

Decentralization of Central Heating Plants

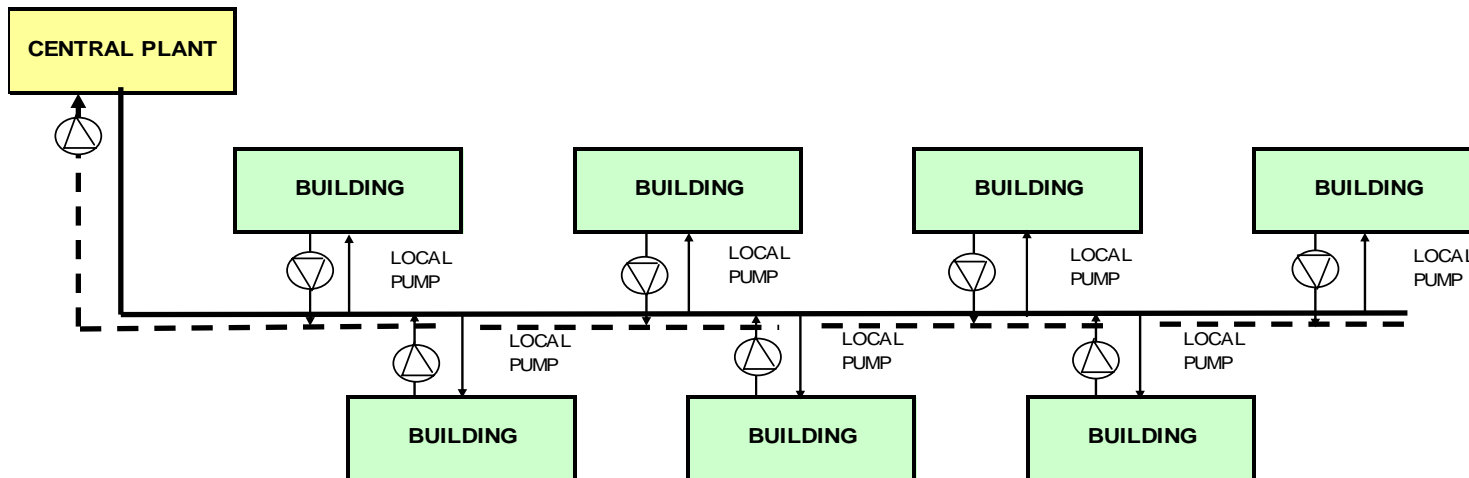


- Central heating plant history
- Energy losses in a typical central heating plant
- Traditional central heating plant set up
- Decentralized heating plant benefits and issues
- Areas of improvement for central plants
- Q&A

- A steam district heating system has been in use at military installations since 1853
- A recent census by the Department of Energy found more than 30,000 central heating systems in the United States
- Heating plants use a variety of sources, including geothermal, cogeneration plants, and waste heat from industry
- Most existing central heating plants on AF Bases have NG, diesel, or oil-fired boilers

Traditional Central Heating Plant

- All boilers typically located in a single plant building
- Underground or overhead steam or hot water mains originating at central plant distribute steam to various and numerous buildings often located miles away
- These buildings use heat directly or indirectly for:
 - Building heating
 - Domestic hot water
 - Snow melting
 - Absorption chillers



Why Central Plants were Built

- Maintenance
 - All primary and auxiliary equipment in one building
 - Easier to monitor and troubleshoot
- Fuel Storage and Delivery
 - Diesel fuel is stored in centrally-located tanks
 - Reduced gas piping runs
 - Centralized fuel metering
- Multiple fuels capability (fuel oil & NG)
- Flexibility to add or remove buildings



■ Overhead Distribution Piping

- High losses due to insulation losses due to water intrusion
- Mains that are often many miles long
- Difficult to identify and maintain drip traps
- Much more maintainable than underground steam distribution system



Central Plant Issues (continued)

- Underground Distribution Piping
 - Mains are in tunnels, conduits, or are direct buried – **difficult to access and maintain insulation**
 - Manholes are required to house expansion joints, shutoff valves, drip traps, groundwater removal pumps. **Manholes are major sources of heat losses**



Misawa AB North Area Central Steam Plant Study



Almost 20% of plant output energy is lost in steam distribution piping

	Average Annual Consumption, MMBtu	Annual Energy Losses, MMBtu
Fuel Input to Steam Plant	115,336	
Energy Output of Steam Plant	94,576	23,644*** Combustion/Blow Down Losses
Steam Energy Delivered to Buildings	77,115	18,670 Steam Distribution Losses**

*Based on \$8.00 per 1 MMBtu of steam

**Distribution losses estimated by sampling 5% of existing buildings - \$149,360 annually

***Based on 82% boiler combustion efficiency

Misawa AB North Area Central Steam Plant Study



	Existing Central Plant	Decentralized Plant
Total Annual Energy (MMBtu)	94,576	77,115
First Cost Equivalent	\$8,543,000*	\$9,085,000
Annual Fuel Oil Cost @ \$2.73/gal	\$1,655,000	\$1,288,000
Routine Maintenance Cost	\$210,000	\$362,000
Annual Electric Cost	\$416,000	\$416,000
Total Annual Operating Cost (Energy and O&M)	\$2,281,000	\$2,066,000

*Cost of scheduled repairs of existing underground distribution piping and central boilers

Estimated payback of less than 4 years

Why Decentralize?



- Existing central plant may be vulnerable to security threat with severe consequences
- Problematic underground and overhead steam distribution mains can be eliminated
- Central plant requiring full-time operators can be shut down
- Smaller condensing high-efficiency hot water boilers (up to 95% efficient) can be used
- Domestic hot water can be generated indirectly from these boilers, thereby saving space

Important Aspects of Decentralized Heating System Design

- Equipment Room with proper access to individual boilers
- Boiler Venting options (roof or wall)
- Boiler Noise consideration
- Retrofit or Replacement of existing air handling coils and radiators
- Boiler Redundancy – don't put all your eggs in one basket



- Decentralized Heating Plant can help meet Energy Cost reduction goals by
 - Eliminating distribution pipe heat losses
 - Using more-efficient boilers

- Reduce Heating System Overhaul Costs

- Reduce Security Vulnerability of the Base

- Reduce Environmental Issues due to underground steam/water leakage

Questions and Answers



BACK-UP SLIDES

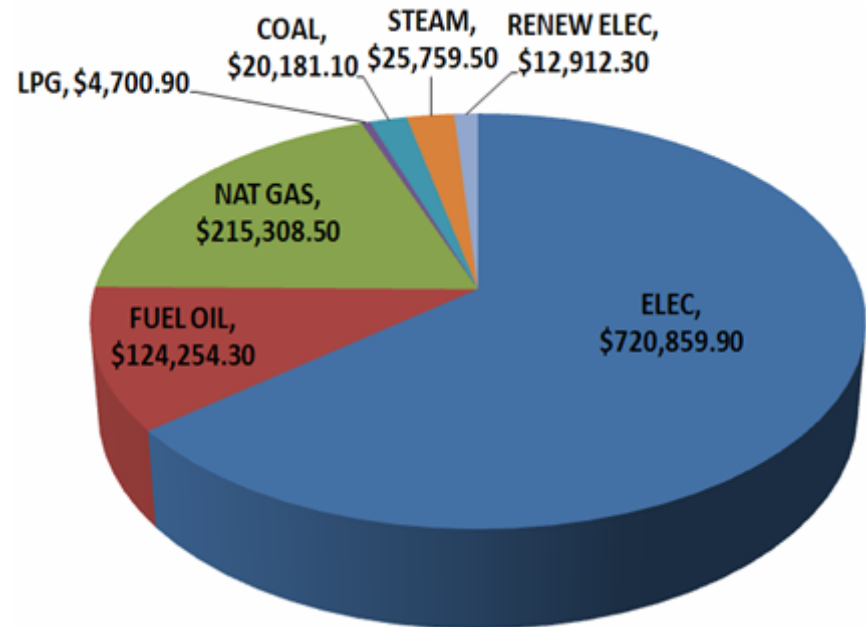
FY08 ENERGY USE

66,842.2 BBTU

70,974.0 BBTU in FY07

5.8% Reduction From FY07

FY08 ENERGY COST (\$000)



\$1,123,976.5

\$1,061,035 in FY07

5.9% Increase From FY07

SOURCE: FY08 ANNUAL ENERGY MANAGEMENT REPORT TO CONGRESS

Why Centralize?

Central heating plants are the way to go if:

- A base is undergoing a major expansion or a new base is being built
 - New piping technologies can be used that reduce maintenance and heat losses
 - New premium-efficiency boilers and auxiliary equipment can be used
- An area served by the central plant is fairly small
 - Heat losses will not be significant due to short pipe runs between the plant and buildings
- Existing distribution piping is installed in readily accessible tunnels allowing for routine maintenance checks
- Building domestic water heating is done locally and do not rely on central boilers

Energy Improvement in Decentralized Heating System design and operation

- Properly size and maintain steam traps
- Properly size and maintain relief valves. Leaky safety relief valves are often result of improperly piped pressure regulating valve stations
- Properly size and pipe temperature control valves which tend to hunt resulting in wasteful overheating
- Frequently check pipe and valve joints for steam leaks
- Maintain pipe insulation. Failed or missing pipe insulation is a major energy waste

All of these issues can be resolved through good piping practice and minimal maintenance



Areas of improvement for central plants (continued)



- For direct-buried pipes, fill empty space between the pipe and the outer conduit, with a high temperature **polyisocyanurate** insulation
 - Steam line losses will be reduced about 40% during ordinary operation
 - Most water intrusion from ground water and manholes will be virtually eliminated saving additional energy using this process
 - This patented process can be done without taking the steam main out of service
 - This process is very expensive but there is still an excellent payback
 - This re-insulation process will cost a small fraction of installing new steam mains.

Areas of improvement for central plants

Existing central heating plants efficiency may be improved by:

- Installing removable insulated manhole covers
- Upgrade existing pipe insulation. A new insulation known as **AEROGEL**, which is water repellent, can be installed over existing underground piping
- Install or upgrade steam-powered float actuated ejector pumps to keep manholes dry. Electric powered pumps are a disaster in steam manholes
- Pumped out manholes and tunnels periodically



Goals for Air Force



- Reduce Operating Cost by 20% by 2020
- Reduce Energy Intensity by 3% Per Annum
- Reduce Water Use by 2% Per Annum
- Increase Renewables at Annual Targets
- Reduce Ground Fuel Use by 2% Per Annum
- Increase Alternative Fuel Use by 10% Per Annum
- Reduce Greenhouse Gases by 28% by 2020