



DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON, DC 20310-0600

DAIM-OD

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: District and Islanded/Decentralized Heating Systems Selection Evaluation with Life Cycle Cost Analysis Guidance

1. Reference: USACE Memorandum, SAB, 18 Dec 2012 (encl).
2. Updated guidance on the selection evaluation process for District and Islanded Decentralized Heating Systems is provided with this memo to assist U.S. Army garrisons and activities in determining the most cost effective lifecycle option for heating solutions. This guidance is the result of a jointly sponsored review funded by ACSIM and executed by USACE.
3. HQ USACE will coordinate with the Air Force and Navy to incorporate the checklist into the existing UFC, Central Heating Plants, UFC 3-430-0SN.
4. Questions regarding the guidance should be directed to Mr. Robert Rizzieri, HQUSACE, 202-761-7769, robert.rizzieri@us.army .mil.

FOR THE ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT:

Encl

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Major General, GS
Director, Operations Directorate

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SUBJECT: District and Islanded/Decentralized Heating Systems Selection Evaluation
with Life Cycle Cost Analysis Guidance

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**Evaluation of District and Islanded/Decentralized Utility Options
with Life-Cycle Cost Analysis Guidance**

Enclosure



DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

CEMP-NWD

DEC 18 2012

MEMORANDUM FOR Director of Operations, MG Aycock, Office of the Assistant Chief of Staff for Installation Management (DAIM-OD), 600 Army Pentagon, Washington, DC20310-0600

SUBJECT: District and Islanded/Decentralized Heating Systems selection evaluation with Life Cycle Cost Analysis Guidance

1. This is in response to your request to update technical guidance on "district and islanded/decentralized" heating systems selection resulting from our studies of Joint Base Lewis McCord and Fort Carson. The guidance will help to bring consistency and alignment across the Army.
2. The attached enclosure of the "Evaluation of District and Islanded/Decentralized Utility Options with Life Cycle Cost Analysis Guidance" is ready for distribution. This guidance has been coordinated with Headquarters, Installation Management Command (IMCOM) and your staff, and they are in agreement with its content. We will now commence coordination with the Air Force and Navy to incorporate this checklist into the existing UFC, Central Heating Plants, UFC 3-430-08N.
3. The study that produced the attached checklist concluded that recapitalization of existing central plants in kind are often not the most life-cycle cost effective solution. New technologies, strategies and alternative fuels may result in lower life cycle costs, and efficiency of central plants improves when distribution networks are minimized through denser development and infill of existing sites. Care must be exercised when completing the checklist to ensure that alternatives systems are considered appropriately.
4. Request your office establish policy and distribute to all Landholding Commands. Upon your approval of the policy, USACE will follow through with implementing guidance in the UFC and to our Districts.
5. Questions regarding the interim guidance should be directed to Mr. Robert Rizzieri, HQUSACE, 202-761-7769, Robert.rizzieri@us.army.mil.

Encl


LLOYD C. CALDWELL, P.E.
Director of Military Programs

Evaluation of District and Islanded/Decentralized Utility Options

with Life-Cycle Cost Analysis Guidance

Army Installations are under increasing pressures to ensure capability to meet their designated missions while reducing their overall energy footprint within the local community in a fiscally responsible manner. This guidance is intended to be applied to District and Islanded/Decentralized systems such as District hot water or steam distribution systems, Islanded hot water distribution systems, and District co-generation systems, among others. Definitions of District and Islanded/Decentralized systems can be found at the end of this guidance. This guidance shall be applied to all new construction projects and projects where capital expenditures are being used to replace generation equipment and/or the distribution network for the purpose of rehabilitation. Emergency repairs are excluded from the studies described herein.

1. Evaluations to determine the most cost effective method for delivering utilities to facilities shall follow this decision making process:
 - a. Define scope and system requirements
 - b. Define alternatives to be considered
 - c. Develop Life-Cycle Cost Analysis
 - d. Determine most cost effective option

2. Questions to consider when evaluating how utilities will be delivered to facilities include:
 - a. Is this a new construction project or project expending capital to replace generation equipment and/or the distribution network for the purpose of rehabilitation?
 - b. What fuel sources are available?
 - c. What is the required output (heat, hot water, electricity)?
 - d. What is the anticipated utility load factor?

3. Evaluations to determine the most cost effective method for delivering utilities to facilities shall comply with the following minimum requirements:
 - a. Be completed in the context of the broader Federal and Army energy mandates.
 - i. Energy Policy Act of 2005
 - ii. Energy Independence and Security Act of 2007
 - iii. National Defense Authorization Act
 - iv. Office of The Assistant Secretary of the Army for Installations and Environment Strategic Plan
 - v. Army Installation Management Community Campaign Plan
 - vi. Other: _____

 - b. Include alternatives to the base case that each meets the defined utility needs using different technologies or bundling of technologies. Although a multi-step transition plan may be used to modernize existing legacy equipment, it is imperative that the alternatives under comparison each meet the defined utility needs. A minimum of three alternatives shall be considered in each study.
 - i. Alternative 1 (Base Case): _____
 - ii. Alternative 2: _____
 - iii. Alternative 3: _____
 - iv. Alternative 4: _____
 - v. Alternative 5: _____

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with Life-Cycle Cost Analysis Guidance

- c. Include a Life-Cycle Cost Analysis (LCCA) which has been conducted for each alternative under consideration. Major LCCA criteria are described in Paragraph 5 and LCCA procedures are described in Paragraph 6.
 - i. LCCA Completed by: _____

 - d. Include sufficient detailed information such that an independent technical review (ITR) can duplicate the results. Assumptions made for the required end state and base and comparison cases shall be clearly identified and documented.
 - i. Assumptions have been clearly documented in evaluation

 - e. Receive an independent technical review (ITR). The ITR shall be a formal review of the study to ensure that planned and completed work complies with predetermined requirements, industry standards, and engineering practices. The ITR team shall be comprised of qualified individuals who have technical expertise applicable to the technologies being studied and shall not have been directly involved in generating the study under review.
 - i. USACE is available to support Installations or other Army Offices in validating the qualifications of the ITR team under consideration. Contact HQUSACE, Chief Installation Support, CEMP-CI, at 202-761-5763 for assistance in confirming that the firm or organization being considered to perform the ITR is fully qualified.
 - ii. USACE has qualified offices that can perform the described ITRs upon request.
 - iii. ITR Conducted by: _____

 - f. Include a narrative describing which alternative was determined to be most cost effective. This decision will be guided by the results of the LCCA.
 - i. Most cost effective option identified and explained

 - g. Include a narrative describing the appropriate programming course of actions required to implement the recommended alternative. Programming course of action shall consider Army regulations on project programming and work classification.

 - h. Army shall review new laws and policies to determine if study re-evaluations are warranted. Army and installations shall review mission changes to determine if study re-evaluation is warranted.
4. At a minimum, the following alternatives shall be considered where applicable:
- a. Base case. When there is an existing system the base case alternative shall assume no change to the system.

 - b. Completely Decentralized. New or renovated solution that meets individual utility needs of buildings using local, dedicated equipment at each facility. Example: Heating and domestic hot water needs of buildings are met using local dedicated boilers at each facility.

 - c. Completely District. New or renovated solution that meets individual utility needs of buildings using one district energy plant (which may or may not include co-generation or tri-generation) with supply and return

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with Life-Cycle Cost Analysis Guidance

lines between the buildings and district plant. Example: Heating and domestic hot water needs of buildings are met using a single district heating plant with supply and return lines between the buildings and district heating plant.

- d. Island. New or renovated solution that meets individual utility needs of buildings using a combination of decentralized solutions in clusters larger than individual buildings. Example: Heating and domestic hot water needs of buildings are met using a combination of decentralized solutions in clusters larger than individual buildings.
5. The following factors have been determined as having primary influence in LCCA outcomes for provision of building utilities. It is imperative that sound economic and engineering data be developed to support each of the following factors and all calculations and assumptions be clearly documented:
- a. First costs of installation
 - i. Capital cost of new equipment: Pricing shall be based on quotations received from manufacturers. Where quotations from manufacturers are not available pricing shall be based on RS Means data. Costs shall be comprehensive and include all components required for a complete and usable system to include distribution network costs.
 - ii. Distribution network costs: These are often a significant percentage of capital costs and should be clearly identified for District and Islanded system analyses.
 - iii. Labor for installation priced per location: Pricing shall be based on data from recent projects at the Army Installation on projects of comparable scope and scale. Where such projects do not exist pricing shall be based on RS Means data.
 - b. Maintenance costs
 - i. Required Maintenance: Hours shall be based on manufacturer provided component and system maintenance requirements and life expectancies. If components and/or systems are recommended to be replaced within the 40 year study period the manufacturer's recommendations shall be accounted for in the LCCA.
 - ii. Labor Rates: Pricing shall be based on data from existing Army Installation maintenance contracts of comparable scope and scale. Where such contracts do not exist pricing shall be based on RS Means data.
 - c. Operations cost
 - i. Energy and fuel prices including consideration for interruptible opportunities: Pricing shall be based on current prices experienced at the Installation. Escalation rates shall be determined using the most current version of the Annual Supplement to NIST Handbook 135 and NBS Special Publication 709, titled "Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis" and using information from the Department of Energy, Energy Information Administration.
 - ii. Energy and fuel used by system: Usage data shall be based on measured use for existing facilities. If measured data does not exist, usage shall be estimated using engineering analysis. For planned projects consumption rates shall be estimated using engineering analysis. Fuel consumption rates shall be obtained from the manufacturer for the life of the equipment being considered. Occupancy schedules and heating/cooling degree days shall be used to determine an average system load factor.

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with Life-Cycle Cost Analysis Guidance

System load factor and equipment fuel consumption rates shall be used to estimate the total fuel consumption and thus the life-cycle cost for fuel use.

- iii. **Labor for operation priced per location:** Pricing shall be based on data from existing Army Installation operation contracts of comparable scope and scale. Where such contracts do not exist pricing shall be based on RS Means data.

Primary Factor	Alternative 1 (Base Case)	Alternative 2 (New, Completely Decentralized)	Alternative 3 (New, Completely District)	Alternative 4 (Hybrid)	Alternative 5 (_____)
Capital cost of new equipment (\$)					
Capital cost of distribution network (\$)					
Labor for installation of new equipment (\$)					
Manufacturer recommended maintenance (hours)					
Labor required for maintenance (\$)					
Fuel price (\$)					
Fuel usage (appropriate units for fuel used)					
Labor required for operations (\$)					

- d. Note: The factors above are not all inclusive factors for a comprehensive LCCA on provision of building utilities. Additional factors identified in NIST Handbook 135 which shall be considered in the LCCA include but are not limited to the following:
 - i. **Renovation and demolition costs:** Pricing shall be based on data from recent projects at the Army Installation on projects of comparable scope and scale. Where such projects do not exist pricing shall be based on RS Means data.
 - ii. **Costs for water treatment:** Pricing shall be based on data from recent projects at the Army Installation on projects of comparable scope and scale. Where such projects do not exist pricing shall be based on RS Means data.

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with Life-Cycle Cost Analysis Guidance

- iii. Costs associated with concurrent applicable projects: Ensure cost savings associated with concurrent projects that open roads, trenches, or accomplish other projects that would support the alternative under consideration are adequately captured.
 - iv. Requirements for equipment redundancy: Costs shall be included when backup equipment is required to meet statutory standby requirements (Example: generator for critical hospital loads).
 - v. Salvage value at end of useful life: Pricing shall be based on data from recent projects at the Army Installation on projects of comparable scope and scale. Where such projects do not exist pricing shall be based on RS Means data.
6. The Life-Cycle Cost Analysis identified above shall be conducted in accordance with the most current version of the National Institute of Standards and Technology (NIST) Handbook 135, “Life-Cycle Costing Manual for the Federal Energy Management Program”, associated supplements and U.S. Army Corps of Engineers Engineering and Construction Bulletin 2012-13, “Energy Implementation Guidance Update, ASHRAE 189.1, Life-Cycle Cost Analysis Requirements”. The study period shall be set at 40 years. Final LCCA documentation shall include a comprehensive summary that defines each alternative considered with assumptions and references provided for each parameter; the assumptions shall be clear and of a level of detail sufficient to be used by a third party to duplicate the results of the LCCA. LCCAs shall be completed using the same matrix of information consistently across alternatives to ensure a fair comparison is made between alternatives. For example, building loads and cost of fuel shall be consistent between base and alternatives.
- a. LCCA complies with NIST Handbook 135
 - b. LCCA study period set at 40 years
 - c. Comprehensive summary defining alternatives considered with assumptions and references for each parameter is provided
 - d. Alternatives use same matrix of information
 - e. LCCA for each alternative reflects all costs associated with meeting the identified long term energy goals
7. The alternative whose LCCA has the lowest life cycle cost is considered the most cost effective solution. Further guidance on analyzing the results of LCCAs can be found in NIST Handbook 135.
8. Definitions
- a. **District System.** A community scale utility system connecting multiple users through a distribution network that provides heating, domestic hot water, and/or electricity to facilities.
 - b. **Islanded/Decentralized System.** A utility system for providing heating, domestic hot water, and/or electricity to one or more co-located buildings at or near the point of use with a limited distribution network.