Headquarters U.S. Air Force

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Air Force Plan For Implementing New Federal Water Conservation Goal

The Air Force Water Conservation Guidebook

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U.S. AIR FORCE

Air Force Water Conservation Program

- **Air Force strongly supports water conservation**
  - **Programs in place long before EO 13123**
  - **AF Water conservation policy established in 1996**
  - **Included ability to do water conservation project in ESPC contracts since 1998**
  - **Implemented many cost effective water conservation projects**
  - **AF Sustainable Facilities Policies include water conservation**

Air Force Water Conservation Program

- Headquarters Air Force Civil Engineer Support Agency (AFCESA) is the lead agency in the Air Force's energy & water conservation programs
  - Develops Policy
  - Proponent for conservation measures
  - Provides technical oversight to program
- Problems
  - Water often undervalued and seen as plentiful
    - It is one of our most precious resources
  - Water seen as cheap when compared to energy cost

The Federal Water Conservation Goal

- Mandated by EO 13123 signed by President Clinton in June 99
- Development of the goal was led by DOE with participation from all Federal Agencies and Military Services
  - Issued in Jul 00, it is called Federal Water Efficiency Goal
- Goal sets an implementation schedule for Water Efficiency Best Management Practices (BMPs)

The Federal Water Conservation Goal

- Goal requires each base (facility) to develop a Water Management Plan (WMP)
  - Goal sets minimum criteria a WMP
  - All locations must have a WMP by 2005

Best Management Practices

- BMP #1—Public Information and Education Programs
- BMP #2—Distribution System Audits, Leak Detection, & Repair
- BMP #3—Water Efficient Landscaping
- BMP #4—Toilets and Urinals
- BMP #5—Faucets and Showerheads
- BMP #6—Boiler/Steam Systems
- BMP #7—Single-Pass Cooling Systems
- BMP #8—Cooling Tower Management
- BMP #9—Miscellaneous High Water-Using Processes
- BMP #10—Water Reuse and Recycling

Best Management Practices

- Goal Requires
  - 5% of bases implement 4 BMPs by 2002
  - 15% of bases implement 4 BMPs by 2004
  - 30% of bases implement 4 BMPs by 2006
  - 50% of bases implement 4 BMPs by 2008
  - 80% of bases implement 4 BMPs by 2010
- Most BMPs have two major parts
  - Operations and Maintenance (O&M) Options
  - Retrofit & Replacement (R&R) Options
- For a BMP to be considered implemented, all O&M options must be accomplished and all cost effective R&R options must be implemented

Water Management Plans (WMPs)

- The Goal Requires each location develop a WMP that contain the following
  - Utility information
  - Facility information (Walk through audit recommended)
  - Emergency response information
  - Comprehensive planning information
  - Method for including O&M options for the BMPs selected for implementation

Air Force Issues With Goal

- A Typical Air Force Base
  - Can have well over 1000 separate facilities
  - Facility water use is generally unmetered, except reimbursable customers (Metered facilities typically less than 5% of total)
  - Base Water is usage determined by master meter
  - Limited resources to implement goal
    - Manpower - At each base, only one or two persons are responsible for all utility usage, tracking, billing, and conservation programs
    - No Funds budgeted to develop WMPs or implement BMPs
    - Limited or no funds for water conservation projects
- Requirements of Goal not easily implemented

The Water Conservation Guidebook

- HQ AFCESA took initiative to develop a Water Conservation Guidebook For Air Force
- Purpose of the Guidebook
  - Significantly reduce the workload of bases to comply with requirements of the water efficiency goal
    - Lists assumptions, methodology & formulas to use in place of walk through facility audits
    - Provides methodology for calculating water use by category
    - Allows WMP to be developed from "the desktop" using available information while still meeting requirements of goal
  - Set a standard format for WMP within the Air Force
  - Standardize reporting requirements format

Guidebook Methodology

- The 105 page Guidebook is intended to walk bases through process of developing a WMP and implementing BMPs.
  - It deals exclusively with goal requirements
- The Guidebook provides:
  - Procedures for estimating water use by category
  - Methods of estimating the incremental cost of water (I.e. Actual cost of water being conserved)
  - Methodology for evaluation of the cost effectiveness of the retrofit & replacement options for each of the BMPs

Guidebook Methodology

- The Guidebook provides (continued):
  - Format for tracking BMP implementation
  - Guide to Financial Resources for water conservation projects
  - Template for a WMP that meets the goal requirements.
  - POCs and sources for additional information.
  - Limited Technical Information
    - Refers readers to other sources for technical details on water conservation measures
- Helps a base develop a WMP that sets it on a course toward water conservation

Steps to Complete A WMP

- The Guidebook outlines the 6 steps to complete a WMP
  - Step 1 – Collect Background Data
  - Step 2 – Categorize Water Base Water Use
  - Step 3 - Calculate Incremental Cost of Water
  - Step 4 – Investigate BMPs for Implementation
    - Calculate Simple Payback for each BMP option
    - Explore financing alternatives
  - Step 5 – Begin Implementation
  - Step 6 – Monitor Program

Step 1 - Collecting Background Data

- Guidebook is designed to minimize data collection effort
- Most information required to develop the WMP is readily available from the Base Utility Manager & Real Property Records
- Provides methods for developing estimates for information not readily available
- No walk through facility audits required
  - Accomplishes the intent of goal without the legwork
- Utilizes existing base plans for emergency response and comprehensive planning information

Step 2 - Estimating Water Use By Category

- Estimating water use by category helps focus conservation on high use applications with greatest potential for savings
- Guidebook breaks water use into 5 categories
  - Category 1 – Housing
  - Category 2 – Commercial
  - Category 3 – Irrigation
  - Category 4 – Leaks & Losses
  - Category 5 - Industrial

Step 2 - Estimating Water Use By Category

- Provides methodology for calculating use by category without individual facility meter readings
- Examples:
  - Housing usage estimate based on national averages (Category 1)
  - Monthly billing comparison to estimate irrigation usage (Category 3)
  - Midnight flow readings of water & sewer to estimate leaks (Category 4)

Step 3 - Calculating Incremental Cost of Water

- Determining incremental cost of water is critical to determining cost effectiveness of conservation measures
- The "incremental cost of water" is the actual cost of water saved. For the purpose of the guidebook, it is equal to the cost of the last 10% to 20% of the water used by the base
- Unless purchasing on a flat rate scale, the incremental cost of water can be very different than the average cost of water, or the water rate charged reimbursable on-base customers

Step 3 - Calculating Incremental Cost of Water

- Guidebook provides 6 different examples for calculating incremental water costs
  - Example 1 – Purchased on Flat Rate Scale
  - Example 2 – Purchased on Declining Sliding Scale
  - Example 3 – On-Base Plant
  - Example 4 – On-Base Plant mixed w/ purchased water
  - Example 5 – Purchased on Increasing Sliding Scale
  - Example 6 – Average & Incremental Sewer Costs

Step 3 - Calculating Incremental Cost of Water

Example 3 - On-Base water plant

	Before Conservation	After Conservation
Water Production	150 Mgal/yr	120 Mgal/yr (20% Reduction)
Treatment Plant O&M	$100,000/ yr	$100,000/ yr
Manpower Costs ($)	$250,000/yr	$250,000/yr
Pumping, Electrical, Utility Costs ($)	$12,000/yr	$9,600/yr (20% reduction)
Chemical Costs ($)	$24,000/yr	$19,200/yr (20% reduction)
Total Production Cost	$386,000	$378,000
Ave Cost of Water	$2,573/Mgal ($2.57/Kgal)	$3,150/Mgal ($3.15/Kgal)
Value of water saved		$8,000
Incremental Cost of Water		$266/Mgal ($0.26/Kgal)

Step 3 - Calculating Incremental Cost of Water

- Even if a location has a very low Incremental Cost of Water, it can still implement 4 BMPs and meet the goal.
  - To get credit for implementing a BMP a location must implement the O&M options, and the cost effective Retrofit & Replacement options.
  - If water costs are low and none of the Retrofit & Replacement Options are cost effective, a location can get credit for the BMP by implementing only the O&M options

Step 4 - Investigating BMPs For Implementation

- Since each Air Force Base must implement only 4 of the 10 BMPs, selecting which BMPs are easiest to implement is critical.
- Most bases will rely on ESPCs for funding water conservation projects. The guidebook is structured to support this
  - Guidebook provides assumptions, formulas, and examples to calculate cost effectiveness of projects in each BMP
  - If this preliminary calculation shows the project to be cost effective, it can be passed over to ESPC for implementation
  - ESPC either implements project, or determines that it is not cost effective

Example of Assumption

- Toilet Replacement
  - Walk Through facility audits are suppose to determine:
    - Number of Toilets
    - Gallons used per flush
    - Number of uses per day
  - Information is used to determine the cost effectiveness of replacement with low flow toilets
  - In place of walk thought audits, guidebook uses assumptions and estimates to determine cost effectiveness of toilet replacement projects

Example of Assumption

- **Toilet Replacement (continued)**
  - **Provides assumptions for estimates**
    - **Number of toilets & urinals in commercial & industrial facilities estimated from worker population**
    - **Housing office for number of toilets in MFH and occupants**
    - **Gallons per flush estimated based on approximate age of facilities, or last major bathroom renovation**
      - Four age groups, pre 1950, 50-80, 80-94, & 94-present
    - **Provides Average uses per person per day (i.e. 5.1 for household, 3.0 for industrial & commercial)**
  - **Provides formula for calculating payback**

Example of Assumption

- **Similar assumptions provided to calculate cost effectiveness of Repair & Replacement Options in most BMPs**
- **These rough calculations show if further investigation is necessary**
- **If the estimate using these assumptions show the project to be cost effective, it can be referred to the ESPC contractor for a Phase 1 study.**

Step 5 - Implementation of BMPs

- O&M Options
  - O&M Options are generally changes in day-to-day procedures
  - Can be incorporated in to Reoccurring Work Program (RWP) or base maintenance contracts.
  - Generally very low cost to implement
- Repair & Retrofit (R&R) Options
  - Payback of 10 years or less to be cost effective
  - Requires capital investment

Step 5 - Implementation of BMPs

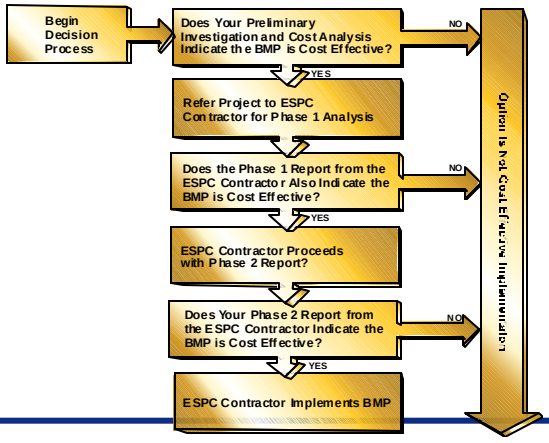
R&R Funding Options

- Energy Savings Performance Contracts (ESPCs)
  - Primary Air Force method for funding conservation projects
  - Guidebook is build around using ESPC funding.
- Energy Conservation Invest Program (ECIP)
- Housing Funds (For MFH)
- Environmental Funds
  - Significant limitations exist
- Operation & Maintenance (O&M) Funds
- Utility Energy Service Contracts (UESC)

R&R Funding Options

- Energy Savings Performance Contracts (ESPCs)
  - Primary Air Force method for funding conservation projects
  - Guaranteed Savings
  - Projects funded by contractor from savings
  - Guidebook focuses on this method for implementing conservation projects
  - After project is referred to ESPC contractor, the contractor is responsible for developing project
  - ESPC projects have 3 Phases
    - 1- Preliminary study
    - 2 - Detailed Study
    - 3 - Implementation & Evaluation

ESPC Implementation Process



R&R Funding Options

- Energy Conservation Invest Program (ECIP)
  - ECIP is a funded through the Military Construction Program (MCP)
  - Payback less than 10 years
  - Mainly for existing facilities
  - Projects compete DoD wide for limited dollars
  - Significant effort required by base to develop project justification, funding documents, etc.

R&R Funding Options

- Housing Funds
  - Limited to projects in Military Family Housing
  - Significant effort required by base to develop project justification, funding documents, etc.
- Environmental Funds
  - Limited to projects where water conservation is consequence of a compliance driven project
  - Example: Base required to reduce wastewater treatment plant discharge due to TMDL. To comply the base implements effluent reuse project

R&R Funding Options

- Operation & Maintenance (O&M) Funds
  - Due to limited O&M funding, projects generally limited to small scale project required limited investment
- Utility Energy Service Contracts (UESC)
  - UESC is a sole source agreement with the local utility for completion of energy or water conservation projects
  - Similar to ESPC but does not require (or exclude) guaranteed savings

Step 6 - Monitoring The Program

- The final step is monitoring the program
- A Water Management Plan using the guidebook format encourages follow-up
- Annual reporting format requires a review of the WMP in order to submit data

Guidebook Appendixes

- FEMP Guidance to Establish Water Efficiency Improvement Goals for Federal Agencies
- Sample Water Management Plan
- Federal Water Use Indices
- Annual Reporting Format
- AFEPPM 96-2, Air Force Water Management Program
- Environmental Funding Policy Memorandum
- Air Force Water Conservation Points of Contact

Getting The Air Force Water Conservation Guidebook

- It is available in hardcopy & electronic versions
  - Hardcopy is about 105 pages
  - Electronic version is a .pdf file approximately 2 MB
- Distribution is unrestricted (available to the public)

It can be downloaded from the HQ AFCESA website

- WWW.AFCESA.AF.MIL
- Go to "Technical Support"
- Then to "Water Systems"
- Can be e-mailed
  - Contact me at michael.clawson@tyndall.af.mil

Summary

- Purpose of Guidebook is to reduce workload of bases to implement the Water Efficiency Improvement Goal for Federal Agencies
- It Walks bases through process of developing a WMP
- The resulting WMP provides the base with a blueprint for meeting the requirements of the goal and puts base on the path to water efficiency

Questions?

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