federal Energy Management Program

Technical Assistance Project 228 US Army Installation Management Command – Pacific Region, Honolulu, Hawaii

WF Sandusky

September 2010



Pacific Northwest
NATIONAL LABORATORY

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Pacific Northwest National Laboratory
Richland, Washington 99352

Executive Summary

The report documents the activities of a resource efficiency manager (REM) that served the US Army Installation Management Command (IMCOM) - Pacific Region during the period of November 23, 2009 and August 31, 2010. The REM was provided by the Redhorse Corporation under subcontract to the Pacific Northwest National Laboratory (PNNL). Funding for the subcontract was made available to PNNL based on American Recovery and Reinvestment Act funding that was allocated to the U.S. Department of Energy's Federal Energy Management Program.

With the funding that was made available for this activity; the REM participated in the development of 10 separate initiatives initially identified by IMCOM – Pacific Region. For these initiatives, the REM was instrumental in refining the initiatives that, once implemented, would result in an annual energy savings of 144,015 million British thermal units (MMBtu) of electrical energy, resulting in an annual cost savings of \$6,273,980. The estimated cost to implement all the initiatives is \$34,150,000, with a simple payback of 5.4 years. The largest portion of the savings and cost are related to two identified power generation opportunities. One is a waste-to-energy project; while the other is a cogeneration project.

If the Army needs assistance with securing alternative financing for any identified capital project, they are strongly encouraged to contact the FEMP Federal Financing Specialist (FSS) for their region. For this site, the designated FSS is Scott Wolf. His contact information is scott.wolf@ee.doe.gov, or (360) 866-9683.

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1.0 Description of ARRA Program

The Federal Energy Management Program (FEMP) facilitates the Federal Government's implementation of sound, cost-effective energy management and investment practices to enhance the nation's energy security and environmental stewardship. To advance that goal and help accelerate agencies' progress, FEMP works to foster collaboration between its Federal agency customers and the U.S. Department of Energy (DOE) national laboratories.

In 2009 and 2010, FEMP has utilized funding from the American Recovery and Reinvestment Act of 2009 (ARRA) to facilitate Federal agency access to the broad range of capabilities expertise at the national laboratories. Funds were directed to the laboratories to assist agencies in making their internal management decisions for investments in energy efficiency and deployment of renewable energy sources, with particular emphasis on assisting with the mandates of the Energy Independence and Security Act of 2007 related to Federal facilities and fleets.

FEMP provided major DOE laboratories with funding that will allow them to respond quickly to provide technical advice and assistance. FEMP applied a simple vetting and approval system to quickly allocate work to each of the laboratories in accordance with FEMP allocated funding. All assistance provided by the laboratories was in accordance with the requirements of Federal Acquisition Regulation (FAR) Subpart 35.017 and the laboratories' designation as "Federal Funded Research and Development Center" (FFRDC) facilities.

The U.S. Army Installation Management Command (ICOM) submitted a response to this call requesting that funding be provided to secure the services of a resource efficiency manager (REM) to serve the Pacific Region. This region includes garrisons located in Hawaii, Alaska, and Japan. The purpose of securing a REM is to identify energy conservation measures that could be implemented in a timely manner and capital projects that have potential for significant energy and/or cost savings. This request was selected by FEMP and designated as Project 228.

2.0 Project Activities

Based on the nature of the requested services, Pacific Northwest National Laboratory (PNNL) contracted with the Redhorse Corporation of San Diego, California to provide a REM. The REM would be located at Fort Shafter, HI to provide support to Pacific Region of the U.S. Army IMCOM. The Region has garrisons located in Hawaii, Alaska, and Japan. The requirements for the position included knowledge of the typical operating environment at Army installations, knowledge of the basic REM concept, and experience in the full-range of energy management activities at Federal facilities. Once potential projects were identified, the REM is expected to identify funding mechanisms to get the projects implemented.

For this position, the REM was expected to develop the Regional Energy Strategic Plan (RESP), which integrates nearly 30 separate initiatives executed or planned within the last 2 years. The RESP provides a roadmap for the Pacific Region to accomplish the myriad of goals and objectives defined by legislation and Executive Orders. The RESP employs a “portfolio approach” to meet the 30% energy intensity reduction by 2015 and the DOD mandate of 25% renewable energy generation by 2025.

During the period of performance, the REM focused on 10 major initiatives that are listed below.

- Schofield Barracks Waste Water Treatment Plant (SBWWTP) Biogas Cogeneration (BCS)
- Waste-to-Energy (W2E) Plant
- Hale Koa Seawater District Cooling (SDC) Project
- US Army Corps of Engineers, Construction Engineering Research Laboratory (CERL) Bio-Fuels Initiative
- Fort Richardson Landfill Gas (LFG) Cogeneration Project
- Schofield Barracks Effluent Reuse System (ERS)
- Power Conditioning System at SBWWTP
- Customer Information System
- Energy Data Management System (EDMS)
- Hale Koa Hotel Power Conditioning System

Several of these projects are still in various stages of development.

3.0 Background

The Pacific Region of the U.S. Army Installation Management Command consists of the following garrisons:

- Fort Greely, Alaska
- Fort Wainwright, Alaska
- Fort Richardson, Alaska
- U.S. Army Garrison – Hawaii
- U.S. Army Garrison – Japan

The region has a total floor space of 44.1 million sq. ft². The energy use index for all facilities in the region is 173,000 Btu per square foot. The energy manager for each respective garrison is responsible for tracking and verifying their utility bills and all garrisons have a recycling program in place. In addition, each garrison has programs in place with their serving electric utility for peak load reduction. Renewable energy projects have been limited to one site that is part of the U.S. Army Garrison – Hawaii. The U.S. Army Garrisons – Alaska have experience in implementing energy saving performance contracts (ESPC).

Based on rules regarding the implementation of ARRA projects, the garrisons in Japan could not be evaluated. Any work at those garrisons would have to be funded directly by the region.

3.1 Climate, Facility Type, and Operations

The climate for the Hawaii portion of the region is humid tropical, while installations in Alaska experience an arctic environment. Specific climatic data is not presented for the various garrisons because of the number of installations involved.

4.0 Initiative Measures Identified

A detailed summary of the initiatives in which the REM participated is included in [Table 1](#) below. The information contained in [Table 1](#) is not complete because the activities related to Initiative were still in the development stage.

Table 1. Pacific Region REM Activities

Initiative Number	Project Description	Payback - Years	Project Cost (\$)	Annual Cost Savings (\$/Yr)	Energy Savings (kWh/Yr)	Energy Savings (MMBtu/yr)	Water Savings (kGal/yr)
1	Schofield Barrack – Biogas Cogeneration	7.7	1,865,000	241,906	1,081,860	3,691	
2	Solid Waste Gasification	4.0	10,585,000	2,634,500	9,014,040	30,756	
3	Hale Koa Hotel - SDC	4.2	700,000	164,854	6,105,720	20,833	TBD
4	Hawaii Bio-Fuel	TBD					
5	Fort Richardson Landfill Gas Cogeneration	5.7	13,375,000	2,337,447	25,831,000	88,136	
6	Effluent Reuse System	8.8	7,500,000	854,100			262,800
7	Power Conditioning	3.0	125,000	41,172	175,200	598	
8	Customer Information System		0	0	0	0	
9	Energy Data Management System		0	0	0	0	
10	Hale Koa Hotel – Power Conditioning		TBD				
Total			34,150,000	6,273,980	42,207,820	144,015	262,800

4.1 Details of Proposed Initiatives

Initiative 1 – Schofield Barracks Wastewater Treatment Plant (SBWWTP) Biogas Cogeneration System (BCS)

Renewable energy is produced by burning biogas (methane) derived from the anaerobic digestion of sludge at the SBWWTP. Approximately 130 kW, or 1,138,800 kWh/yr, is estimated to be produced by the BCS based upon the enhanced gas production resulting from the addition of fats, oils, and grease (FOG) to the digester. This initiative is being implemented by Aqua Engineers, the utility privatization contractor for the SBWWTP.

REM Contributions: Identified and enabled implementation of the FOG injection option, thereby doubling the output of the BCS. The REM developed an approach to fund the project so that Aqua Engineers finances the projects and recovers its cost through the energy savings. The anticipated start date for the project is October 2010, with completion by March 2012.

Initiative 2 – Waste-to-Energy (W2E) Plant

The US Army Garrison – Hawaii is exploring the potential of a W2E plant to be located on Army property that will convert problematic solid wastes into electricity using a high-temperature gasification process. Biomass Energy Systems Inc. is working under a U.S. Air Force initiative through the Air Force Power Technology Office to study the potential for a W2E plant. Target waste products include bio-solids (treated wastewater sludge) and other organic and cellulosic waster, such as construction debris. The concept is to develop a 1-MW base load plant that would require 50 ton/day of fuel source.

REM Contributions: Identified the best option to be a regional plant in the central portion of Oahu that would be fueled with bio-solids from the SBWWTP and the Wahiawa Wastewater Treatment Plant, supplemented with debris from on-going Army construction projects.

Initiative 3 – Hale Koa SDC Project

The project consists of providing 20,000+ tons of chilled water for the hotels in Waikiki, including 1,00 tons of renewable ocean energy at the Hale Koa Hotel at Fort DeRussy. The initiative involves taking deep seawater (1,000 meters or more below the surface) up to the surface and exchanging the heat from the chilled water loop that serves multiple hotels.

REM Contributions: Began this initiative on behalf of IMCOM interfacing with the project developer. A business case analysis was developed by the REM for discussions with the project developer.

Initiative 4 – US Army Corps of Engineers, Construction Engineering Research Laboratory (CERL) Bio-Fuels Initiative

The Construction Engineering Research Laboratory (CERL) is managing the bio-fuel demonstration and evaluation project in Hawaii funded by an FY10 Congressional earmark. The proposed project is to demonstrate the harvesting and processing stages of the bio-fuel industry. A contract has been awarded to Pacific Biodiesel to grow, harvest, and process sufficient oil seed crops to demonstrate the potential commercialization of the process in Hawaii.

REM Contributions: Supported the IMCOM Pacific Region Sustainability Manager in the identification of 200+ acres of Army or adjacent lands on Oahu for the oil seed crop. The REM provided technical assistance in the identification and implementation of the irrigation system to support crop development. Multiple alternative sites are under consideration, including parcels identified by the REM.

Initiative 5 – Fort Richardson Landfill Gas (LFG) Cogeneration Project

The Municipality of Anchorage (MOA) issued a proposal to make beneficial use of the LFG generated adjacent to Fort Richardson. The project, as envisioned, would 4.0 MW (2012) to 6.4 MW (2032) of energy by generators housed in a power plant on Army land adjacent to the MOA landfill.

REM Contributions: The REM participated in proposal development strategy sessions with the Army, Doyon Utilities, Defense Energy Support Center, and Air Force personnel. The proposal was submitted by Doyon. The REM developed the draft Pro Forma for the 20-year contract necessary to calculate the price that Doyon could pay the MOA for the gas and potential economic benefit to the Army.

Initiative 6 – Schofield Barracks Effluent Reuse System (ERS)

US Army Garrison – Hawaii (USAG-Hawaii) is planning on using reclaimed water on golf courses, recreational fields, landscaped areas, and agricultural areas for installations on Oahu. This would eliminate the effluent disposal fee of \$575,000 per year paid to Dole Foods to effluent into their north shore irrigations ditch. Currently, a preliminary Pro Forma for the proposed ERS, based on the latest effluent distribution plans, include the irrigation of the Leilehua Golf Course. The estimated need for the golf course is 350,000 gallons/day of the available effluent (2-3 million gallons/day) and is a key contribution to the Garrison water conservation program. Full implementation of the ERS would enable the Garrison to meet the water reuse and potable water conservation legislative goals.

REM Contribution: The REM facilitated planning sessions to identify economics and efficiencies associated with pipeline routing and methods to accelerate implementation of the ERS.

Initiative 7 – Power Conditioning System at SBWWTP

A power quality improvement program is being considered for selected installations of the USAG-Hawaii. The initial project will be installed as part of Initiative 1, but with follow-on activities planned for other installations. Power quality problems are pervasive in Hawaii because of inherent issues associated with the island grid system. Planned activities include a real-time power conditioner that maintains voltage while reducing or eliminating harmful harmonic distortion. It is estimated that an energy savings of 10 to 15% would be realized for facilities with industrial loads, such as water and wastewater plants.

REM Contribution: The REM has considerable experience in this area. Several potential vendors have been researched and a program implementation strategy has been developed. The REM identified potential follow-on sites, such as water pumping and treatment facility at Wheeler Army Air Field, the Hale Koa hotel, and the Tripler Army Medical Center. Full implementation of the system at these sites would yield a total energy reduction for USAG-Hawaii of 1%.

Initiative 8 – Customer Information System

Utility grade meters will be installed at the largest energy intensive buildings are Fort Wainwright and Fort Greely to enable the identification of energy efficiency opportunities and meet the requirements set forth in EPC Act 2005. Installation of the meters will not result in energy savings directly, but will provide information regarding the performance of buildings to identify savings opportunities.

REM Contribution: Worked with utility to identify the most appropriate buildings to be metered.

Initiative 9 – Energy Data Management System (EDMS)

There is a need to develop a regional energy conservation information management tool that can be deployed at USAG – Hawaii. Implementation of an EDMS will not result in energy savings directly, but will provide information regarding the performance of buildings to identify savings opportunities.

REM Contributions: Worked with the IMCOM-Pacific Region Sustainability Manager to explore alternatives for including an EDMS as part of activities related to Initiative 4. The REM developed multiple working solutions that incorporated automated meter reading and analysis of data from a single large

facility. Potential candidates include Hale Koa complex or the Tripler Army Medical Center.

Initiative 10 – Hale Koa Hotel Power Conditioning System

See Initiative 7 for details.

5.0 Potential Greenhouse Gas Reduction

The proposed initiatives will reduce greenhouse gas (GHG) emissions. All reported calculations in Table 2 below are based on the U.S. Environmental Protection Agency (EPA) GHG emissions calculator and are reported as carbon dioxide equivalent (CO₂e). The EPA calculator estimates avoided CO₂ emissions in metric ton equivalent based on estimated kilowatt hour (kWh) savings. Once the initiatives are implemented, the actual kWh savings can be used to estimate GHG emissions reductions using the EPA eGRID model (Pechan 2008), using actual data from the electricity provider, which takes into consideration complex factors such as the mix of utility generation sources.

Table 2. Estimated Greenhouse Gas Reductions for Each Proposed Initiative

Reference: <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>

Initiative	Estimated Energy Savings (kWh/yr)	GHG Avoided (Metric tons of CO ₂ e)
1	1,081,860	777
2	9,014,040	6,474
3	6,105,720	4,385
4	0	0
5	25,831,000	18,551
6	0	0
7	175,000	126
8	0	0
9	0	0
10	0	0
Total	42,207,820	30,313

To calculate jobs created and retained, one job for every \$92,000 in funds expended was assumed. The cost to implement the activities associated with the various initiatives (\$34,150,000) will result in 371 jobs created and 30,313 metric tons of CO₂e emissions avoided.

6.0 Assessment Team Members and Site Team

The Redhorse team for this activity consisted of Sheldon Hunt, who was the REM located at Fort Shafter, and Ben Hough. William Sandusky, PNNL Program Manager, provided technical direction for the activity and development of this report.

7.0 References

H. Pechan & Associates (Pechan). September 2008. The Emissions & Generation Resource Integrated Database for 2007 (eGRID 2007). Report Number 08.09.006/9011.239. Springfield, Virginia.