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EASTERN PROGRAM

F. C. Paddison

APL/Johns Hopkins University

This brief report summarizes the status of federal and state programs to aid the development of hydrothermal energy in the Eastern United States, as well as a general analysis of potential applications. The Eastern United States as defined here, includes all of the thirty-one states east of the Rocky Mountains, excluding Texas, Louisiana, Oklahoma, Arkansas, North Dakota and South Dakota.

The Fourth Technical Interchange meeting to review effort in the Eastern United States was held in late October 1979 at Berkeley Springs, West Virginia. The minutes of that meeting appear in an APL/JHU report dated December 1979 OM-79-261 and is available from the laboratory or in time from NTIS.

The eastern hydrothermal effort is focused on the Atlantic Coastal Plain, but there are programs underway in the balance of the east.

1. The Atlantic Coastal Plain

The DOE has a very active program of location assessment and confirmation of hydrothermal reservoirs within the sedimentary sequences from New Jersey to Georgia. A separate summary report, prepared by the Virginia Polytechnic Institute and State University, discusses the DOE Atlantic Coastal Plain Geologic program. To assist in the geologic program there is a state-coupled DOE program with the state geologic survey in the state of Delaware. In areas where a hydrothermal resource is suspected from geophysical and other indicators, shallow thermal gradient wells have been drilled and measured from New Jersey to North Carolina. A market survey by APL/JHU in these same areas has been completed, providing location and size of energy markets which could consider the use of the geothermal resource located in the area. A deep reservoir confirmation test well was drilled and tested in Crisfield, Maryland, in the summer of 1979. Although the temperature and permeability of the basal sands were lower than predicted on the basis of shallow wells, they turn out to be an adequate and cost effective energy form for space heating of moderate sized buildings and

selected industrial process heat. The testing of the Crisfield well was short and the extrapolation of the reservoir data to other regions of the Delmarva Peninsula or Atlantic Coastal Plain is difficult (see APL/JHU OM-79-261 for details). Accordingly DOE plans a second deep well, cost-shared with a user, to obtain longer term reservoir data. The locale of this second deep well is to be selected from responses to an RFO planned to be issued, by DOE, early in CY-1980.

To set the stage for orderly development and application of the hydrothermal resources under the Atlantic Coastal Plain, the individual states must consider the legal aspects of ownership, insurance, permitting, access, reservoir management, etc. The state of Maryland has passed a Geothermal Resources Act in 1978 but has yet to issue the attendant rules and regulations. Further, no user has yet applied to force a determination of ownership left ambiguous by the current law.

To assist other states the National Conference of State Legislatures (NCSL) is supported by DOE to organize legislative workshops to assist the states. The states so assisted are initially Delaware and Virginia, to be followed by Georgia and possibly North or South Carolina. Johns Hopkins University and Virginia Polytechnic Institute assist in these workshops.

To further local initiative and to involve state and community planning agencies, economic development agencies, the state geologic survey, and water control personnel, DOE is funding the establishment of state teams to write a state geothermal prospectus. Initially the states of Delaware, Maryland and Virginia will be funded to support the team. These will be followed by other Coastal Plain states next fiscal year. The Delaware Plan is already organized and funded. Maryland and Virginia are still in the process of team organization.

There are many prospective users of geothermal energy in the Delmarva Peninsula awaiting the completion of the DOE hydrothermal resource assessment. Some of these are listed on the attached figure. The Campbell Soup Company together with the engineering firm of Burns and Roe were awarded a PRDA in 1979 to analyze the potential of geothermal energy located in Salisbury, Maryland area as an energy form in the preparation of frozen dinners. The PRDA contract is handled through the DOE Regional Office IV located in Atlanta, Georgia.

During this fiscal year the DOE Coastal Plain program will extend the VPI and SU gradient well and geologic program to the states of Georgia and South Carolina. The Johns Hopkins University Market analysis for these same states will also begin. Additional deep test wells to confirm resource, and develop resource engineering data are planned in fiscal year 1981.

The Hot Dry Rock program technically directed in the Los Alamos Scientific Laboratory (LASL) supports geologic studies in many states in the East, these are listed in the figure. In addition they plan a detailed analysis of the geology, geophysics, market assessment and economics concentrated in a 100 - square mile rectangle from Crisfield, Maryland to Wallops Island, Virginia.

The USGS/WR is just starting a National Regional Aquifer program. The location and the dynamics of the dividing line between potable and saline ground water is to be determined under the Atlantic Coastal Plain as one element of this program. These data are of common interest to all Atlantic Coastal Plain states: hydrothermal resource managers and users, accordingly very close cooperation with this USGS program is planned.

In summary hydrothermal resources, heated apparently by radiogenic granite emplacements in the basement rock, are located in all of the mid and southern Atlantic coastal plain states. These resources are modest in temperature. Their transmissivity and potentiometric head limit water withdrawal rates per well and per resource area. Applications engineering must be done with care to maximize utilization of the geothermal well while at the same time not drawing down the well and unduly increasing the operating costs of the water retrieved.

Some significant issues resulting from the Atlantic Coastal Plain program are:

- a. It is important that resource ownership be treated as ground water, reowned and allocated by the state. The legal cost of determining the size of a geothermal field, the magnitude of royalties, and who should receive them, is a significant deterrent to development of moderate temperature hydrothermal resources.

- b. The Department of Energy must assume responsibility for resource engineering, including the long-term operating characteristics, in each new resource area. These data are vital for state agencies charged with resource

management and allocation, and to encourage individual applicants.

Other Eastern Areas

The Department of Energy has resource assessment programs in nine other eastern states. These are listed in the figure. In addition DOE is funding Gruy Federal Incorporated to assist in initial definition studies of geothermal resources in other selected states; these are also listed on the figure.

The Johns Hopkins University has analyzed all eastern counties where the AADG/USGS data show gradients greater than $1.6^{\circ}\text{F}/100\text{Ft}$ to order these potential resource areas preferentially on the basis of quality of resource, cost of resource, and local energy market. This report APL/JHU OM-79-163/GT of July 1979, titled "Evaluation of Potential Geothermal Resource Areas" documents the results and points to several areas of considerable interest in the East, for example in New York and Pennsylvania. This report is available from APL/JHU or from NTIS.

Other Pertinent Eastern Initiatives

Mr. L. Falick, who has left the Department of Energy, is planning a document to show prospective geothermal users where and how to find assistance in financing.

The Oak Ridge Associated Universities (ORAU) is contracted by DOE to assess geothermal applications in the TVA region of the South East.

Finally a loose-leaf book containing Fact Sheets relating to the existing use of energy in general and geothermal in particular in the Eastern United States, APL/JHU OM-79-037 of January, 1979 has been issued. This book is in the process of extension to encompass all states.

EASTERN GEOTHERMAL PROGRAMS

ATLANTIC COASTAL PLAIN

- RESOURCE EVALUATION AND TARGETING VPI&SU
- FORMATION OF STATE TEAMS JHU
 - DELAWARE - MONEY ON THE WAY
 - VIRGINIA } IN PROCESS
 - MARYLAND }
 - GEORGIA }
 - NORTH CAROLINA } TO FOLLOW FY-81
 - SOUTH CAROLINA }
- LEGISLATIVE WORKSHOPS JHU/VPI/NC SL
 - MARYLAND PASSED GEOTHERMAL RESOURCES ACT 1978
 - VIRGINIA } 1979 & 1980 SESSIONS
 - DELAWARE }
 - GEORGIA }
 - NORTH CAROLINA } TO FOLLOW 1981
 - SOUTH CAROLINA }
- RESOURCE CONFIRMATION AND ENGINEERING DGE
 - DEEP WELL IN CRISFIELD, MD
 - COMPLETED } 1979
 - TESTED }
 - ABANDONED }
 - RFQ - SECOND WELL IN DELMARVA PLANNED FY-80
 - USER COUPLED
 - ADDITIONAL DEEP WELLS - FY-81

EASTERN GEOTHERMAL PROGRAMS

ATLANTIC COASTAL PLAIN (continued)

- MARKET ASSESSMENT JHU
 - AREA NEW JERSEY TO NORTH CAROLINA COMPLETED
 - REPORT IN PROCESS
 - AREA NORTH CAROLINA TO GEORGIA CY 1980
- ECONOMICS OF EASTERN GEOTHERMAL ENERGY JHU
 - SEVERAL CODES OF VARYING COMPLEXITY AVAILABLE
 - COSTS - UTILIZATION FACTOR OF WELL } CRITICAL
 - RESOURCE CHARACTERISTICS }
 - ROYALTY PAYMENTS - NOT A PROBLEM
 - POTENTIAL LITIGATION RE OWNERSHIP - DISINCENTIVE
 - OPTIMIZATION NECESSARY THROUGH CASCADE USE OR PEAKING SYSTEM
- PRDA - GEOTHERMAL UTILIZATION FOOD PROCESSING INDUSTRY, SALISBURY, MD CAMPBELL SOUP & BURNS & ROE
- ACTIVE SOLICITANTS
- SPACE HEATING
 - CRISFIELD HIGH SCHOOL, SOMERSET, MD
 - PITTSVILLE ELEMENTARY SCHOOL, WICOMICO, MD
 - DOWNTOWN SALISBURY, WICOMICO, MD
 - NEW COMMUNITY CENTER, OCEAN CITY, WORCESTER, MD
 - FOOD PROCESSOR - SHOWELL FARMS, SHOWELL, MD
 - MULTI-USE-LEWES, DELAWARE
 - MARICULTURE - OYSTERS AND CLAMS, CEDA CORP, ANNAPOLIS, MD
 - VAPORIZING LNG - COLUMBIA GAS, COVE POINT, MD

EASTERN GEOTHERMAL PROGRAMS

ATLANTIC COASTAL PLAIN (continued)

– HOT DRY ROCK EASTERN PROGRAM

LASL/CONTRACTORS

DELMARVA STUDY – CRISFIELD TO WALLOPS ISLAND
 STUMPY POINT, NORTH CAROLINA
 NEW YORK
 NEW HAMPSHIRE
 PENNSYLVANIA AND OHIO
 NEBRASKA
 SOUTHEASTERN COASTAL PLAIN
 WEST VIRGINIA
 ARKANSAS
 ILLINOIS/INDIANA

– USGS/WR – REGIONAL AQUIFER PROGRAM

USGS/WR

EASTERN GEOTHERMAL PROGRAMS

OTHER EASTERN AREAS

– RESOURCE ASSESSMENT PROGRAMS

DGE/STATES/VPI/LASL

DELAWARE	KANSAS	OHIO
ALABAMA	MISSOURI	NEW YORK
ARKANSAS	NEBRASKA	WEST VIRGINIA

– INITIAL DEFINITION OF SELECTED GEOTHERMAL RESOURCES

DGE/GRUY

ILLINOIS	VIRGINIA
IOWA	WEST VIRGINIA
INDIANA	MASSACHUSETTS
MISSOURI	MICHIGAN

– IDENTIFICATION OF EASTERN COUNTIES WITH RESOURCE AND MARKET MATCH – REPORTED

JHU

– LOAN GUARANTY AND GEOTHERMAL FINANCE BROKER

L. FALICK

– GEOTHERMAL APPLICATION ASSESSMENT FOR TVA REGION OF SOUTHEAST

ORAU

– TECHNICAL INFORMATION INTERCHANGE MEETING

JHU

– STATE FACT BOOKS

JHU