BUILDING HEATING AND COOLING APPLICATIONS

Program Area Synopsis:

Plans are being developed for a comprehensive thermal energy storage technology and development program covering building heating and cooling applications in the residential and commercial sectors.

Three elements have been identified to undergo an Applications Assessment, Technology Development, and Demonstration. The element receiving primary emphasis is the Utility Load Management TES Application where the stress is on the "customer side of the meter". A second element involves improved and advanced thermal storage subsystems for space conditioning. The third element is Conservation by means of increased thermal mass within the building envelope and by means of low-grade waste heat recovery.

BUILDING HEATING AND COOLING APPLICATIONS THERMAL ENERGY STORAGE PROGRAM OVERVIEW

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PROGRAM OBJECTIVE IS REDUCED CONSUMPTION OF OIL AND GAS FOR RESIDENTIAL/COMMERCIAL SPACE CONDITIONING BY USING THERMAL ENERGY STORAGE

- SWITCHING TO COAL AND NUCLEAR (ELECTRICITY)
- INCREASED UTILIZATION OF SOLAR
- MORE EFFICIENT USE OF OIL AND GAS

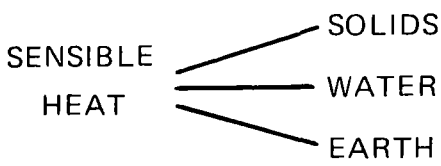
THE PROGRAM IS DIRECTED AT ACHIEVING SIGNIFICANT REDUCTION IN OIL/GAS CONSUMPTION

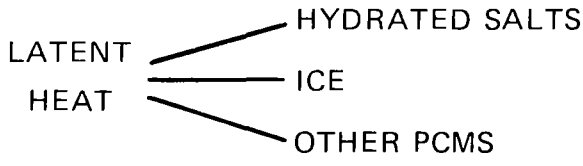
- NEAR- TO MID-TERM TECHNOLOGIES
- NEW AND RETROFIT INSTALLATIONS
- BROAD GEOGRAPHIC/CLIMATIC APPLICATIONS

THE PROGRAM IS DIVIDED INTO THREE ELEMENTS

- STORAGE OF OFF-PEAK ELECTRICITY AS THERMAL ENERGY
- STORAGE OF SOLAR ENERGY AS THERMAL ENERGY
- INCREASE IN HEATING AND COOLING SYSTEMS' EFFICIENCY BY MEANS OF THERMAL ENERGY STORAGE

EACH PROGRAM ELEMENT WILL EXPLORE IMPROVED AND ADVANCED STORAGE MATERIALS AND TECHNOLOGIES





APPROPRIATE STORAGE MATERIALS AND TECHNOLOGIES WILL BE THOROUGHLY EXPLORED

- TECHNO-ECONOMIC ANALYSES
- ADVANCED CONCEPT DEVELOPMENT
- APPLIED RESEARCH
- TECHNOLOGY DEVELOPMENT
- ENGINEERING DEMONSTRATIONS

OFF-PEAK ELECTRICITY UTILIZATION IS THE MAJOR PROGRAM ELEMENT

- BASED ON INCENTIVES OFFERED ELECTRICITY CONSUMER TO OWN AND UTILIZE TES SYSTEMS
- INVOLVES HEAT AND/OR COOL STORAGE
- NEAR-TERM
- WIDESPREAD APPLICATION/LARGE FUEL SWITCHING POTENTIAL

TES SYSTEMS FOR OFF-PEAK ELECTRICITY UTILIZATION MUST SATISFY THREE CONSTRAINTS

- COST EFFECTIVE (INCENTIVE >COST)
- FUNCTIONAL (COMFORTABLE, CONVENIENT, RELIABLE, SAFE)
- TECHNICALLY EFFECTIVE (ACHIEVE UTILITY LOAD LEVELING GOALS)

SEVERAL PATHS TO IMPROVED OR ADVANCED CUSTOMER-OWNED TES ARE BEING FOLLOWED

	RESIDENTIAL	COMMERCIAL
• HEATING	REFRACTORY BRICK WATER MOLTEN SALTS	WATER
• COOLING	ICE HYDRATED SALTS	ICE WATER

SOLAR THERMAL STORAGE IS A SECOND MAJOR THRUST AREA

- PASSIVE SOLAR
- ACTIVE SOLAR HEATING
- ACTIVE SOLAR COOLING
- SOLAR ASSIST HEAT PUMPS

PROGRAM OBJECTIVE FOR PASSIVE SOLAR STORAGE TECHNOLOGY IS IMPROVEMENT OVER TROMBE WALL

- REDUCED WEIGHT, VOLUME
- FLATTENED DIURNAL TEMPERATURE SWING
- INCREASED ARCHITECTURAL OPTIONS

BY INCORPORATION OF PHASE-CHANGE MATERIALS INTO BUILDING MATERIALS

OBJECTIVE OF STORAGE TECHNOLOGY DEVELOPMENT FOR ACTIVE SOLAR HEATING APPLICATION IS OVERALL SYSTEM COST REDUCTION AND INCREASED ACCEPTABILITY

- STORAGE AT MINIMUM TEMPERATURE FOR USE OPTIMIZES COLLECTOR PERFORMANCE
- WEIGHT, VOLUME REDUCTION
- REDUCED PEAK CAPACITY OF BACKUP

SOLAR COOLING, A MORE DISTANT OPTION, REQUIRES DEVELOPMENT OF APPROPRIATE STORAGE TECHNOLOGIES TO REDUCE TOTAL SYSTEM COST

- HOTSIDE (120^{o}C)
- COLDSIDE (7^{o}C)

HOT-SIDE STORAGE MATERIALS ARE BEING DEVELOPED UNDER A SMALL PROGRAM

OBJECTIVE OF THERMAL STORAGE FOR SOLAR-ASSISTED HEAT PUMPS IS LOW-COST BOOSTING OF HEAT PUMP PERFORMANCE

- STORAGE OF SOLAR HEAT AT NEAR-AMBIENT TEMPERATURE
- COMBINED WITH OFF-PEAK ELECTRICITY USE
- SINGLE STORAGE MEDIUM FOR BOTH HEAT *AND COOL*

DEVELOPMENT OF STORAGE FOR USE WITH CONVENTIONAL OIL OR GAS HEATING SYSTEMS CAN REDUCE FUEL CONSUMPTION

- REDUCED CYCLING FREQUENCY
- REDUCED HEATING, STACK LOSSES
- DISTRIBUTED OR CENTRAL STORAGE
- NEW OR RETROFIT

TECHNO-ECONOMIC ANALYSIS IS REQUIRED TO DETERMINE MERITS

USE OF THERMAL STORAGE TO TEMPER THE HEAT SOURCE/SINK FOR RESIDENTIAL OR COMMERCIAL HEAT PUMPS CONSERVES ELECTRICITY

- CRAWLSPACE/EARTH STORAGE
- DAILY ACES

CURRENT DEVELOPMENT OF A CRAWLSPACE SOURCE HEAT PUMP LOOKS VERY PROMISING

THE PROGRAM FOR FY 1980-81 WILL INCLUDE MAJOR PROJECTS ADDRESSING TWO PROGRAM ELEMENTS

MAJOR

- RESIDENTIAL COOL STORAGE FOR OFF-PEAK ELECTRICITY
- RESIDENTIAL HOT STORAGE FOR OFF-PEAK ELECTRICITY
- RESIDENTIAL STORAGE INCORPORATED IN BUILDING MATERIALS
- RESIDENTIAL HOT STORAGE FOR SOLAR HEATING
- COMMERCIAL HOT/COLD STORAGE FOR OFF-PEAK ELECTRICITY

ADDITIONAL MINOR AND SUPPORT PROGRAMS ADDRESS ALL PROGRAM ELEMENTS

MINOR

- RESIDENTIAL HOT STORAGE FOR INCREASING OIL/GAS BURNER EFFICIENCY
- RESIDENTIAL HOT SIDE STORAGE FOR SOLAR COOLING
- RESIDENTIAL HOT/COOL STORAGE FOR INCREASING HEAT PUMP EFFICIENCY

SUPPORT

- ASSESSMENT OF STORAGE/HEAT PUMP SYSTEMS
- ASSESSMENT OF STORAGE/OIL-GAS HEATER SYSTEMS
- ANALYSIS OF PHASE-CHANGE HEAT/MASS TRANSFER
- PERFORMANCE TESTING OF HOT AND COOL TES SYSTEMS
- FIELD TESTING OF COOL STORAGE SYSTEMS