BEST PRACTICES GUIDE

Energy and Water Efficiency Improvements for Dishrooms in Military Dining Facilities

ESTCP Project EW-201518

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14. ABSTRACT

Energy and water usage for commercial foodservice have a significant impact on the overall usage of a facility. Daily meal preparation and cleanup in a military dining facility (DFAC) represents more than 75% of the energy and water load. Within the foodservice facility itself, the dishwashing room or "dishroom" has the highest energy intensity compared to the other zones within a DFAC (ASHRAE, 2012). This project identified and demonstrated dish machine with waste water heat recovery to reduce the energy and water usage and intensity within a dishroom at a military installation used for cleaning and sanitizing of flatware, dishes, cooking vessels, and other foodservice related utensils. Results showed a savings of 35 therms per day of natural gas and 6,375 gallons of water per day when replacing the existing machine with an energy efficient design. These savings equate to 12,775 therms per year and 2.33 million gallons of water per year.

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ACRONYMS AND ABBREVIATIONS

ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
Btu	British thermal unit
CERL	Construction Engineering Research Laboratory
CFM	Cubic feet per minute
DFAC	Dining Facility
DLIFLC	Defense Language Institute Foreign Language
DoD	Department of Defense
EPA	U.S. Environmental Protection Agency
ESCOs	Energy Service Companies
ESTCP	Environmental Security Technology Certification Program
EW	Energy and Water
FNi	Fisher Nickel, Inc.
gpm	gallons per minute
GTI	Gas Technology Institute
HVAC	Heating, Ventilation and Air-Conditioning
kW	kilowatt
lb/hr	pounds per hour
MW	megawatt
SCFM	standard cubic feet per minute
SERDP	Strategic Environmental Research and Development Program
UFC	Unified Facilities Criteria
USAG	United States Army Garrison

1.0 INTRODUCTION

1.1 BACKGROUND

Energy and water usage for commercial foodservice have a significant impact on the overall usage of a facility. Daily meal preparation and cleanup in a military dining facility (DFAC) represents more than 75% of the energy and water load of the facility (ASHRAE, 2012). Within the foodservice facility itself, the dishwashing room or "dishroom" has the highest energy intensity compared to the other zones within a DFAC (ASHRAE, 2012). The dishroom has an intensity of 53.5 W/ft^2, compared to 29.3 W/ft^2 for the Carry Out zone, 27.1 W/ft^2 for the Server zone and 13.5 W/ft^2 for the Kitchen zone. Up to 75% of the hot water in the kitchen is consumed in the dishroom. Many of the dishwashers installed in foodservice facilities and DFACs are older, use excessive volumes of hot water and are being operated inefficiently. Preliminary field monitoring has shown significant water and energy savings potential by replacing outdated dishwashers with modern ENERGY STAR® qualified models. Recent findings have shown that not only are these existing dishwashers (also called warewashers) consuming large volumes of hot water for the rinse operation, but also the staff operating practices are greatly adding to additional water waste. Water and energy savings of up to 90% have been experienced in unpublished dishwasher replacement field projects by Frontier Energy (Fisher Nickel, Inc.). While energy-efficient cooking equipment, improved ventilation systems and advanced space conditions systems have been developed and used for the kitchen, dining and serving zones; the dishroom has experienced fewer improvements in energy and water usage for all types of foodservice facilities including DFACs.

1.2 OBJECTIVE OF THE DEMONSTRATION

The objective of this project is to identify and demonstrate a comprehensive strategy of installing and analyzing different technologies to reduce the energy and water usage and intensity within a dishroom at a military installation used for cleaning and sanitizing of flatware, dishes, cooking vessels and other foodservice related utensils. Included are technologies to recover heat from waste water, to reduce waste water, to improve worker environmental conditions, demonstrate reliability and to reduce space conditioning loads. The specific Performance Objectives are: 60% energy savings for heating water to the dishwasher and 75% savings for water for washing.

1.3 DEMONSTRATION FACILITY/SITE LOCATION AND OPERATIONS

The demonstration was conducted at the US Army Garrison Presidio of Monterey located in Monterey, CA. The Presidio of Monterey provides professional base support services to facilitate mission readiness and promote wellbeing for all supported elements. The primary tenant organization is the Defense Language Institute Foreign Language Center (DLIFLC). DLIFLC provides foreign language education, training, evaluation, and sustainment for DoD personnel to ensure the success of the Defense Foreign Language Program and enhance the security of the Nation. The present facilities at the Presidio of Monterey accommodate approximately 3,500 Soldiers, Marines, Sailors and Airmen, as well as select DoD members and the U.S. Coast Guard. The base has two active DFACs with Belas Hall chosen for the demonstration. The project team visited the Presidio of Monterey and determined the type of dishroom equipment used and the layout of the dishroom in the Belas Hall was compatible with the objectives of the

proposed project. Specifically, there is sufficient room to install a new dish machine with the heat recovery unit on the waste water drain and an existing ventilation system to be monitored and replaced. The project team worked with the DFAC staff to ensure the installation of data monitoring equipment and demonstration units did not interfere with the day-to-day operations of the facility. Jay Tulley, Energy Manage, served as the point of contact.

Figure 1. Belas Hall at US Army Garrison Presidio of Monterey

The DFAC is in Monterey, CA approximately 110 miles from Frontier Energy. This allowed Frontier to visit the site in a timely manner to retrieve data and address any issues when needed.

Figure 2. Map of Demonstration Site and closest Project Team member

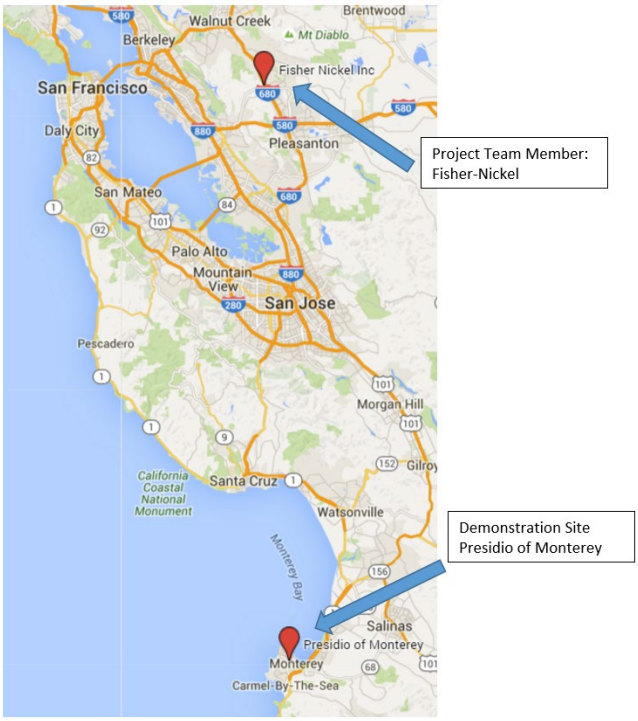

Figure 3. Dish Room at Belas Hall

1.4 RESULTS OF THE DEMONSTRATION

After extensive redesign of the dishroom, the old carousel dish machine was replaced with the conveyor dish washer shown in the following figure.

Figure 4. Dish Room at Belas Hall with New Dish Machine

After decommissioning the boiler system, an average of 3.5 MMbtu/day of energy in the form of natural gas was saved for a 51% savings compared to the baseline and 11 kWh/day of electricity

was saved for a 41% savings compared to the baseline. The water savings was measured to be 6,375 gal/day for the entire dishroom (5,185 gal/day for the dish machine) giving an 84% reduction compared with the baseline. This equates to approximately 2.3 million gallons of water saved per year. A more in-depth discussion of the results is presented in the final report for the project, ESTCP EW-201518 Final Report.

2.0 BEST PRACTICES GUIDE

During the baseline and demonstration testing of the project, several best practices were identified that could have significant time, energy and water savings if identified during the initial stages of the project. Some of these practices would be applicable to existing installations that are not planning a change in equipment.

2.1 EVALUATING EXISTING WATER USAGE PRACTICES

Water usage in a dishroom is not limited to the dish machine. **Figure *5*** shows, significant water usage comes from the pre-rinse. The pre-rinse is done to remove food items and large stains for the dishware before entering the dish machine for cleaning and sanitation.

Figure 5. Water Usage in Dish Room

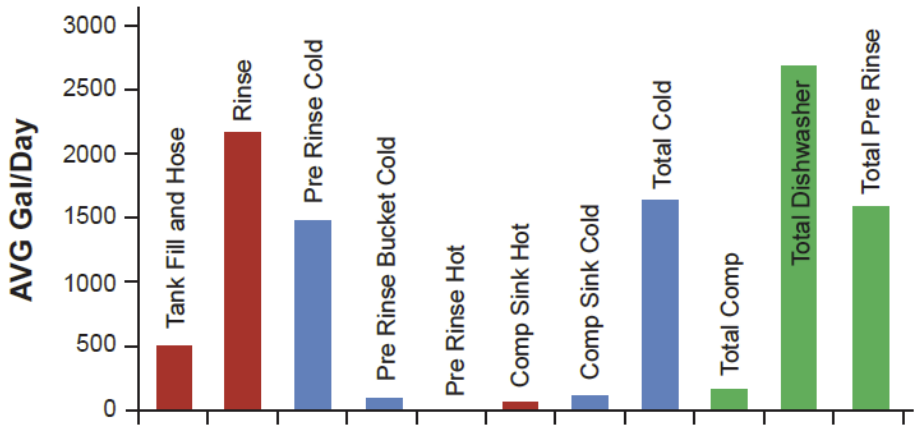

Figure *6* shows that a garden hose without a nozzle was being used to pre-rinse the dishware and at times the hose would be left on to "wash out" the tough were the scraps collected below the station. After identifying this, the project team replaced the open hose with low flow spray nozzle and recommended using a dry scrapping method to remove larger food items from the dishware. As discussed in the final report for this project, this process saved close to 3 gallons of water per meal served.

Figure 6. Pre-Rinse Station in Dish Room

Based on these results, a best practice before any dishroom project would be to identify the different water sources in the dishroom and determine if the current usage method is the most efficient use of water.

2.2 USING KITCHEN DESIGNERS IN THE EARLY STAGES

Because the basic methodology of operating the dish machine was not going to change from the baseline to the new machine, a kitchen designer was not used during the early stages of the project. The plan was to place a new machine into the existing footprint of the old machine and use the same conveyor system to move trays from the drop off location to the pre-rinse station to the dish machine. However, as the baseline testing was coming to an end, it was determined that existing layout of the dishroom and the location of the hoods would not work with the new machine. Also, the pre-rinse station needed to be relocated. After working with the site energy manager and existing staff, it was determined an experienced kitchen designer was needed to meet the needs of the sites, incorporate new plans of the usage of the dishroom and to determine the dish machine and hood location. If a designer had been used in the early stages of the project, several issues and delays could have been avoided. The team eventually hired the original designer of the facility to assist with the new layout. Based on this experience, a best practice before doing any changes to a dishroom would be to hire an experienced DFAC kitchen designer.

2.3 USING INSTALLER EXPERIENCED WITH DFACS AND LOCATED NEAR THE SITE

A best practice recommendation is to use an experienced and local installer if possible. Several delays to the project occurred because the nearest installer was located over an hour away from the site. There also were issues with the installer on getting to site and determining the correct

location of the new equipment in the site. Including a kitchen designer in the early stages would have helped.

2.4 INFORM AND EDUCATE THE STAFF ON USING THE NEW EQUIPMENT

The biggest issue with the installation and use of the new machine was getting outside contracted staff's buy in to the benefits of the new machine. Despite the old machine using a lot more energy and water, it was very easy for one person to operate. The trays would go from the pre-rinse station and placed on the carousel to go through the machine. After the tray exited the machine, if no one was present to remove it, it would just go through the machine again. While a waste of energy and water, a staffer did not have to be present at the exit of the machine to remove cleaned trays. With the new conveyor dish machine, if trays were not removed from the exit conveyor, there would be back up of tray preventing new trays from entering the new system. Also, the stacking and organization of dishware and utensils in the trays on the new conveyor system had to be done more carefully and with an established organization pattern. If not done correctly, some dishware or utensils would tend to be "bumped" out of the tray and fall onto the floor. After several attempts at educating the staffers and purchasing of replacement dishware, the team was able to remedy the problem. Because of the changes in the operation of the dishroom, many of the staffer became "frustrated" with the new machine and were resistant with changing their behavior to suit the machine. Based on this experience, a best practice before doing any changes to a dishroom would be to educate and inform the staff and kitchen managers of the reasons for replacing the old equipment, the benefits to the DFAC and the potential changes in operation of the dish room that will need to occur to optimize the benefits of the new machine. Another best practice would be to setup classes or training for the staff with the new machine with local rep from the dish machine manufacturer.

Figure 7. Baseline Carousel Dish Machine

2.5 OTHER WATER SAVINGS: TRAYLESS SERVICE

A study in the 2012 Journal of Hunger & Environmental Nutrition showed that food waste could be reduced by 30% and the number of dishes washed reduced by 27% if the service in the facility is switched to trayless. Trayless service means trays are not made available to the consumers to put their plates or bowls of food, cups and utensils on while being served food. Without trays, generally more food is put on single plates, few utensils are taken and single drink container used instead of multiple ones. A result of the trayless method is that drink containers are refilled and less food is wasted because less food is taken during each trip to the serving area and after the first serving, fewer persons return for more food or tend to get less food because they are not as hunger. Significant water savings is realized because fewer dishware and no trays are washed using the dish machine. For this project, the team suggested changing to a trayless system, but it was decided to keep using tray because the students in the DFAC had a limited time for each meal and needed to get all their food during a single trip to the serving area.

2.6 SUMMARY OF BEST PRACTICES

The following is summary of recommended best practices for installing a new or replacement dish machine that could have significant time, energy and water.

- ✓ Evaluating existing water usage practices
- ✓ Using kitchen designers in the early stages
- ✓ Using installer experienced with DFACs and located near the site
- ✓ Inform and educate the staff on using the new equipment
- ✓ Other water savings: trayless service

3.0 REFERENCES

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