



UNITED STATES MARINE CORPS
MARINE CORPS BASE
MARINE CORPS COMBAT DEVELOPMENT COMMAND
QUANTICO, VIRGINIA 22134-5000

MCBO 4100.1A
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27 May 97

MARINE CORPS BASE ORDER 4100.1A

From: Commanding General
To: Distribution List

Subj: ENERGY AND WATER CONSERVATION PROGRAM

Ref: (a) MCO P11000.9C
(b) Executive Order 12759 (NOTAL)
(c) Executive Order 12902 (NOTAL)
(d) OPNAVINST 4100.5D
(e) Energy Policy Act of 1992 (NOTAL)
(f) ASHRAE/IES Standard 90.1-1989 (10 CFR 435) (NOTAL)
(g) MIL-HDBK-1190
(h) DOD 4270.1-M (NOTAL)
(i) Navy Utilities Policy Letter UPL-94-001 (NOTAL)
(j) Chesapeake Div A/E Guide, Section 3.8-11;
Revision April 1990 (NOTAL)
(k) 10 CFR 436 (NOTAL)
(l) OMB Policy Letter 92-4 (NOTAL)
(m) MCBO 11000.1

Encl: (1) Goals and Objectives for the Energy and
Water Conservation Program
(2) Life-Cycle Costing (LCC) Tools
(3) Energy and Water Conservation Design Guidelines Summary
(4) Energy and Water Conservation Coordinators
(5) Utilities Conservation and Appraisal Board (UCAB)

1. Purpose. To establish goals and policies and to assign responsibilities for the management of the Energy and Water Conservation Program at MCB, Quantico, per the references and enclosures.

2. Cancellation. MCBO 4100.1.

3. Applicability. This Order is to be instituted by all MCB, Quantico area commanders that use utilities provided by the Base and are involved, directly or by contract, in the construction, operation and maintenance of facilities.

4. Summary of Revision. This revision contains a substantial number of changes and should be completely reviewed.

5. Background. The President and Congress require that all Federal organizations meet energy and water conservation mandates.

Improving the energy and water efficiency of our facilities and equipment will have significant savings to MCB, Quantico in cost avoidance, environmental conservation, energy security, and enhanced operational capabilities.

6. Policy. It is the policy of the CG MCB to support and implement the energy and water conservation mandates, goals, and policies as directed by the President, Congress, HQMC, and the Navy. Efforts will be made to reduce the consumption of energy and water by following the policies of this Order. Significant reductions in consumption can be made without impinging on operational readiness or the comfort of personnel. This can be accomplished by ensuring the maximum efficient use of all energy and water resources.

7. Goals and Objectives. The goals and objectives for the Energy and Water Conservation Program at MCB, Quantico are identified in enclosure (1).

8. Action. Through the institutionalization of more efficient methods of energy and water utilization, all area commanders of MCB, Quantico will work to ensure that the Base meets its conservation goals. All area commanders at MCB, Quantico are responsible for implementing, within their authority and capability, the objectives described in enclosure (1), paragraph 2 and to reach the goals described in enclosure (1), paragraph 1. Tools to be used in performing life-cycle cost (LCC) analysis are listed in enclosure (2). Conservation design guidance is summarized in enclosure (3). Specific tasks for individual organizations are assigned as follows.

a. Director, Facilities Division

(1) Head, Bachelor Housins Branch and Head, Family Housing Branch, Facilities Division

(a) Coordinate all energy and water conservation projects with the Head, Maintenance Branch, Facilities Division.

(b) Ensure that the energy and water conservation guidance and efficiency standards of this Order, and its references and enclosures, are followed by Housing employees and tenants.

(c) In coordination with the Head, Maintenance Branch, Facilities Division, distribute energy and water conservation awareness materials to occupants of MCB, Quantico quarters.

(2) Head, Maintenance Branch, Facilities Division

(a) Manage the Base Energy and Water Conservation Program under the guidance and direction of higher authority. Provide support to Base area commanders to help them accomplish the goals of this Order through a coordinated conservation program.

(b) In coordination with HQMC and Base area commanders, develop energy and water conservation studies and projects. Solicit

funding from HQMC and other sources. Provide project documentation to the Head, Public Works, Facilities Division or other contracting authority for implementation.

(c) Ensure that applicable energy and water conservation objectives and efficiency standards of this Order, and its references and enclosures, are a factor in the maintenance, repair, and replacement of facilities and equipment at MCB, Quantico. The project specifications of all projects constructed at MCB, Quantico are to reflect the energy and water objectives and standards of this Order, including its references and enclosures. The design of new Federal buildings, and the application of energy and water conservation measures to existing Federal buildings, shall be made using lowest LCC methods vice the lowest initial cost.

(d) Periodically update this Order and its enclosures.

(e) Track Base energy and water consumption and costs. As discussed in reference (a), paragraph 2202, send Defense Utility and Energy Reporting System (DUERS) energy, water, and square footage data to the Naval Facilities Engineering Support Center each month by modem.

(f) Review window air-conditioning requests. Verify that spaces are authorized cooling. Verify BTU size of units and ensure that building electrical service will not be overloaded. Ensure that window air-conditioning is LCC effective in comparison to central air-conditioning.

(g) Review all projects provided by the Head, Public Works Division, and other divisions and tenants for their effect on Base energy and water consumption and costs.

(h) Develop an agenda and coordinate events for the annual Department of the Navy Energy Awareness Week.

(i) As discussed in enclosure (4), develop an Activity Energy and Water Conservation Coordinators Program. Maintain a list of energy and water coordinators and instruct new coordinators in their duties.

(j) As discussed in reference (a) and enclosure (5), provide technical advice and support to the Utilities Conservation and Appraisal Board.

(k) Work with utility providers to obtain their assistance in reducing energy and water consumption and costs aboard MCB, Quantico.

(l) Maintain all the inspection and maintenance records required of Maintenance Branch by this Order in a central computer database for easy review.

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(m) See enclosure (1) for additional guidance that applies to Maintenance Branch functions.

(3) Head, Public Works Branch, Facilities Division

(a) Ensure that the project specifications of all projects constructed at MCB, Quantico reflect the energy and water objectives and standards of this Order, including its references and enclosures. Many of the design standards are summarized for convenience in enclosure (3). Per reference (b), Title 1, Subtitle A, all new building projects must meet or exceed the energy standards of reference (c) or risk losing Congressional funding. References (d) and (e) contain additional guidance in selecting energy and water conservation alternatives.

(b) As discussed in references (a), (b), (d), (f), (g), (h), (i), and (j), the design of new Federal buildings, and the application of energy and water conservation measures to existing Federal buildings, shall be made using LCC methods vice the lowest initial cost. The Head, Maintenance Branch, Facilities Division is to be contacted for current utility rates to use in LCC analyses. Electric costs must differentiate between demand and consumption and accurately reflect the actual cost of electricity to MCB, Quantico. Life-cycle costing is per the requirements of reference (k). See enclosure (2) for a list of LCC tools to be used in performing LCC analyses.

(c) As an aid in accomplishing our mandate to complete all energy and water conservation projects with an economic payback of 10 years or less, all new building and renovation projects are to incorporate any energy and water conservation measures that fall within the 10 year economic payback period and are within the project scope.

(d) As an aid in reducing peak electric demand, projects that install electric central air-conditioning over 100 tons must have water-cooled condensers, unless proven LCC ineffective. Electric chiller systems must utilize centrifugal or screw compressors, when feasible. Alternatives to standard electric cooling must be evaluated when adding or replacing cooling systems. Small district cooling plants, thermal storage, geothermal heat pumps, natural gas engine-driven chillers and indirect- or direct-fired absorption chillers must be analyzed for viability during the design process as a way to reduce peak electric demand. Selection of air-conditioning system types for economic comparison is to be coordinated with the Head, Maintenance Branch, Facilities Division. See enclosure (1) of this Order for additional air-conditioning guidance.

(e) Utilize building spaces efficiently. Evaluate the consolidation of functions at MCB, Quantico with an eye towards reducing the number of buildings that require utility services. Ensure that unoccupied (abandoned) buildings have their utilities secured.

(f) New substantial nonresidential buildings and existing buildings undergoing major heating, ventilation and air conditioning renovations are to incorporate Direct Digital Control (DDC) for the monitoring and control of their heating, ventilation, and air conditioning (HVAC) systems. The DDC systems must be designed according to the latest Naval Facilities Guide Specification (NFGS) 15972 and have full hardware and software compatibility with the existing centrally accessible and controllable Base DDC system.

(g) Submit all construction projects at MCB, Quantico that have any affect on utilities consumption and costs to the Head, Maintenance Branch, Facilities Division for review.

(4) Head, Support Branch, Facilities Division

(a) Provide a monthly vehicle report that includes the number of vehicles in operation by energy type, energy consumption by energy type, and miles driven by energy type to the Head, Maintenance Branch, Facilities Division.

(b) Develop policies and projects to ensure that energy and water conservation are factors in the operations, maintenance, and washing of motor vehicles.

(c) Coordinate vehicle conservation programs and the introduction of nonpetroleum fueled vehicles to the Base with HQMC and the Head, Maintenance Branch, Facilities Division. Government vehicle petroleum consumption is to be reduced through the purchase and utilization of alternate fuel vehicles and more fuel efficient gasoline vehicles. As discussed in reference (b), the purchase of nonpetroleum new vehicles by each motor fleet are to be 25 percent in FY 1996, 33 percent in FY 1997, 50 percent in FY 1998, and 75 percent in FY 1999 and thereafter. Prudent usage of vehicles is essential to reducing our dependence on foreign-supplied oil.

b. Director, Logistics Division

(1) Provide a monthly heating-oil delivery report to the Head, Maintenance Branch, Facilities Division, for the monthly DUERS report required by reference (a), paragraph 2202.

(2) Reference (1) establishes policies regarding the acquisition of energy efficient goods and services that were outlined in reference (f). Procurement of major energy and water consuming goods and services must be based on the LCC in comparing similar models and not the lowest initial cost. As discussed in reference (1), when requested, vendors must provide appropriate data that can be used to assess the LCC of each product. Ensure that all energy and water consuming equipment selected for LCC analysis meets the minimum efficiency standards of this Order and its references and enclosures. See enclosure (1) for additional requirements of specialized equipment. For equipment that is not specifically covered by this Order and its references and enclosures, ensure that

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its energy or water cost is no more than 10 percent higher than that of the most efficient comparable model on the Department of Energy (DOE) "EnergyGuide" product label. Equipment not specifically covered by this Order or included in the DOE EnergyGuide label program is exempted from prescribed minimum energy and water standards and should be selected solely on the basis of life-cycle cost analyses. All LCC analyses are to be submitted to the Head, Maintenance Branch, Facilities Division for review. Current energy and water utility costs for use in life-cycle costing are to be obtained from the Head, Maintenance Branch. See enclosure (2) for a listing of life-cycle costing tools.

(3) Have all requests for "authorization for purchase and installation" of new and replacement window air-conditioners and portable heat pumps approved by the Head, Maintenance Branch, Facilities Division before purchase per reference (m). All new window units must exceed the energy efficiency ratio requirements of reference (c) and the latest pertinent NFGS.

(4) Ensure that Self-Service Store Issue Point 01 and Shop Stores Issue Point 60 stock energy and water efficient products. Use this Order, including its references and enclosures, and contact the Head, Maintenance Branch, Facilities Division for aid in developing an inventory of conservation oriented products.

c. Director, Operations Division. Broadcast conservation messages and tapes on the Quantico cable television station. Assist the Head, Maintenance Branch, Facilities Division, in the preparation of awareness posters, brochures, and other materials as required.

d. Public Affairs Officer. Publish energy and water conservation awareness articles in the Quantico Sentry on a regular basis. Coordinate publication of articles with the Head, Maintenance Branch, Facilities Division.

e. Inspector. Include energy and water conservation as a specific item to be examined during Base inspections.

f. Activity Heads

(1) As discussed in enclosure (4), submit an appointment letter to the Head, Maintenance Branch, Facilities Division, that provides the name, title, location, and phone number of the Energy and Water Conservation Coordinator for your organization.

(2) As discussed in enclosure (5), attend meetings of the Utilities Conservation and Appraisal Board (UCAB) as directed.

(3) Develop a 5-year energy and water conservation plan that includes policies, projects, and personnel training for your organization that will help HQMC and MCB, Quantico meet conservation mandates. Submit plans to the Head, Maintenance Branch, Facilities

Division, within 180 days of the date of this Order for compilation into a 5-year Base conservation master plan. Update your organizational plan annually.



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Chief of Staff

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(6) Domestic water heating equipment of more than 100 gallon capacity should be inspected at least annually for defects in operation and insulation.

(7) Per OPNAVINST 4100.5D and NAVFACINST 11300.37A, paragraph 3140, maintenance personnel are to check the combustion efficiency of all boilers that are continuously manned at least every 8 hours. All other boilers of 350,000 BTU/HR input capacity or greater shall be checked at least monthly. Monitor the energy and water consumption of all boilers of 350,000 BTU/HR input capacity or greater with flow meters.

(8) As discussed in MCO P11000.9, Executive Orders 12759, 12845, and 12902, OPNAVINST 4100.5D, the EPACT of 1992, OMB Policy Letter 92-4, MCBO 11000.1, and MIL-HDBK-1190, select domestic water heating equipment based on the lowest LCC obtained in comparing at least three different types of systems; one of which must be the connection to a district heating system, when such a connection is feasible. Incremental energy and environmental costs must be used to determine the actual gas, oil, and/or electric costs to the government of the new heating equipment. Selection of systems for comparison is to be coordinated with the Head, Maintenance Branch, Facilities Division. The latest energy rates for use in LCC analyses are to be obtained from the Head, Maintenance Branch, Facilities Division. Once the new heating system type is selected, ensure that the system specified for purchase has the highest standard energy efficiency rating that is available for a system of that type from three manufacturers. These ratings must exceed the minimum standards of ASHRAE/IES Standard 90.1-1989 and the latest pertinent NFGS.

(9) See enclosure (3) for additional guidance in selecting plumbing equipment.

f. Lighting. Develop projects and policies to reduce base energy consumption and costs due to lighting.

(1) Keep unneeded indoor and outdoor lights off. Use appropriately calibrated timers and sensors where helpful. Work requests are to be submitted to the appropriate maintenance personnel to have timers and sensors adjusted when they cannot be locally adjusted for proper operation. Maintenance personnel are to respond to written notification of timer and sensor problems within 2 working days of receiving such notification.

(2) Per MCO P11000.9C, paragraph 4303; OPNAVINST 4100.5D; and NAVFACINST 11300.3714, paragraph 7004, work station lighting shall not exceed 50 foot-candles, work area lighting shall not exceed 30 foot-candles, and **nonwork** area lighting shall not exceed 10 foot-candles. Indoor and outdoor lighting systems are to be designed per ASHRAE/IES Standard 90.1-1989 and the latest pertinent NFGS.

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b. Reduce energy consumption per gross square foot by 30 percent by the end of FY 2005.

c. Perform energy and water efficiency audits of all facilities; a minimum of 10 percent of Base facilities a year for 10 years.

d. Complete all energy and water conservation measures with an economic payback of 10 years or less by 1 January 2005.

e. Improve equipment and utility distribution system efficiency and reliability by performing cost effective scheduled preventive maintenance.

f. Reduce facility petroleum consumption.

g. Include energy-efficiency improvements in repair projects.

h. Ensure that conservation-conscious maintenance is performed with energy and water efficient replacement components.

i. Ensure that personnel who design, install, operate, and maintain energy and water consuming systems are properly trained.

j. Ensure that energy and water efficiency and fuel flexibility are incorporated in the design and acquisition of new facilities and equipment. The acquisition of major energy consuming equipment is to be done based on LCC. See paragraph 2a, for further guidance on LCC. See enclosure (2) for a list of LCC analysis tools.

2. Objectives. All area commanders at MCB, Quantico are responsible for implementing, within their authority and capability, the objectives described here to meet the goals described above:

a. Purchasing. Develop policies to ensure that only energy and water efficient appliances and equipment are purchased and/or installed.

(1) OMB Policy Letter 92-4 establishes policies regarding the acquisition of energy efficient goods and services that were outlined in Executive Order 12759. Procurement of major energy and water consuming goods and services must be based on the LCC in comparing similar models and not the lowest initial cost. As discussed in OMB Policy Letter 92-4, when requested, vendors must provide appropriate data that can be used to assess the LCC of each product. Ensure that all energy and water consuming equipment selected for LCC analysis meets the minimum efficiency standards of this Order and its references and enclosures. See this enclosure for additional requirements of air-conditioning, space heating, and domestic water heating equipment. For equipment that is not specifically covered by

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this Order and its references and enclosures, ensure that its energy or water cost is no more than 10 percent higher than that of the most efficient comparable model on the Department of Energy (DOE) "EnergyGuide" product label. Equipment not specifically covered by this Order or included in the DOE EnergyGuide label program is exempted from prescribed minimum energy and water standards and should be selected solely on the basis of life-cycle cost analyses. All LCC analyses are to be submitted to the Head, Maintenance Branch, Facilities Division, for review. Current energy and water utility costs for use in LCC are to be obtained from the Head, Maintenance Branch, Facilities Division. See enclosure (2) for a listing of LCC tools.

(2) Executive Order 12845 requires that all computers, monitors, and printers meet Environmental Protection Agency "Energy Star" requirements for energy efficiency and low-power standby. Exemptions are allowed on a case-by-case basis for specialized equipment. In addition, all purchased copiers, typewriters, and other office equipment are to employ similar energy saving techniques as they are made available.

b. Air-Conditioning. Develop projects and policies to reduce base energy consumption and costs due to air-conditioning (see MCO P11000.9C, paragraphs 4206 and 4404).

(1) Only authorized maintenance personnel are to adjust building space temperature settings. Occupants of quarters should be allowed to adjust their own temperatures. Work requests should be submitted to the appropriate maintenance organization to have temperatures adjusted. Maintenance personnel are to respond to written notification of space temperature problems within 2 working days of receiving such notification. Occupied administrative-type spaces and spaces with temperature sensitive equipment or processes are to be cooled to no lower than 76°F (24.4°C) during summer months. Warehouse, maintenance bay, and hangar-type spaces are not authorized cooling.

(2) Remote monitoring and control of workspace temperatures is to be provided for through direct digital control (DDC) when feasible. Except in special use areas, these systems are to be configured to turn off air-conditioning systems or raise the indoor temperature setpoints to a minimum of 84°F (28.9°C) when spaces are unoccupied.

(3) To lower peak electric demand charges caused by air-conditioning, avoid nonessential electrical consumption daily from 1200-1700 during June through September. Turn off computer equipment, copiers, typewriters, lights, etc., when not in use. As discussed in MCO P11000.9C, paragraph 2301, when feasible, all major electrical equipment, including building cooling systems, are to be controlled by an account-wide electric peak demand reduction system.

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Remotely controllable indoor temperature set-points are to be raised a minimum of 2°F (1.1°C) during peak demand periods.

(4) Ensure that all chilled water piping insulation exceeds the minimum insulation thickness standards of reference (f) and the latest pertinent NFGS.

(5) Perform preventive maintenance on all air-conditioning equipment as recommended by NAVFAC and GSA guidance.

(6) Effective water treatment of open condenser systems shall be maintained.

(7) Consider the replacement of window air-conditioners (WAC) and portable heat pumps with central air-conditioning systems, when LCC effective.

(8) Consolidate multiple central air-conditioning units within a facility into one unit, when applicable (see paragraph 2b(10) below) and LCC effective.

(9) All requests for "authorization for purchase and installation" of new and replacement WAC's must be submitted to the Head, Maintenance Branch, Facilities Division, for approval before purchase per MCBO P11000.1. Requestors must submit a description of why air-conditioning is needed, what has been done to obtain central air-conditioning (if applicable), what energy conservation initiatives have been undertaken recently by the organization, a drawing of the proposed location(s) of the WAC's that includes: a building floor-plan (showing doors and windows) with building and room dimensions (height, width and depth), the proposed WAC's size in BTU's, voltage, and current ratings of the proposed unit(s) and the location(s) and size(s) of all other window and central air-conditioning units (if any) that are in the building. All new WAC's must exceed the energy efficiency ratio requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)/Illumination Engineering Society (IES) Standard 90.1-1989 and the latest pertinent NFGS.

(10) Special use areas within buildings, such as computer rooms, kitchens, and night watch areas should have cooling systems that operate independently from the main building cooling systems, when LCC effective.

(11) Electric air-conditioning over 100 tons will have water-cooled condensers, unless proven to have a poor LCC in comparison to other systems.

(12) Electric air-conditioning will utilize centrifugal or screw compressors when feasible.

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(13) As discussed in MCO P11000.9, Executive Orders 12759, 12845, and 12902, OPNAVINST 4100.5D, the Environmental Protection Act (EPACT) of 1992, OMB Policy Letter 92-4, MCBO 11000.1, and MIL-HDBK-1190, select new air-conditioning equipment based on the lowest LCC obtained in comparing at least three different types of systems; one of which must be the connection to a district energy system, when such a connection is feasible. If such a connection is not feasible, direct-fired and engine-driven chillers are to be examined where natural gas can be made available. Alternative types of air-conditioning that will reduce electric peak demand; i.e., small district systems, thermal storage, geothermal heat pumps are to also be considered. Selection of air-conditioning system types for economic comparison is to be coordinated with the Head, Maintenance Branch, Facilities Division. The latest energy rates for use in LCC analyses are to be obtained from the Head, Maintenance Branch, Facilities Division, for use in determining the actual energy and demand costs to the government of new air-conditioning equipment. Once the new cooling system type is selected, ensure that the system specified for purchase has the highest standard energy efficiency rating that is available for a system of that type from three manufacturers. These ratings must exceed the minimum standards of ASHRAE/IES Standard 90.1-1989 and the latest pertinent NFGS.

c. Space Heating Develop projects and policies to reduce base energy consumption and costs due to space heating (see MCO P11000.9C, paragraph 4206).

(1) Only authorized maintenance personnel are to adjust space temperature settings. Occupants of quarters should be allowed to adjust their own temperatures. Work requests are to be submitted to the appropriate maintenance personnel to have temperatures adjusted. Maintenance personnel are to respond to written notification of space temperature problems within 2 working days of receiving such notification. Per MIL-HDBK-1190, section 10-3, warehouse and similar facilities without materials subject to freezing are not to be heated. Warehouse and similar facilities containing materials subject to freezing are to be heated to no higher than 40°F (4.4°C). Occupied active (shop and warehouse-type) work areas are to be heated to no higher than 55°F (12.8°C). Administrative-type occupied spaces are to be maintained no higher than 70°F (21.1°C) during winter months.

(2) Remote monitoring and control of workspace temperatures is to be provided through DDC when feasible. These systems are to be configured to "setback" unoccupied space temperature setpoints to no higher than 49°F (9.4°C) for active work areas and 62°F (16.7°C) for administrative-type spaces during winter months. In addition, when applicable, remote monitoring and control of building steam pressure reducing stations through DDC should be provided for. Maintenance personnel are to check control systems at least semiannually for setback and steam pressure control.

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(3) Per NAVFACINST 11300.37A, paragraph 7006, hangar and bay heating systems shall be turned off when exterior doors are open.

(4) Hangars, gyms, shop spaces, and other areas with high ceilings and/or large fresh air requirements are to be considered for infrared heating per LCC analyses.

(5) Ensure that rain and ground water do not collect in steam or hot water manholes and tunnels and settle around pipe surfaces.

(6) Ensure that all steam and hot water piping insulation exceeds the minimum insulation thickness standards of ASHRAE/IES Standard 90.1-1989 and the latest pertinent NFGS.

(7) Increase the amount of steam condensate returned to the Central Heating Plant (CHP). All buildings on the CHP district system must have their condensate returned to the CHP. Condensate return pumps and piping must be sized to handle the maximum projected condensate flow.

(8) As discussed in NAVFACINST 11300.37A, paragraph 4064, identify unused or unnecessary district heating system lines and secure them.

(9) Investigate district heating branch line efficiency. If branch line efficiency is low (low demand on a long line), evaluate by LCC analyses supplying the heating loads by other means.

(10) As discussed in Navy Utilities Policy Letter UPL-94-001, evaluate connecting facilities utilizing their own boilers to central heating systems based on LCC analyses. District heating systems represent a considerable investment to MCB, Quantico. The decision to add to or subtract from the load on an existing district system must be based on a thorough analysis of the cost and risk to MCB, Quantico, and not a particular facility or organization.

(11) As discussed in MCO P11000.9, Executive Orders 12759, 12845, and 12902, OPNAVINST 4100.5D, the EPACT of 1992, OMB Policy Letter 92-4, MCBO 11000.1, and MIL-HDBK-1190, select new space heating equipment based on the lowest LCC obtained in comparing at least three different types of systems; one of which must be the connection to a district heating system, when such a connection is feasible. Selection of system types for economic evaluation is to be coordinated with the Head, Maintenance Branch, Facilities Division. A secondary fuel source shall be considered for boilers over 750,000 BTU/HR input capacity. Incremental energy and environmental costs must be used to determine the actual gas, oil, and/or electric costs to the government of the new heating equipment. The latest energy rates for use in analyses are to be obtained from the Head, Maintenance Branch. Once the new heating system type is selected, ensure that the system specified for purchase has the highest

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standard energy efficiency rating that is available for a system of that type from three manufacturers. These ratings must exceed the minimum standards of ASHRAE/IES Standard 90.1-1989 and the latest pertinent NFGS.

d. Miscellaneous HVAC and Building Envelope. As an aid in accomplishing paragraphs 2b and 2c, see that the following is complied with:

(1) As discussed in NAVFACINST 11300.37A, paragraph 7008, seal all door, window, and utility penetration cracks.

(2) Keep exterior doors and windows closed when buildings are in heating or cooling mode.

(3) Upgrade building thermal envelopes by installing energy efficient windows and doors and adding insulation and weather-stripping. See ASHRAE/IES Standard 90.1-1989, enclosure (3), and the latest pertinent NFGS for the minimum standards pertaining to building envelopes.

(4) Low-e, insulated glass is to be a standard feature of new exterior windows. The window area of facilities should be minimized. Solar tinting or screening of windows should be used where appropriate on old windows to reduce internal solar heat gain and the fading of interior fabrics.

(5) Insulation of heating and cooling ductwork is to exceed the minimum standards of ASHRAE/IES 90.1-1989 and the latest pertinent NFGS.

(6) Maintenance personnel are to inspect exterior doors and windows, weather-stripping, and roof, wall, foundation, and duct insulation annually. Ductwork and heating and cooling coils should be inspected for balance and leaks concurrently.

(7) Per NAVFACINST 11300.37A, paragraph 7006, maintenance personnel are to inspect air handling unit filters at least every 6 months and replace or clean as necessary. When feasible, filter status should be monitored remotely through DDC.

(8) New substantial nonresidential buildings and existing buildings undergoing major heating, ventilation, and air-conditioning renovations are to incorporate DDC for the monitoring and control of the heating, ventilation and air-conditioning systems. The DDC systems must be designed according to the latest NFGS 15972 and have full hardware and software compatibility with the existing centrally accessible and controllable base DDC system.

(9) See enclosure (3) for additional guidance in selecting insulation and exterior doors and windows.

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e. Domestic Hot Water. Develop projects and policies to reduce Base energy consumption and costs due to domestic hot water use.

(1) Only authorized maintenance personnel are to adjust domestic water heating equipment settings. Work requests are to be submitted to the appropriate maintenance personnel to have temperatures adjusted. Maintenance personnel are to respond to written notification of water temperature problems within 2 working days of receiving such notification. Hot water temperatures are to be set within the guidelines of MCO P11000.9C, paragraph 4506. Large systems are to be remotely monitorable and controllable through DDC.

(a) In facilities without tubs or showers, hot water temperatures at the point of use are not to exceed 100°F (37.8°C).

(b) Hot water temperatures in facilities with tubs and showers shall not exceed 110°F (43.3°C) at the point of use.

(c) Family Housing units without dishwashers (and with dishwashers that have their own booster heating element) shall have domestic hot water temperatures not exceeding 120°F (48.9°C) at the point of use.

(d) Family Housing units with dishwashers that do not have their own booster heating elements shall have domestic hot water temperatures not exceeding 140°F (60.0°C) at the point of use. Replacement dishwashers are to be equipped with integral booster heaters in order that hot water temperatures may be lowered to 120°F (48.9°C).

(e) Where appropriate, new plumbing fixtures are to mechanically restrict hot water temperatures through the use of thermally sensitive water supply valves in lavatories, tub faucets, and showerheads to a maximum of 110°F (43.3°C).

(2) Install point-of-use water heaters or booster heater elements when specific areas or equipment in buildings, such as dishwashers, require water hotter than the rest of the building.

(3) Instantaneous water heating systems will be used instead of hot water storage tank systems in buildings with large hot water requirements, when LCC effective.

(4) Ensure that all domestic hot water piping and equipment insulation exceeds the minimum insulation thickness standards of ASHRAE/IES 90.1-1989 and the latest pertinent NFGS.

(5) Install timer controls on water heaters that minimize standby losses by turning the water heaters off when hot water is not required. Remotely accessible and controllable DDC temperature setback and timer systems are to be used on large domestic hot water systems.

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(6) Domestic water heating equipment of more than 100 gallon capacity should be inspected at least annually for defects in operation and insulation.

(7) Per OPNAVINST 4100.5D and NAVFACINST 11300.37A, paragraph 3140, maintenance personnel are to check the combustion efficiency of all boilers that are continuously manned at least every 8 hours. All other boilers of 350,000 BTU/HR input capacity or greater shall be checked at least monthly. Monitor the energy and water consumption of all boilers of 350,000 BTU/HR input capacity or greater with flow meters.

(8) As discussed in MCO P11000.9, Executive Orders 12759, 12845, and 12902, OPNAVINST 4100.5D, the EPACT of 1992, OMB Policy Letter 92-4, MCBO 11000.1, and MIL-HDBK-1190, select domestic water heating equipment based on the lowest LCC obtained in comparing at least three different types of systems; one of which must be the connection to a district heating system, when such a connection is feasible. Incremental energy and environmental costs must be used to determine the actual gas, oil, and/or electric costs to the government of the new heating equipment. Selection of systems for comparison is to be coordinated with the Head, Maintenance Branch, Facilities Division. The latest energy rates for use in LCC analyses are to be obtained from the Head, Maintenance Branch, Facilities Division. Once the new heating system type is selected, ensure that the system specified for purchase has the highest standard energy efficiency rating that is available for a system of that type from three manufacturers. These ratings must exceed the minimum standards of ASHRAE/IES Standard 90.1-1989 and the latest pertinent NFGS.

(9) See enclosure (3) for additional guidance in selecting plumbing equipment.

f. Lighting. Develop projects and policies to reduce base energy consumption and costs due to lighting.

(1) Keep unneeded indoor and outdoor lights off. Use appropriately calibrated timers and sensors where helpful. Work requests are to be submitted to the appropriate maintenance personnel to have timers and sensors adjusted when they cannot be locally adjusted for proper operation. Maintenance personnel are to respond to written notification of timer and sensor problems within 2 working days of receiving such notification.

(2) Per MCO P11000.9C, paragraph 4303; OPNAVINST 4100.5D; and NAVFACINST 11300.3714, paragraph 7004, work station lighting shall not exceed 50 foot-candles, work area lighting shall not exceed 30 foot-candles, and **nonwork** area lighting shall not exceed 10 foot-candles. Indoor and outdoor lighting systems are to be designed per ASHRAE/IES Standard 90.1-1989 and the latest pertinent NFGS.

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(3) Lighting fixtures are to be cleaned annually and when their bulbs, tubes, or ballasts are replaced.

(4) Replace incandescent lighting with either high-pressure sodium fixtures, metal-halide fixtures, fluorescent-tube fixtures, or compact fluorescent lighting.

(5) Replace magnetic ballasts and F40T12 40 watt tubes in fluorescent-tube lighting fixtures with high power-factor T-8 electronic ballasts and F32T8 32 watt tubes. In situations where electronic ballasts are not applicable, replace F40T12 40 watt fluorescent tubes with F40T12 34 watt tubes.

(6) Replace exterior incandescent, fluorescent, and mercury vapor lighting with high pressure sodium lighting.

(7) Replace incandescent and fluorescent EXIT signs with signs utilizing light emitting diode (LED) technology.

(8) Consider reducing overhead lighting levels and installing task lighting.

(9) Per NAVFACINST 11300.37A, paragraph 7004, high bay areas such as shops, warehouses, and aircraft hangars are to utilize high pressure sodium lighting.

(10) See enclosure (3) for additional guidance in selecting new lighting equipment.

g. Motors. Develop projects and policies to reduce base energy consumption and costs due to electric motors.

(1) Replace standard-efficiency electric motors upon breakdown with premium efficiency motors that have heavy duty bearings. Evaluate replacing standard motors in good condition with premium motors on an LCC basis. All motor efficiencies are to exceed the minimum energy efficiencies given in ASHRAE/IES 90.1-1989 and the latest pertinent NFES.

(2) Maintenance personnel are to perform preventive maintenance on electric motors of 10 hp and greater as recommended by NAVFAC and GSA guidance.

(3) Motor-type selection is to be made based on the lowest LCC. Consider using variable frequency drives or multi-speed motors whenever a variable flow is required instead of using throttling or by-pass devices. MCB, Quantico energy costs must be used to determine the actual electric costs to the government of the new motor equipment.

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h. Compressed Air. Develop projects and policies to reduce base energy consumption and costs due to compressed air systems. Compressed air is the single most expensive type of energy. In most systems, approximately 15 - 25 percent of compressed air is lost to system leaks.

(1) Maintenance personnel are to perform scheduled preventive maintenance as recommended by NAVFAC and GSA guidance. Maintenance is to include leak detection surveys using an ultrasonic leak detector or other means.

(2) Compressed air is not to be used for cleaning shop counters and floors.

(3) Consider replacing central compressed air systems with point-of-use air compressors, when LCC effective.

(4) Electronic controls, instead of pneumatic controls, should be used on control systems. Consider replacing compressed air controls on heating, ventilation, and air-conditioning systems with electronic controls, when LCC effective.

(5) Compressed air system selection is to be made based on the lowest LCC. Incremental energy costs must be used to determine the true electric, oil, or gas costs to the Marine Corps of the new compressed air equipment. The latest energy rates for use in analyses are to be obtained from the Head, Maintenance Branch, Facilities Division.

i. Electric Distribution. Develop projects and policies to reduce base electric distribution system energy losses.

(1) As discussed in NAVFACINST 11300.37A, paragraph 3402, paint exterior electrical equipment white or a light color. This has been shown to reduce the operating temperatures of electrical equipment which results in increased capacity, longer life, and energy savings.

(2) Low-loss electric transformers are to be used instead of standard efficiency transformers. Incorporate the latest transformer energy loss specification contained in NFGS 16462 for projects installing new or replacement transformers.

(3) Inspect and correct power factor and phase imbalance problems annually.

(4) Inspect all major electric distribution gear as recommended by NAVFAC and GSA guidance.

j. Natural Gas Distribution. Develop projects and policies to reduce base natural gas distribution system losses. Gas leaks'

endanger personnel and facilities and contribute to the depletion of the ozone layer. Maintenance personnel are to implement a gas line leak detection and repair program.

k. Water. Develop projects and policies to reduce base water consumption and costs. GSA Handbook: Water Management, is an excellent water conservation program resource.

(1) Modify existing toilets to reduce their water consumption or, preferably, install new high-efficiency toilets.

(2) Use dye tablets to check for leaks in toilets at least annually.

(3) Install tamper-proof water conserving showerheads.

(4) Lavatory faucets shall use aerators and be of the self-closing type.

(5) Organizations with vehicle wash stations are to evaluate the feasibility of centralizing wash facilities and recycling wash water.

(6) The use of landscape irrigation systems is discouraged, Timers and moisture sensors must be installed to control irrigation systems. Ensure spray is not wasted on sidewalks, roadways, etc. Only irrigate at night or early morning to minimize evaporative losses. Use recycled or storm water where it is LCC effective.

(7) Landscape with native, low maintenance plants.

(8) Use proper chemical treatment of boiler and cooling water to minimize blowoff requirements.

(9) Operate water and wastewater plants to minimize in-plant potable water requirements.

(10) Maintenance personnel are to implement a potable water line leak detection and repair program. Maintain inspection and maintenance records for a minimum of 3 years.

(11) All water leaks not repaired in-house must be reported to the Head, Maintenance Branch, Facilities Division.

(12) Decrease makeup water requirements at the CHP district steam plant by increasing condensate return to the plant.

(13) Ensure that new and replacement plumbing fixtures meet the minimum efficiency standards of ASHRAE/IES 90.1-1989, enclosure (3), and the latest pertinent NFGS.

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l. Metering. As discussed in MCO P11000.9C, paragraph 3402, the metering of base energy and water consumption is an important part of MCB, Quantico's energy and water conservation program. Metering provides information for raising awareness and the monitoring of conservation progress. Utility plants and distribution systems are to be metered for monitoring of plant and distribution system efficiencies. All major buildings and buildings occupied by reimbursable tenants are to be metered. As discussed in MCO P11000.9C, paragraph 3402, the installation costs for metering of reimbursable customers shall be paid for by the consumer of that utility. Meters are to be read remotely through the base DDC network when feasible. Maintenance personnel are to inspect, calibrate, and maintain all meters per NAVFAC and GSA criteria.

m. Ride-Sharing. Employees are encouraged to make use of carpools, vanpools, and public transportation for travel between home and work and between work sites. Employees are also encouraged to take advantage of flexible work schedules so that they may make use of such transportation. The Marine Corps operates a van service between MCB, Quantico, the Navy Annex, and Clarendon.

n. Vehicle Operation. Ensure that all government vehicles are operated in an energy efficient manner. Vehicles are to be warmed up no longer than necessary for their proper operation and they are to be turned off when unoccupied or out of service for more than 1 minute. Prudent usage of vehicles is essential to reducing our dependence on foreign-supplied oil.

o. Construction Project Review. Ensure that all construction projects that affect the energy and/or water consumption of MCB, Quantico are reviewed for energy and water conservation by the Head, Maintenance Branch, Facilities Division.

ENCLOSURE (1)

LIFE-CYCLE COSTING (LCC) TOOLS

Call the Federal Energy Management Program (FEMP) Help Desk at 1-800-566-2877 to obtain copies of the following National Institute of Standards and Technology (NIST) tools:

1. Life-Cycle Costing Manual for the Federal Energy Management Program, NIST Handbook 135 (current version 1996).
2. Present Worth Factors for Life-Cycle Cost Studies in the Department of Defense, NISTIR 4942 (current version 1995). Included in this document is a Memorandum of Agreement on Criteria/Standards for Economic Analysis/Life Cycle Costing for MILCON Design dated March 18, 1991, which includes further information on basic life-cycle analysis assumptions and criteria.
3. Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis 1996, Annual Supplement to NIST Handbook 135 and NBS Special Publication 709 (current version dated October 1995).
4. NIST "Building Life Cycle Cost" (BLCC) Computer Program (current version 4.3-96).

In addition, the Navy publishes its own Economic Analysis Handbook, NAVFAC P-442, dated June 1986.

ENERGY AND WATER CONSERVATION DESIGN GUIDELINES SUMMARY

The EPACT of 1992, Title 1, Subtitle A, requires new federal buildings to meet or exceed the energy and water standards put forth by the Council of American Building Officials and the ASHRAE. ASHRAE/IES Standard 90.1-1989 is the latest energy standard published by ASHRAE and will be the energy standard against which new federal facilities and major renovations are measured for the foreseeable future. Among other things, ASHRAE/IES 90.1-1989 contains interior and exterior lighting standards, building envelope standards, minimum HVAC equipment efficiencies and design requirements, and plumbing standards.

In an effort to meet the conservation goals set forth in the EPACT of 1992 and Executive Order 12902, and reduce Marine Corps utilities costs, architectural and engineering firms are encouraged to exceed the minimum energy and water requirements of ASHRAE/IES 90.1 and the specifications of this document whenever it is LCC effective to do so. The following standards are of particular interest to MCB, Quantico and are recommended for general use in the design of new buildings and renovations:

Building Envelope

1. Exterior walls will be insulated with R-13-19 insulation.
2. Roofs/ceilings will be insulated with R-30-38 insulation.
3. Floors and foundations will be insulated with R-13-19 insulation.
4. Exterior window U values will not exceed 0.28. Replacement windows of a historical design are not to have U values exceeding 0.30.
5. Exterior door U values will not exceed 0.10.

Lighting

1. Lighting power allowances are not to exceed those of ASHRAE/IES Standard 90.1.
2. Interior fluorescent lighting is to utilize F32T8 lamps and high power-factor T-8 electronic ballasts. Ballasts are to have a total harmonic distortion no greater than 15%.
3. Exterior lighting is to be of high-pressure sodium type with astronomical timer and photocell controls.
4. Photocell and infrared lighting controls are required in interior spaces where economical.
5. Exit sign lighting is to utilize LED technology.

Equipment

1. Piping and equipment is to be insulated per NFSGS 15250.
2. Each water heater in a noncirculating system is to have a heat trap to prevent convective losses.
3. Electric motors are to be of "premium" efficiency.
4. Whenever a variable output is required, the use of variable frequency drives must be considered in place of throttling or bypass devices.
5. Low-loss electric transformers are to be used versus standard transformers.
6. Air-conditioning, boiler, furnace and water heater equipment energy efficiency ratings are to be the most efficient in production by at least three manufacturers.

Plumbing

1. Lavatory faucets will be mechanically limited to a 110°F maximum temperature. Total faucet flow will be limited to 2.5 gpm. Aerators and self-closing valves are to be utilized.
2. Shower faucets shall use no more than 2.5 gpm flow.
3. Water closets are to use 1.6 gallons or less per flush.
4. Urinals are to use 1.0 gallon or less per flush.

HVAC and Domestic Hot Water Controls

DDC systems compatible with and connected to the existing centralized base DDC system are to be used for monitoring and controlling substantial building HVAC and centralized domestic hot water systems.

ENERGY AND WATER CONSERVATION COORDINATORS

All organizational commanders at MCB, Quantico are to assign an individual as an energy and water conservation coordinator. This person will assist the Head, Maintenance Branch, Facilities Division, in coordinating the base energy and water conservation program within their organization. This person's name, title, location, and phone number is to be forwarded to the Head, Maintenance Branch via letter or E-mail. These coordinators will accomplish the following:

- a. Receive instruction from the Head, Maintenance Branch.
- b. Serve as a single point of contact for energy and water conservation matters within their organizations.
- c. Assist the Head, Maintenance Branch in developing energy and water conserving projects within their facilities.
- d. Ensure that energy and water efficient equipment is purchased for use within their organization.
- e. Periodically inspect their facilities to ensure that the energy and water conservation objectives of this Order are complied with.
- f. Ensure that maintenance requirements affecting energy and water consumption are resolved.
- g. Assist in educating personnel within their organization to conserve energy and water resources.

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UTILITIES CONSERVATION AND APPRAISAL BOARD (UCAB)

1. Composition. The UCAB is comprised of personnel representing the following:

Director, Comptroller Division
Director, Facilities Division (Senior Member)
Director, Logistics Division
Director, Morale, Welfare and Recreation Division
Head, Family Housing Branch, Facilities Division
Head, Maintenance Branch, Facilities Division
Head, Public Works Branch, Facilities Division
Others as appointed by the Senior Member

2. Duties. The duties of the UCAB as discussed in MCO P11000.9C, paragraph 2102, include:

- a. Meet quarterly or at the call of the Senior Member.
- b. Monitor the effectiveness of the Base in meeting energy and water conservation goals.
- c. Make recommendations for the effective and efficient management of energy and water resources to the CG MCB for review and approval.
- d. Provide visibility of conservation efforts, programs, and goals to all service personnel, civilian employees, and dependents.
- e. Establish tenant activity and private party rates as discussed in MCO P11000.9 and MCBO 11300.1.
- f. Conduct reviews of un-metered utilities services to verify or adjust consumption estimates.

ENCLOSURE (5)