COMNAVSURFLANT
Inport Energy Management Handbook

Introduction

The COMNAVSURFLANT (CNSL) Inport Energy Management handbook was developed by the US Fleet Forces (USFF) Resource Efficiency Manager (REM) in conjunction with the CNSL Material Readiness Office (N43) to provide recommendations to CNSL ships on simple and proven actions to reduce pier side utility usage.

The goal of this publication is to educate ship's force personnel on the management of inport energy resources, thereby reducing electricity, steam, and water consumption.

This manual describes basic methodologies for reducing utility consumption, highlights shipboard resource management lessons learned, provides guidance on monthly shipboard utility consumption, and concludes with a best practices checklist for shipboard implementation. This should be considered an initial starting point for energy reduction and referenced regularly during inport operations. Also included are:

- methods used to meter pier-side utilities
- methods used to baseline energy consumption
- typical electrical equipment energy usage

Ships are encouraged to use this manual as a baseline and to consider innovative means to improve energy conservation. Creative solutions or practical applications implemented by ship's force should be forwarded to CNSL N43 for consolidation and distribution throughout the fleet in addition to recommendations made in this manual.

NOTE: None of the recommendations contained herein supersede Engineering Operational Sequencing System (EOSS) or Combat Systems Operational Sequencing System (CSOSS) procedures. EOSS and CSOSS procedures are to be followed at all times.

How to Achieve Energy Reduction Goals (ERG)

Energy Reduction Programs are primarily comprised of three components:

- Energy Policy
- Electrical / Mechanical Efficiency
- Culture Change

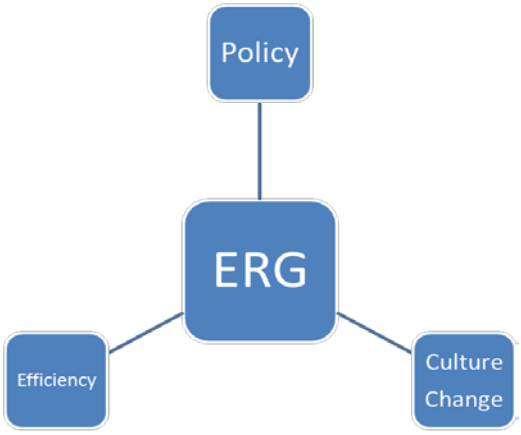

Figure 1

1. Energy Policy: Refers to instructions, such as the Secretary of the Navy Energy Conservation Awards Program (SECNAVINST 4101.2), that provides a framework for implementation of conservation measures and articulates the overall program goals. Commanding Officers are encouraged to implement further energy conservation measures based on conditions, location, and installed systems.

The following areas are evaluated annually to determine awardees:

- Awareness and compliance with energy management directives
- Command commitment to effective energy management
- Energy management planning
- Efficient use and maintenance of energy consuming, producing, and distribution systems
- Innovative improvements in existing equipment and procedures, or development of new processes or equipment to address energy management related issues / problems
- Training of personnel in energy awareness and energy management methods
- Results of the energy management program

2. Electrical / Mechanical Efficiency: Refers to reducing energy wastage by securing equipment that is not required or making changes that are easy to implement. These items are fairly straightforward; however, it requires effort to determine exactly what equipment is required in port. Also, the ship has to be cognizant of what is required to get the ship underway should emergent tasking arise.

3. Culture Change: In order for any program to take root within the command, everyone has to be aligned with the goal of energy conservation. This will also improve the ship's material readiness as equipment operating hours can be reduced. An energy efficient vessel tends to be better maintained than a similar ship that is not energy efficient. Policy reinforced with sound methods will develop a culture of, *"Using only what's needed or required."*

Methodology for Reducing Utility Consumption

There are a few basic actions that will reduce utility consumption for any ship. Instead of asking, "What should we turn off when not in use?" a more effective strategy is, "What is absolutely essential to maintain the ship hotel services, crew comfort, and shipboard operations?" This is an essential element of the Efficiency section of the ERG tripod.

Tenets of consumption reduction include:

- Secure equipment when not in use (i.e., re-heaters during warm periods)
- Minimize the speed of equipment: the amount of energy required to increase the speed of fans and pumps increases by a factor of three. For example, if fan speed doubles the amount of energy required increases by eight times.
- Determine the most efficient method of operating the ship by educating sailors on how to operate efficiently and periodically review energy consumption to ensure conservation techniques are being adhered to and to evaluate their intended effectiveness.

Energy Baselines and Load Shapes

Energy and utility baselines are the essential starting points for all ERG. It is difficult for activities to evaluate where they are if they do not have a referenced starting point. Creating a baseline requires an accurate measurement of utility usage.

The CNSL Energy Management Team (EMT) will provide timely and accurate feedback to pierside ships on their energy and utility consumption. NAVFAC is developing a utility metering program which will provide ship consumption data, aiding CNSL EMT in the creation of baselines for all vessels in port.

Load shapes are the graphical representation of the utilities consumed. Load shapes are not dependent on the size of a ship, but rather when utilities are used and how much energy was expended. A pierside load shape should be low during off-peak hours, increase when work begins, and then return to low levels after peak hours of operation.

The following is an example of an appropriate ship load shape from an actual MSC vessel inport Norfolk, VA during the fall of 2010. The load size in kW is small and reflects a small crew even though the ship is relatively large. The most important indicator on the graph is the securing of loads at the end of the work day as reflected by the load shape. Regardless of ship size, the load shapes should be similar to this when in port. Off hours energy consumption should go down approximately 20% as compared to normal working hours.

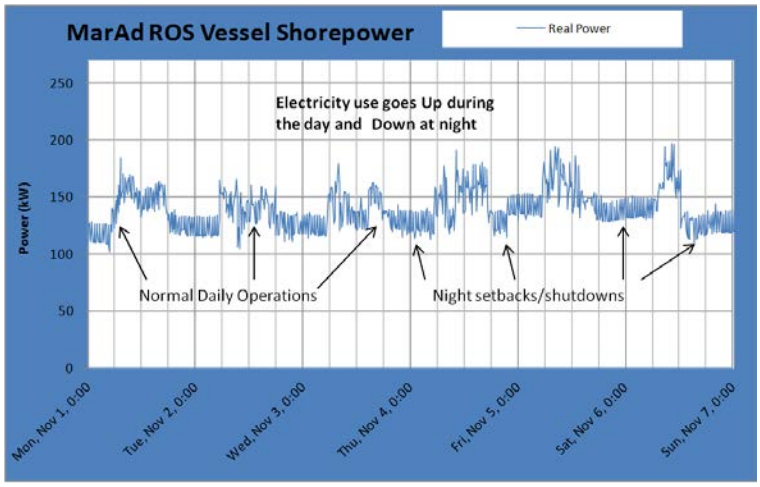

Figure 2

The following is an example of an inport load profile of a Navy ship returning from an extended deployment and is representative of every Navy ship we have measured. Some baselines are higher or lower, however the basic flat load shape has been prevalent.

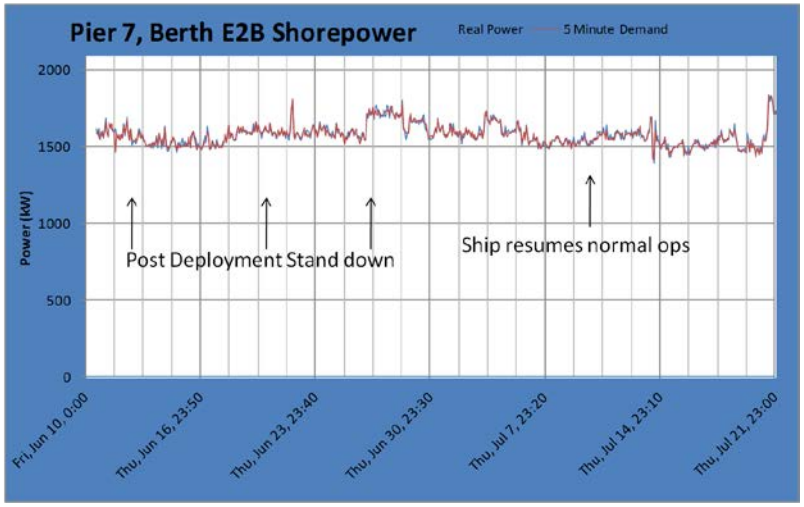

Figure 3

The graph above is an example of a five minute electrical demand profile of a DDG during routine in port operations. The electrical load was fairly constant during stand down and did not change appreciably when the ship commenced normal operations. A flat load profile could indicate that equipment was running unnecessarily at night and on weekends. It is interesting to note that this ship has been a consistent top performer in the Incentivized Energy Conservation (I-ENCON) program for underway operations. In fact, during this same time period, the ship was recognized as the best performing ship underway for her size category. However, the data indicates this ship has to invest more focus in conserving energy while pierside.

Shipboard Energy Management Lessons Learned

Large energy reductions can be realized by securing high energy use motors. These motors include air conditioning (A/C) and ventilation systems, firemain pumps, seawater service pumps, compressors, and other ancillary equipment. Noticeable, real-time changes can be observed on ship's electrical load profiles when these motors are energized and secured. Results can be seen on the ship's electrical switchboard with the reduction in amperage draw.

In addition to engineering equipment line-ups, energy and water reductions have been observed from ships that implemented all-hands energy awareness activities. After working hours tours of the ship by Command Duty Officers and duty section personnel are key to verifying non-required equipment is not in operation. Ship's personnel should also verify unnecessary lights are secured. Commanding Officers should implement an inport energy management instruction, make regular announcements concerning energy conservation (i.e., 1MC or plan of the day), and integrate energy conservation into their zone inspection program. Focus should be placed on items such as water / steam leaks, missing insulation / lagging, and A/C boundary closures.

Calculations of Daily Averages by Ship Class

Shipboard electricity and water consumption is often influenced by environmental conditions and mission requirements. Shipboard Energy Managers (SEM) shall consolidate consumption information with in-port days to provide daily averages by ship and ship class. Monthly billing information, electricity in kilowatt hours, and water in gallons should be divided by the number of days a ship is in port. The daily average will be graphed in units or in dollars and monitored monthly. Recent assessments have determined that a DDG class ship estimated daily electric consumption cost in port Norfolk, VA is approximately $3,500.

Best practices for All Ship Classes

Electricity and water are the two metered commodities that may be managed by crews during in port periods. SEMs help ships achieve an optimum energy awareness program that also supports in port requirements without compromising mission readiness, quality of life, and safety. Listed below are some best practices that have been implemented by ships to save energy and water.

Efficient Engineering Plant Line-up

- Engineering Operational Sequencing System (EOSS) validated, properly maintained, and used with verbatim compliance
- Configure engineering plant for efficiency, consciously selecting each day's line-up
- Minimize number of fire pumps used whenever possible. One 2,000 GPM fire pump (FP) or two 1,000 GPM FP's should be running depending on the number of A/C plants in operation
- Machinery alignment status board properly updated and maintained
- Minimize number of A/C units operated when conditions permit
- Operate A/C plants in an open loop configuration whenever possible
- Secure ventilation motor controllers in unmanned spaces when equipment operation and safety allow
- Conduct scheduled preventive maintenance on motor controllers and circuit breakers to minimize chattering contacts and correct weak spring tension
- IAW EOSS procedures, LPAC's and control air systems are to be secured when not required for use

Securing Vacant Spaces

- Secure chilled water and ventilation to unmanned troop spaces (amphibious ships) where appropriate **Note:** Care must be taken to ensure that condensation does not develop which could result in mold and decreased paint coating life
- Secure well deck ventilation exhaust systems whenever feasible
- Shift ventilation fans to slow or off when conditions permit
- Reduce energy redundancies while in port by operating minimum equipment to support port operations

Secure Lights and Equipment after Working Hours

- Secure space lighting when not in use
- Secure deck lighting and force protection lights during hours of daylight
- Secure quarterdeck space heaters when not in use
- Secure office computers, monitors, and electrical plug loads when not in use
- Change out flickering fluorescent lamps and starters to prevent excessive current draw
- Replace incandescent lights with fluorescent lights whenever possible
- Set and maintain darken ship from taps to reveille
- Secure galley electric ovens immediately after use
- Replace all site / space TVs from CRT / Vacuum tube models to LCD / LED Energy Star versions
- Execute timely phased replacement of rechargeable batteries for battle lanterns and hand held radios

Manage Compressed Air Systems, Potable Water, and Other Ancillary Equipment

- Reduce cycle time of air compressors and address leaks immediately
- Minimize long runs of air hoses to reduce line losses
- Replace defective or leaking compressed air connections
- Use compressed air only where required (i.e., do not use to ventilate spaces)
- Monitor water usage and address leaks immediately
- When feasible, install low flow (1.5 GPM) shower heads and keep in good working order
- When feasible, install spring loaded sink faucets to reduce running water while in use
- Keep faucets in heads and deep sinks in good working order
- Insulate hot and cold water pipes and valves
- Direct crewmembers, embarked personnel, and guests to not waste water when showering (i.e., turn the water off when lathering and shaving)
- In laundry, wash full loads and rinse with cold water
- Run scullery dishwashers with full loads and use the low flow scullery spray nozzle
- Use morning quarters, eight o'clock reports, and zone inspections to stress energy conservation
- Seek assistance and feedback from SEM as needed

Operate Equipment at Maximum Efficiency

- Clean ventilation filters per preventive maintenance schedule
- Clean saltwater strainers regularly
- Monitor water flow and clear heat exchangers regularly
- Ensure space thermostat controllers are fully operational
- Inspect and clean ventilation ducting
- Verify seals on galley ovens are air tight and insulation is adequate
- Aggressively evaluate equipment operating parameters for maximum efficiency
- Isolate and correct grounds in electrical systems immediately

Maintain A/C Boundaries

- Strictly enforce A/C boundaries and mark with signs as necessary
- Shift ventilation fans to slow or off when conditions permit
- Use remote fans to circulate heated or cooled air when possible
- Set thermostat controllers to moderate temperatures

Eliminate Unnecessary Ship Movements

- Avoid shifting berths whenever possible to reduce disconnect and hookup charges
- Avoid last minute changes to ship schedule to prevent utility hookup and disconnect cancellation / change charges

Methods Used to Meter Pierside Utilities

Computerized Utility Billing Integrated Control (CUBIC) System

This system includes meters, electronic communication devices, and data management devices. Electricity will be monitored by meters at each pier berth electric transformer. The consumption measured by these meters will be used to bill (bill is used as a term to determine individual usage) the ship that consumed electricity at the berth. The bill is currently based upon the class of ship, the number of connected power cables, and the ship connection hours as managed by CUBIC. The bill apportions the monthly use to the ship connected to electricity at that berth during the billing month. The total monthly steam and water use is apportioned among the ships connected to that berth during the billing month based upon the class of ship and the ship connection hours. Empirical estimates are used based upon the class of ship and ship connection hours via CUBIC.

Energy efficiency is an integral part of our daily lives, now more than ever. Energy inititiaves and conservation efforts are critical to our commands, our navy, and our planet. All hands support of in port energy management is of the utmost importance.