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TechData Sheet

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Low Cost/No Cost Energy Conservation Opportunities

Funding for energy conservation projects will not likely increase over the next 5 years. Naval activities will, however, still be responsible for their energy consumption reduction goals. In this new environment, energy managers will have to consider low cost energy conservation opportunities (ECO) that can be funded through the activities' operating funds or through their claimant or conservation measures, which require no funding. Changes in operation, modification of design practices and rescheduling of activities are common low cost/no cost (LCNC) ECO's.

The lists below are divided into categories by technology and method. There is also a savings opportunity rating assigned to each to help prioritize your efforts. The rating is based on how much money will be spent, how much time will be invested, and how difficult the ECO is to identify compared to how much energy it can save. They are rated by low (L), medium (M), and high (H). Keep in mind that this is not a complete list of every conceivable low cost or no cost ECO. There is an infinite number of this type of ECO, limited only by the imagination of energy managers. If you have a unique low cost or no cost ECO feel free to contact the NFESC with your idea.

Steam Systems

<u>ECO</u>	<u>Savings Opportunity</u>
Leaks	H
Summer shutdown	M
Condensate Return	M
Traps	M
Insulation	L-M
Boiler Blowdown	M

The potential savings from fixing steam leaks varies considerably based on the size of the leak and the pressure of the system. If an inspection plan is not in place one

should be implemented as soon as possible. Energy managers can segment off parts of the distribution system and inspect them one at a time then submit work requests for repairs in groups.

During the summer when steam use is reduced, evaluate each load and consider options for that steam use. If a building is far from the central plant and uses summer steam only to heat domestic water, consider other options. If the load is relatively small, a natural gas water heater could be more economical.

In large steam distribution systems, it is rare for 100 percent of the condensate to be returned. The piping, reservoirs, traps, and pumps can all be costly to install and maintain. However, it is common to find missed opportunities for increased condensate return that could be realized with a small investment. Often condensate will drain to storm drains or sewers when a tie line to the main return system is nearby. These opportunities can be discovered with little time investment.

The *savings* opportunity is rated medium for steam traps because it is often difficult to determine if a trap is working correctly. There are several common types of traps and each has its own unique inspection method. It is also common for a trap to work well, but be sized incorrectly. When undersized it may cycle too often and fail prematurely and when oversized may not remove the proper amount of condensate, both situations cost money. In any case, there is usually a significant time investment for an active inspection and replacement steam trap program. In some cases it may be more cost effective to group replace all traps every 3 to 5 years. If time allows, it is a good idea to catalog all traps in a system and update it often.

Like traps, insulation should be an ongoing, organized inspection program. There is relatively little time investment involved in inspecting insulation but it can be costly to replace large sections (about \$25 per linear foot for 6-inch pipe), while the thermal savings can be small.

Energy managers should consult with central plant personnel regarding the boiler blowdown procedure. The amount of blowdown should be kept as low as possible. Acceptable percentages of blowdown vary greatly with boiler type and water quality, 2 percent is a good guideline.

Two important elements of an energy program for steam systems are preventative (and or predictive) maintenance and scheduled boiler tune ups. The cost of these excludes them from the list of true Low Cost/No Cost ECO but they should be a part of any energy program.

Domestic Hot Water

<u>ECO</u>	<u>Savings Opportunity</u>
Leaks	L-M
Insulate	L
Reduce Setpoint	M-H
Control	M
Water Conservation	M

As with steam systems, water leaks in domestic hot water (DHW) systems should be fixed before any other conservation measure is considered. Depending on the size of the leak, water leaks can be more costly than heat loss regardless of the cost of water.

The next step in making a DHW system efficient is to insulate where necessary. On older, small (40- to 80-gallon units), there is often insufficient insulation on the tank. Also, all the piping near the tank should be insulated. Although it is occasionally done, insulating pipe throughout the distribution is usually not cost effective, particularly if there is no recirculation loop. A thorough life cycle cost should be done before considering insulating for the entire distribution.

Reducing the water temperature on DHW systems is almost guaranteed to save money and requires little or no investment. With a lower temperature the system will also lose less heat. A system at 180°F will lose twice as much heat as system at 130°F. When there is a demand for a large percentage of the system's capacity in a short period of time, many operators will turn the temperature up to meet demand. At these higher temperatures heat loss will increase as well as energy consumption. Surprisingly, it is often more cost effective to have more than one heater and set them to lower temperatures.

The next step beyond lowering the setpoint is to control the temperature. With an investment of a couple hundred dollars, full programmable control of the heat source is possible. In steam systems a control valve can be used to secure steam, regardless of water temperature when there is no demand. For electric heaters a simple switch can secure power to the coils.

If less water is used, less water will need to be heated. A conservation program should include awareness and low-flow showerheads and faucets.

Lighting

<u>ECO</u>	<u>Savings Opportunity</u>
Compact Fluorescents	M
Switches	M-H
Occupancy Sensors	M

Most Navy bases already have active lighting retrofit programs underway through Federal Energy Management Program (FEMP) and Energy Conservation Investment Program (ECIP) funded projects. There are still opportunities for conservation with lower cost equipment. Compact fluorescent lights, for instance, may not be enough to fund with an FEMP project, but could be implemented with operating funds.

An often overlooked and inexpensive retrofit is to install multiple switches. Often light switches control an entire bank of lights rather than discreet areas. In some cases the only option is to turn on all the lights in a room even when there is enough natural light. A good scheme is to provide switching that allows every other fixture to be on or every other lamp in each fixture to be on. This can be done at relatively little cost but can save a considerable amount of energy in large areas.

At the average cost of occupancy sensors today it would take quite a few to meet the minimum cost requirements for an FEMP project. This is no reason to ignore the savings potential of occupancy sensors. Locations for sensors should be individually chosen rather than installing them in all room types. A good approach is to keep them in stock and then ask occupants to suggest which rooms would be the most appropriate. Refer to ESC's TDS-2027-E&U of May 1996 for details on occupancy sensors.

Heating, Ventilation, and Air Conditioning

Heating, ventilation, and air conditioning (HVAC) equipment consumes 40 to 70 percent of building energy and should be a major concern of all energy managers. There are numerous energy conservation measures within the HVAC realm. All of these can be put into one of three categories:

- Maintenance
- Operations
- Equipment

The most common maintenance ECO follow. Because extensive analysis of these ECO has been done, percent savings figures are available. The figures represent the percent reduction of total energy consumed. The percentages of some of these may seem high, but all are documented cases. HVAC maintenance ECO are:

<u>ECO</u>	<u>Savings Opportunity (%)</u>
Cleaning Coils	5-15
Changing Dirty Air Filters	10-15
Cleaning Fan Blades	5-10
Removing Scale from Condenser Coils	25-30
Adjusting Air/Fuel Ratio on Burner	15
Cleaning Burner Assembly	15
Eliminating Belt Slippage and Poor Alignment on Fan Motors	15-20
Calibration of Conventional Controls	Varies
Repair Duct and Piping Leaks and Insulation	Varies

Operational ECO can also be Low Cost/No Cost. Quantifying savings is difficult to generalize so HVAC operational ECO will use the savings opportunity figure from the previous lists to rank the ECO.

<u>ECO</u>	<u>Savings Opportunity</u>
Thermostat Settings	H
Control Exhaust Fans	M
Reduced Infiltration	M
Outside Air Temperature On/Off Control	M
Insulate Ducts and Fix Leaks	M
Reduce Hours of Operation	L

Controlling thermostat settings can save a significant amount of energy with very little investment of time and money. Winter setpoints should be 70°F and summer setpoints should be 76°F as per OPNAVINST 4100.5D. Lockable covers are inexpensive and can ensure that the setpoint is not adjusted by the occupants. Programmable thermostats have become very inexpensive and can be used to program night setback.

Exhaust fans of all types are often overlooked and run constantly. Timers that are cheap and easy to install can control fans in bathrooms and shops. Consider installing timer fans for fume hoods and paint booths.

Reducing infiltration should be a part of an ongoing program for all buildings. Cracks in walls, old door and window seals, and open doors and windows all contribute to conditioned air loss.

An inexpensive way to ensure that simple heating equipment is secured when it should be is to control by outside air temperature. During the heating season a steam control valve could be tied to an outside air sensor that would secure it when the temperature rose above a given setpoint.

Duct maintenance should be included with infiltration as an ongoing program. Insulating ducts is not always cost effective. Only lengths of duct that run outside or through extreme temperature areas should be considered.

Although not always a popular suggestion, energy managers should at least consider whether or not the hours of occupation of a given building can be modified to conserve energy. For instance, changing shifts to electrical off-peak hours or lower cooling or heating hours. On another level consider energy intensive equipment operational hours. Staggering the startup of large ovens, such as those used for annealing, is easily implemented and can reduce the peak demand in some cases.

Energy managers should become familiar with HVAC system components and proper control of the system. Energy managers should go to buildings with the HVAC mechanic responsible for that building. During a meeting at the building, the mechanic and energy manager should discuss possible energy conservation ideas, such as: shutting down unoccupied equipment and resetting hot water supply temperatures. Energy conservation measures taken without the agreement of the HVAC mechanic will not succeed. The meeting should include existing problems and suggestions to make the system operate more efficiently, without more complexity in the controls.

Additional maintenance issues such as disabled time clocks, open inlet guide vanes (IGV), and hot water reset not working should also be considered. Repairing the timeclock to proper scheduling requires testing all of the controls to ensure the building will be up to (or down to) proper temperature at the occupancy time. Digital, battery backed, timeclocks should always be used to avoid problems with power outages. Repair of IGV in variable air volume systems must include ensuring that the duct static pressure control is working properly and all zones receive adequate air flow. Proper reset of the hot water temperature should be based on outside air temperature. When reinstalling the hot water reset, verify that the hot water supply and outside air temperature sensors are calibrated.

Chillers

Because chillers are such large energy consumers, we will examine their ECO separately. The same categories that were applied to the HVAC ECO are used here: maintenance, operations, and equipment.

Chiller operation and maintenance involves many parameters that must be considered together. Fine tuning and changing procedures is best left to the experienced operator or mechanic. An energy manager should confer with HVAC personnel to ensure the most energy efficient operation of chillers and auxiliary equipment, but decisions to modify operation should only be made by experienced mechanics and operators.

The most common chiller maintenance ECO follow.

<u>ECO</u>	<u>Savings Opportunity</u>
Maintain Proper Refrigerant Level	M
Fix Refrigerant and Air Leaks	M
Prevent Tube Fouling (Water Treatment)	L

The wrong refrigerant levels can increase head pressure and decrease the evaporator temperature -- both can increase energy consumption. Consider that for each °F the evaporator temperature can be raised, the energy consumption will be reduced by 1.5 percent, at full load. A regularly scheduled inspection of refrigerant level should be part of any chiller maintenance program. An inspection log helps ensure that the inspections are performed regularly.

In low pressure systems, air leaks will create excess air in the condenser. This air will displace refrigerant vapor and increase condenser pressure. An overall system inspection for air and refrigerant leaks should be included in the maintenance plan.

Condenser tube fouling degrades heat transfer efficiency, which increases head pressure and the load on the compressor. An inexpensive method of reducing tube fouling, and energy waste, is to ensure that water treatment equipment is operating correctly.

Chiller operational ECO are:

<u>ECO</u>	<u>Savings Opportunity</u>
Raise Chilled Water Temperature	0.5-0.75/degree*
Lower Entering Condenser Water Temperature	1.5/degree
Demand Limiting	H
Optimize Chiller Sequence	H
Maintain Condenser Water Flow Rate	M
Pump Sequencing	L

* At 40-80% load

During times of decreased cooling load, cooling coils can deliver the required cooling load at higher chilled water temperatures. Energy managers should discuss the possibility of raising the chilled water setpoint with HVAC mechanics. If the setpoint is raised it will have to be lowered for full load conditions so it is best to automate the setpoint adjusting process.

Raising the chilled water temperature is only recommended for chillers operating above 40 percent, unless they are equipped with variable speed drives (VSD). Studies have shown that constant speed chillers, loaded under 40 percent, actually consume more energy when the chilled water temperature is raised. On centrifugal chillers, equipped with

a VSD, energy can be reduced by 2 to 3 percent per degree of raised water temperature. This is true when the chiller is loaded at 80 percent to as low as 10 percent.

Lowering the condenser water temperature lowers the refrigerant condensing pressure and, thus, the load on the compressor. There is not a large range of acceptable condenser water temperatures for a given chiller so caution must be used when attempting this adjustment. A good rule of thumb to use when considering this ECO is to compare the difference between the entering condenser water temperature and the water temperature leaving the cooling tower. If the entering condenser water temperature is more than 2°F higher than the cooling tower temperature there may be room for improvement.

Many chillers come equipped with demand limiters, either manual or automatic. They can reduce the startup current by as much as 60 percent. In the case of large chillers, the demand spike associated with chiller startup can coincide with the monthly peak demand billed by utility companies. Startup of large chillers can cause current spikes that last up to 8 minutes. Although the possibility of this contributing to the monthly peak is unlikely if the demand limiting equipment is available it should be used.

As the cooling load varies the percent load on chillers will vary. In general most chiller's efficiency drops off sharply below 40-percent load. If there are multiple chillers, consider the sequence of operation when the load is reduced. Two chillers operating at a 20-percent load will consume more energy than one chiller operating at a 40-percent load. These rules are true for constant speed chillers. But chillers equipped with VSD can maintain relatively high efficiencies at loadings as low as 10 percent.

A 20-percent reduction from the condenser water design flow rate can increase energy consumption by 3 percent. Reduced flow is usually caused by partially closed valves or corroded and partially blocked tubes. This situation can sometimes be remedied by adjusting the discharge valve on the condenser pump. Adjusting the flow rate of condenser water should only be performed by experienced chiller plant personnel. The best solution to decrease condenser water flow rate is to treat the water and clean the tubes as soon as they become obstructed.

When a chiller is idle, condenser pumps should not be pumping water. This situation is easily addressed by installing automatic shut-off valves to prevent flow through idle chillers. This particular ECO should be approached with caution since any modifications to the pumping system can affect the chiller's overall performance.

Chiller equipment ECO are:

<u>ECO</u>	<u>Savings Opportunity</u>
Interconnect Systems	L
Monitoring	L

If a building is being serviced by more than one chiller plant, consider interconnecting the two systems. Often the load on a chiller can be changed to a level at which it will operate more efficiently. This is included as a Low Cost/No Cost ECO for those cases where a small piping retrofit could interconnect the systems.

To maximize chiller performance, monitoring and automated controls are helpful. While automated controls can be expensive, the minimum amount of monitoring needed for improved manual control is relatively inexpensive. Only monitor the critical parameters and use the data to keep chiller loads where the efficiency will be the highest.

For more information, NFESC Code ESC24 offers full service metering expertise. Contact *Bill Pierce* at (805) 982-3595, DSN 551-3595, or Internet: wpierce@nfesc.navy.mil.

For more information, Code ESC23 offers expertise in Direct Digital Control (DDC) of all HVAC equipment. Contact *Glen Sittel* at (805) 982-3533, DSN 551-3533, or Internet: gsittel@nfesc.navy.mil.

Each category of ECO listed here should be part of its own system energy program. Equipment inventory, regularly scheduled inspections, and equipment status updates are key components in making these programs successful. Low Cost/No Cost ECOs can help achieve mandated energy reduction goals when they are part of a responsible dynamic program.

As an example, Table 1 was put together by the PWC Norfolk audit team and lists the low cost ECOs they identified in the Norfolk area.

Table 1. NAS Norfolk Global Low Cost Energy Conservation Opportunities

Energy Conservation Opportunity	Quantity
Install low-flow shower heads and faucet aerators	320
Locate and repair steam leaks	1500
Test and repair control sensors	19 bldgs
Replace leaking or non functioning steam traps	---
Repair thermally critical building penetrations	---
Maintain building envelope insulation	---
Caulk door and window frames	---
Replace damaged door and window weather stripping	---
Laser align direct coupled motors and equipment	167
Repair leaking ductwork	2033
Repair water weaks	---
Fix compressed air leaks	312
Install energy efficient V-belts	1225
Ensure broken belts are replaced	50
Clean HVAC equipment coils in AHU	1062
Replace filters in AHU	1062
Clean fouled cooling towers	29
Clean hot water heat exchangers	9
Replace and repair missing or damaged piping insulation	---
Repair external lighting sensors	43
Maintain time clocks	---
Connect and repair actuators on HVAC systems	---

*SIR = Savings to Investment Ratio

Below is an ECO list prepared by the Davis group for Atlantic Division, NAVFAC. Some of the ECOs may not be cost effective at all utility rates.

A. Lighting

1. Secure lights in sunlit foyers, halls, and passageways during daylight hours
2. Secure lights in unoccupied spaces during day, such as storage rooms
3. Secure lights in unoccupied spaces over night and on weekends
4. Secure lights in spaces that are vacated for more than 15 minutes
5. Delamp
6. Remove egg crate diffusers
7. Ensure proper sequencing of lighting by custodial services and stockers
8. Establish and color code security light switches or breakers
9. Check and clean photoelectric cells
10. Reduce lighting watts in living spaces
11. Clean lamps
12. Clean lens
13. Remove lens and attach safety wire
14. Replace defective lamps
15. Clean windows that provide natural light
16. Recircuit lighting systems with separate switches for
 - a. Security lights
 - b. Small or large areas with respect to personnel, such as classrooms, office bays, shop spaces
 - c. Separate circuit for lights near windows
 - d. Area control light (about \$50)
 - e. Variable intensities
17. Install spot lighting
18. Provide moveable high intensity lighting
19. Install limiting timers
20. Install night timers
21. Install photoelectric control for foyers, docks, and hangar bays
22. Install photoelectric control for external lights
23. Lower lighting height
24. Improve room reflectivity with light surfaces
25. Install light reflectors after careful analysis of net benefit
26. Install ellipsoidal reflector floodlights
27. Install efficient fluorescent
28. Install maximizer ballasts when originals fail
29. De-energize ballasts of delamped fixtures
30. Install socket compatible fluorescent lighting
31. Replace incandescent with fluorescent lights
32. Replace high bay lights with HP sodium lights
33. Install 18-watt LP sodium lighting for 24-hour security
34. Replace exterior lights with HP sodium lighting

B. Domestic Hot Water

1. Secure hot water during the summer
2. Secure excessive hot water tanks
3. Set washroom water temperature at 105°F
4. Set shower water temperature to lowest setting that will provide needed amounts of hot water, 125 to 140°F
5. Set domestic hot water pressure to 25 psi
6. Repair water leaks
7. Repair steam leaks
8. Flush domestic hot water tanks
9. Install reducers in shower heads
10. Install automatic shutoff valves for faucets
11. Install small area domestic hot water heaters to secure steam service during mild weather
12. Install hot water boosters in kitchens and medical facilities
13. Heat pump water heater

C. Thermostats

1. Establish normal winter temperature - 70°F
2. Establish normal summer temperature - 76°F
3. Set thermostat at 50 to 55°F over night and on weekends during the winter
4. Set thermostat to off over night and on weekends during the summer
5. Where outside controls are available set so that air conditioning is secured when outside ambient falls below 55 to 60°F
6. Where outside controls are available set so that heating is secured when outside ambient rises above 55 to 60°F
7. Check and calibrate thermostats
8. Check and properly set mechanical and digital clock thermostats
9. Bleed water from pneumatic control systems
10. Provide digital outside thermostats to control ventilation equipment and dampers
11. Provide digital outside thermostats to control air conditioning equipment
12. Provide digital outside thermostats to control heating equipment
13. Check interior spaces for proper zoning and placement of thermostats

D. Ventilation

1. Secure ventilation during summer and mild weather when space is unoccupied
2. Reduce ventilation requirements to a minimum
3. Reduce outside air early on cold mornings
4. Reduce outside air toward end of normal working day during hot weather
5. Close off ventilation where infiltration is high
6. Use outside air for cooling during mild weather and at night

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7. Secure unnecessary exhaust fans
 8. Provide unrestricted delivery/return of HVAC outputs by unblocking registers and air coil units
 9. Replace filters
 10. Repair leaks in duct work
 11. Replace loose insulation
 12. Clean duct work
 13. Ensure that damper linkages and modulating motors are working properly
 14. Repair manual or automatic controls on natural ventilation systems
 15. Install window screens to allow for natural ventilation
 16. Install wall and door grills to facilitate natural ventilation
 17. Install passive exhaust units in attics, with blanks for securing during cold weather
 18. Install timers on exhaust fans (About \$30 - \$400)
 19. Install controls for industrial process ventilation

E. Air Conditioning

1. Secure air conditioning during unoccupied periods (unless required for equipment)
2. Secure air conditioning during no heat/cool periods
3. Secure registers supplying foyers, passageways, stairs
4. Raise chill water temperature from 40s to low 50s °F
5. Establish no cool periods/building
6. Check refrigerant pressures and add if necessary
7. Check for short cycling and increase thermostat differential if required
8. Check for proper unloading of valves in staged reciprocating systems
9. Clean air registers
10. Clean condenser coils
11. Clean water towers
12. Ensure that cooling tower fan controls operate correctly
13. Ensure that chemical treatment system is functioning correctly
14. Clean evaporator coils
15. Straighten fins on coils
16. Ensure proper operation of chilled water and cooling water pumps
17. Recalibrate measuring and control instruments
18. Repair torn, missing, or wet insulation
19. Remove fan coil units from foyers, passageways, and stairways
20. Remove and relocate window units with condensers presently exhausting into interior spaces
21. Provide window units to watch spaces of buildings with central systems that can be secured when not normally occupied
22. Provide residential units to spaces that need special cooling so that the rest of a building with a central system can be secured when not normally occupied

23. Vent waste heat to the outside
24. Use dehumidifiers in spaces that require humidity control rather than use the central air conditioning system
25. Caulk and weatherstrip around window units
26. Install ceiling fans
27. Shade south facing walls with trees
28. Paint south and west walls a light color
29. Install chemical treatment for hydronic systems

F. Heating

1. Secure heating during unoccupied periods of mild weather
 2. Secure heating during no heat/cool periods
 3. Reduce heating during unoccupied periods (to a level that will not freeze pipes)
 4. Secure registers and radiators supplying foyers, passageways, stairs
 5. Secure secondary hot water pumps to air handling units during mild weather
 6. Secure steam lines where possible during the cooling season
 7. Check and secure inoperable economizers
 8. Establish no heat periods in the building
 9. Shut off steam to piping during summer months
 10. Ensure valves are functioning properly
 11. Repair inside and outside steam leaks
 12. Repair inside and outside hot water leaks
 13. Ensure that automatic valves operate satisfactorily
 14. Check firing rates of furnaces and boilers and adjust
 15. Clean or replace burner assemblies
 16. Remove scale from fire side surfaces
 17. Remove scale from water side surfaces
 18. Ensure that chemical treatment system is operating
 19. Recalibrate instruments
 20. Recalibrate and tune level controller on continuous blowdown tank
 21. Execute steam trap program
 22. Decrease central steam pressure to minimum allowable
 23. Remove radiators from foyers, passageways, and stairways
 24. Hood window units during heating season
 25. Provide heat pumps and resistance heating to watch spaces of buildings with central systems that can be secured when not normally occupied
 26. Install temperature regulating valves
 27. Insulate exposed steam lines
 28. Install chemical treatment for hydronic systems
 29. Install spot infrared heating
 30. Install performance systems for central boilers such as oxygen analysis and automatic trim
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G. Equipment

1. Secure equipment when not required:
 - a. Motor generating sets
 - b. Air compressors
 - c. Conveyors
 - d. Work fans
2. Secure office equipment when not required:
 - a. PC terminals
 - b. Typewriters
 - c. Copiers
3. Secure appliances when not required:
 - a. Coffee machines
 - b. Refrigerators
 - c. Hot plates
4. Remove large refrigerators
5. Check and repair compressed air system leaks
6. Purge water from compressed air tanks
7. Replace air filters on compressors with air inlet filters
8. Incorporate load limiters on motor driven equipment
9. Cover open heat generating processes when not in use
10. Cover open cold and frozen food service areas
11. Inspect variable speed drives for motors
12. Replace old motor with newer, more efficient motors
13. Match motor size to its load
14. Install dehumidifiers with airtight gaskets on air compressor systems (about \$500)
15. Install inlet air filters on air compressors (about \$500)

16. Install reefer compressor/condenser units outside or provide adequate outside ventilation to the spaces
17. Install barriers to open chilled display cases:
 - a. Transparent barriers for vertical entry
 - b. Covers for horizontal units after hours

H. Miscellaneous

1. Use blinds, shades, and drapes
2. Shift operations to off peak times
3. Shave peak demand using standby generating capacity
4. Repair broken windows and window hardware
5. Repair screens
6. Remove paint from windows that could provide natural light
7. Rehang crooked doors
8. Caulk and weatherstrip windows and doors
9. Install solar window film
10. Provide positive closure of windows and doors
11. Reduce window area
12. Insulate walls of corner rooms
13. Insulate walls of perimeter
14. Install double glazed windows in corner rooms
15. Install air curtains
16. Keep mechanical rooms clean
17. Do not use mechanical rooms for storage
18. Keep energy related equipment (using or distribution) clean

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