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THE STATE OF ALASKA GEOTHERMAL PROGRAM

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ABSTRACT

The State of Alaska geothermal program presently consists of a regional hot spring reconnaissance project and 15 proposed site-specific projects. The general outline of this program is presented.

INTRODUCTION

The intent of this report is to outline a geothermal program that will lead to immediate geothermal energy development in Alaska. Any investigation and/or assessment program intended to encourage immediate geothermal development in Alaska should concentrate on hydrothermal (i.e. hot water and/or steam) systems rather than hot dry-rock or molten-igneous systems. This strategy is necessary since the technology for harnessing hot dry-rock and molten-igneous energy is poorly developed (Peck, 1975; Smith, 1978; and Murphy, 1979). Hydrothermal systems are being successfully used with existing technology as energy sources throughout the world (Armstead, ed., 1973; and Wehlage, 1979). In order to better use geothermal energy in Alaska, further investigations such as described here will need to be undertaken.

PLAN OUTLINE

The State of Alaska hydrothermal resource investigation program consists of two basic concurrent projects: hot spring reconnaissance, and site-specific assessment. The available hot spring resources will be catalogued regionally; this will be accomplished by reconnaissance examinations of all known hot spring occurrences in the state. The concurrent second project of the geothermal program involves detailed investigations of at least one potentially developable hydrothermal site each year.

The hot spring reconnaissance activities are composed of field studies designed to acquire new data on each of the state's geothermal hot springs. Special attention will be given to collecting samples and data that will allow preliminary reservoir capacity and temperature estimates to be made. The results of this work will be published as an atlas entitled "Geologic Atlas of Hot Spring Areas in Alaska".

A modular site-specific hydrothermal exploration and reservoir assessment plan is outlined in figure 1. This modular plan identifies the tasks that must be accomplished in developing a successful geothermal-energy facility. Its form and content has been influenced by other plans successfully executed elsewhere (Goldstein, 1977; Ward, 1977; and Ball et al., 1979).

The site-specific assessment plan consists of 13 steps that are organized in five phases:

- Phase I, the initial assessment;
- Phase II, initial reservoir definition;
- Phase III, advanced assessment;
- Phase IV, commercial feasibility; and
- Phase V, development.

The steps within each phase contain one or more modules of critical tasks that should be completed and evaluated before proceeding to the next step.

The project design provides numerous checkpoints to terminate expenditures on a site if the accumulating data indicate a low probability of finding an exploitable energy source. The identification of specific modules of general tasks in this design allows flexibility in tailoring the details of a specific evaluation program to the peculiarities of the site involved. In this regard, figure 1 should be regarded as a general example for a hypothetical site which can be easily adjusted to fit local geological and logistical constraints.

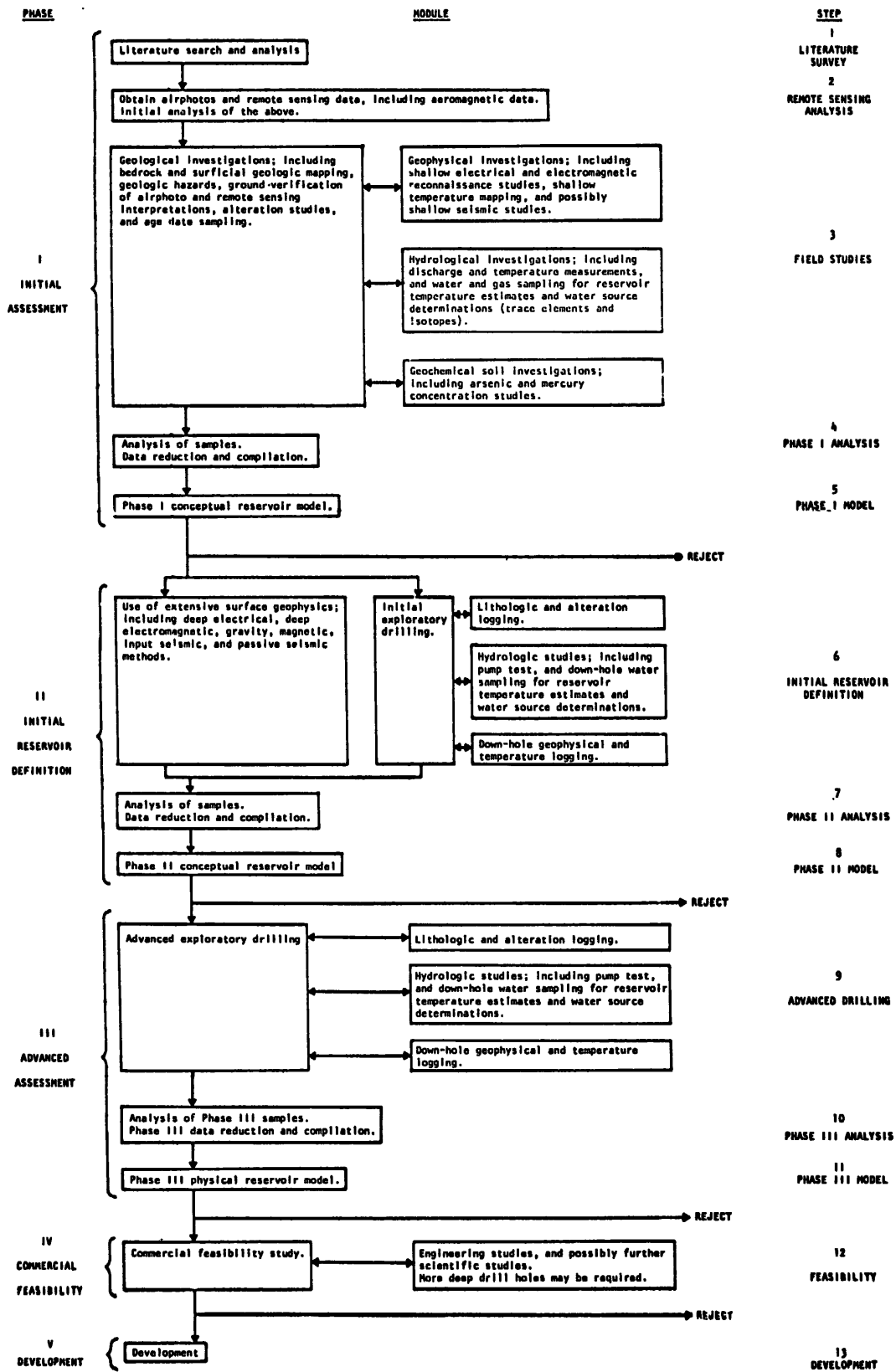


Figure 1. A modular site-specific hydrothermal exploration and reservoir assessment plan.

POTENTIALLY DEVELOPABLE SITES

Hydrothermal systems in Alaska are, in general, related to geologically young volcanoes, to fractured granitic plutons, and/or to large sedimentary basins. A tentative selection of 15 potentially developable hydrothermal sites, representing all of the above mentioned geological settings and a broad regional distribution throughout the state, is proposed for development consideration. These sites are:

Pilgrim Springs,
Kotzebue,
West side of Mount Drum (Klawasi),
Willow,
Chena Hot Springs,
Circle Hot Springs,
Manley Hot Springs,
Horner Hot Springs,
Clear Creek Hot Springs,
Central Baranof Island (Sitka Hot Springs),
Tenakee Hot Springs,
Northern part of Unalaska Island,
Umnak Island,
Emmons Caldera, and
Northeastern Atka Island.

This proposed site selection for hydrothermal development is based on the works by Waring (1917), Miller (1973), Miller and Barnes (1976), Turner et al. (1978), Markle (1979), Wescott and Turner, eds. (1979), and Turner and Forbes, eds. (1980). These sites are subject to change as new data become available from sources such as: the hot spring atlas project, mandates of the Alaska Legislature, and expressed needs of Alaskans.

The foregoing project plan for site-specific investigations, figure 1, has been adopted to these 15 selected sites. The exploration scenario developed for each site includes exploration techniques, required time, and estimated cost. The feasibility and development considerations for the sites are beyond the scope of these plans.

IMPLEMENTATION

General reconnaissance of Alaska hot springs required for the statewide atlas compilation is presently underway, funded by both the State of Alaska and the U. S. Department of Energy. This project should be completed within two years.

The number of detailed site-specific investigations to be undertaken in the near future will depend upon funding. Because field seasons are usually restricted to the summer months, Phase I field work should be conducted during the first summer of the funding period, where Phase II work should not be conducted until the following summer. Naturally, there are exceptions. For

example, exploratory drilling can be performed any time of the year at the Kotzebue site. But, for most Alaska hydrothermal sites, at least two years will be required just to accomplish a detailed hydrothermal assessment. Actual development of any site could easily require several more years. Site-specific hydrothermal investigations should be initiated immediately if Alaska is to realize its hydrothermal resources in the near future.

CLOSING

Unfortunately, the temperatures of most known hydrothermal systems in Alaska are too low for large electrical generation. Also, the systems are located in regions so remote and distant that transport of hydrothermal waters to communities is not feasible. In fact, most of the sites used in this program are probably uneconomical to develop at present.

Since a hydrothermal reservoir must yield 160 degree C waters before it is usually considered commercial for electrical generation (Greider, 1978), large electrical generation from hydrothermal resources is presently possible only in the Alaska Peninsula, Aleutian Islands, and possibly in the Wrangell Mountains. Thus, hydrothermal site-specific investigations in these regions should be strongly encouraged.

Hydrothermal systems which could be used for space heating are suspected near Alaskan communities such as Kotzebue, Shismaref, Saint Michael, Sitka, Copper Center, and Unalaska. Numerous other communities in Alaska may be located over presently unknown hydrothermal systems useable for space heating. Remote sensing, geological, and hydrological expertise should be combined in an effort to locate such hydrothermal systems at or near existing Alaskan communities.

Large electrical power generation is presently unlikely from low-temperature (under 160° C) waters (Abbin, 1978; and Demuth, 1979) of most known hydrothermal systems in the state. However, serious investigation of several low temperature remote sites should be of great importance. Such investigations would determine the actual value of such resources for direct use and small electrical power generation.

In general, the geothermal potential of Alaska is great; yet it is hardly used. Such energy resources should not be ignored as they have been in the past.

ACKNOWLEDGEMENTS

This work was supported by the Department of Energy under Contract DE-FG51-79R000074, administered by the Alaska State Division of Energy and Power Development.

Reeder et al.

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ALPHABETICAL INDEX OF AUTHORS

Ahmed, U., K. M. Wolgemuth, A. S. Abou-Sayed, J. F. Schatz and A. H. Jones: RAFT RIVER GEOTHERMAL SITE: A REINJECTION STUDY	385
Allen, Elliot M.: KLAMATH FALLS MUNICIPAL DISTRICT HEATING & RESERVOIR MANAGEMENT ORDINANCE: A PRELIMINARY OREGON MODEL ORDINANCE	759
Allis, Richard G.: POSSIBLE EFFECTS OF REINJECTION AT WAIRAKEI GEOTHERMAL FIELD	389
Allis, Richard G. and Russell James: A NATURAL-CONVECTION PROMOTER FOR GEOTHERMAL WELLS	409
Alvarez, Román: OUTLINING TECTONISM AND FAULTING WITH TELLURICS IN LOS HUMEROS - DERRUMBADAS GEOTHERMAL AREA	1
Ammerlaan, Anton C. F., Raymond M. Costello, Martin E. Knebel and Robert J. Czarnecki: EAST COAST GEOTHERMAL RESOURCES: DIRECT APPLICATIONS IN THE FROZEN FOOD INDUSTRY	541
Ander, Mark E., Ron Goss, David Strangway, Cary Hillebrand, A. W. Laughlin and Cassandra Hudson: MAGNETOTELLURIC/AUDIOMAGNETOTELLURIC STUDY OF THE ZUNI HOT DRY ROCK GEOTHERMAL PROSPECT, NEW MEXICO	5
Aplenc, Andrej and John A. Halat: A THERMAL PUMPING SYSTEM FOR HIGH TEMPERATURE RESERVOIRS	487
Arney, B. H., J. H. Beyer, D. B. Simon, F. B. Tonani and R. B. Weiss: HOT DRY ROCK GEOTHERMAL SITE EVALUATION, WESTERN SNAKE RIVER PLAIN, IDAHO	197
Atkinson, David J.: MARKETING GEOTHERMAL ENERGY FOR SPACE CONDITIONING	545
Atkinson, David J. and W. T. Meyer: LOW COST AIRBORNE GEOCHEMICAL DETECTION AND EVALUATION OF "BLIND" GEOTHERMAL RESERVOIRS	141
Atkinson, Paul G.: GEOTHERMAL RESERVOIR INITIAL STATE, BACA LOCATION NO. 1 - NEW MEXICO, REDONDO CREEK FIELD	435
Avera, Harmon Q.: REMOTE SENSING ANALYSIS INSTRUMENTATION FOR GEOTHERMAL EXPLORATION	145
Barron, William, Robin Dubin and Sally Kane: AN ANALYSIS OF BENEFITS AND COSTS OF ACCELERATED MARKET PENETRATION BY A GEOTHERMAL COMMUNITY HEATING SYSTEM	699
Bergosh, Jerry L., Richard G. Van Buskirk, Dan O. Enniss and Scott W. Butters: EAST MESA ROCK PROPERTIES AT SIMULATED <i>IN SITU</i> GEOTHERMAL CONDITIONS	309
Bhogal, P.S.: ELECTRICAL RESISTIVITY INVESTIGATIONS AT THE OLKARIA GEOTHERMAL FIELD, KENYA	9
Bjornsson, Helgi, Sveinbjorn Bjornsson and Thorbjorn Sigurgeirsson: GEOTHERMAL EFFECTS OF WATER PENETRATING INTO HOT ROCK BOUNDARIES OF MAGMA BODIES	13
Bodvarsson, Gudmundur S. and Chin Fu Tsang: INJECTION INTO A FRACTURED GEOTHERMAL RESERVOIR	393
Bond, Marc A.: ENVIRONMENTAL IMPACT OF GEOTHERMAL POWER DEVELOPMENT AND UTILIZATION	665
Bressler, Sandra E.: POTENTIAL FOR GEOTHERMAL DIRECT USE IN THE GREENHOUSE, LUMBER, CHEMICAL AND POTATO AND ONION PROCESSING INDUSTRIES	763
Brittenham, Terry L., R. Edward Williams, John C. Rowley and Joseph W. Neudecker: DIRECTIONAL DRILLING OPERATIONS HOT DRY ROCK WELL EE-2	273
Brown, F. C. and William H. Dyer: STATUS OF THE EIC PROCESS FOR HYDROGEN SULFIDE ABATEMENT	667
Butz, James R.: A CASE STUDY OF TWO-PHASE FLOW AT THE ROOSEVELT HOT SPRINGS, UTAH KGRA	439
Caenn, Ryen, D. A. Tyssee and O. J. Vetter: DEGRADATION OF POLYMERS USED IN GEOTHERMAL FRACTURING	413
Cannon, Melinda S., Charles A. Tabet and Yoram Eckstein: A LOW ENTHALPY CONVECTIVE SYSTEM IN WESTERN OHIO	105

Carrier, D. L. and D. S. Chapman: GRAVITY AND THERMAL MODELS OF THE TWIN PEAKS MAGMA SYSTEM, WEST-CENTRAL UTAH	17
Carson, C. C. and Y. T. Lin: GEOTHERMAL WELL COST SENSITIVITY ANALYSIS: CURRENT STATUS	277
Castanier, Louis and Subir K. Sanyal: GEOTHERMAL RESERVOIR MODELING - A REVIEW OF APPROACHES	313
Castrantas, Harry M.: HYDROGEN SULFIDE ABATEMENT WITH HYDROGEN PEROXIDE IN GEOTHERMAL OPERATIONS	637
Chang, P. T. and C. S. Lee: GEOLOGICAL INVESTIGATION OF LUSHAN GEOTHERMAL FIELD, CENTRAL TAIWAN	109
Chaturvedi, Lokesh and Jeffrey K. Lory: A PRELIMINARY EVALUATION OF GEOTHERMAL POTENTIAL OF SAN JUAN BASIN, NEW MEXICO, USING BOTTOM HOLE TEMPERATURES FROM OIL AND GAS WELLS	21
Chen, Bill H., Louis P. Lopez, James T. Kuwada and Ray J. Farrington: PROGRESS REPORT ON HGP-A WELLHEAD GENERATOR FEASIBILITY PROJECT	491
Cheng, M. C. and H. B. Crichlow: USE OF SEQUENTIAL METHOD IN GEOTHERMAL RESERVOIR SIMULATION	317
Childs, F. W., K. W. Jones, L. B. Nelson, J. A. Strawn and M. K. Tucker: PROGRESS IN DIRECT HEAT APPLICATIONS PROJECTS	549
Christensen, Odin D., Joseph N. Moore and Regina M. Capuano: TRACE ELEMENT GEOCHEMICAL ZONING IN THE ROOSEVELT HOT SPRINGS THERMAL AREA, UTAH	149
Christopherson, Karen R.: GEOPHYSICAL STUDIES OF THE LASSEN KGRA, CALIFORNIA	25
Christopherson, Karen R., Carl L. Long and Donald B. Hoover: AIRBORNE ELECTROMAGNETIC SURVEYS AS A RECONNAISSANCE TECHNIQUE FOR GEOTHERMAL EXPLORATION	29
Coe, Barbara A.: THE EFFECT OF HUMAN JUDGMENT ON GEOTHERMAL LEASING: A CASE STUDY	767
Coe, Barbara A., Paul Bright and Richard T. Meyer: IDENTIFICATION OF PROSPECTIVE INDUSTRIAL GEOTHERMAL ENERGY USERS	553
Connors, James H., II and Michael J. Otto: A NEW AND DIFFERENT GEOTHERMAL DRILLING FLUIDS SYSTEM	281
Cordon, Ulrich J.: MOMOTOMBO FIELD MODELS AT SIX STAGES IN TIME	443
Cordon, Ulrich J. and Ernst G. Zurfleuh: GEOPHYSICAL INVESTIGATIONS AT MOMOTOMBO, NICARAGUA	447
Covington, H. R.: SUBSURFACE GEOLOGY OF THE RAFT RIVER GEOTHERMAL AREA, IDAHO	113
Cox, Malcolm E.: CHEMICAL DESCRIPTION OF THERMAL WATERS IN THE FIJI ISLANDS	153
Cox, Malcolm E. and Kevin E. Cuff: Rn AND Hg SURVEYS: GEOTHERMAL EXPLORATION IN N.E. MAUI, HAWAII	451
Crecraft, Harrison R., W. P. Nash and S. H. Evans, Jr.: CHEMICAL AND THERMAL EVOLUTION OF THE TWIN PEAKS MAGMA SYSTEM, WEST CENTRAL UTAH	117
Darby, d'E.C.: ARSENIC AND BORON IN THE TONGONAN ENVIRONMENT	671
Davis, A. E., W. I. Enderlin, D. E. Blahnik, J. J. Jacobson and S. A. Weakley: ASSESSMENT OF GEOTHERMAL ENERGY AS A POWER SOURCE FOR U.S. ALUMINUM REDUCTION PLANTS	495
DeMouilly, Gregory T. and Robert F. Corwin: SELF-POTENTIAL SURVEY RESULTS FROM THE BEOWAWE KGRA, NEVADA	33
Denton, Barry N.: INVESTIGATION AND DEVELOPMENT OF GEOTHERMAL ENERGY IN NEW ZEALAND FROM 1978 TO 1980	455
Diment, W. H., T. C. Urban and Manuel Nathenson: NOTES ON THE SHALLOW THERMAL REGIME OF THE LONG VALLEY CALDERA, MONO COUNTY, CALIFORNIA	37

Donovan, Joseph J., Charles J. Wideman and John L. Sonderegger III: GEOCHEMICAL EVALUATION OF SHALLOW DILUTION OF GEOTHERMAL WATER IN THE LITTLE BITTERROOT VALLEY, MONTANA	157
Eastlake, William B.: A PRIMER ON ECONOMIC FEASIBILITY FOR DIRECT-USERS	703
Ehlig-Economides, Christine, Michael J. Economides and Frank G. Miller: INTERFERENCE BETWEEN WELLS IN A FRACTURED FORMATION	321
Elders, Wilfred A., James R. Hoagland and Alan E. Williams: HYDROTHERMAL ALTERATION AS AN INDICATOR OF TEMPERATURE AND FLOW REGIME IN THE CERRO PRIETO GEOTHERMAL FIELD OF BAJA CALIFORNIA	121
Eliasson, Einar T., Ásbjorn Einarsson and Valdimar K. Jónsson: KRAFLA GEOTHERMAL ELECTRIC POWER PLANT, ICELAND	499
Ennis, Dan O., J. L. Bergosh, S. W. Butters and A. H. Jones: DRILLING FLUID/FORMATION INTERACTION AT SIMULATED <i>IN SITU</i> GEOTHERMAL CONDITIONS	285
Erickson, Mary V.: THE UTILIZATION OF GEOTHERMAL ENERGY IN THE MINING AND PROCESSING OF TUNGSTEN ORE	557
Fassbender, Linda L., Clarence H. Bloomster and Bobi A. Price: THE ECONOMICS OF GEOTHERMAL, SOLAR AND CONVENTIONAL SPACE HEATING	707
Fick, Theodore R., Jerome W. Hankin, Alexander Renton and Robert K. Swanson: TECHNICAL AND ECONOMIC ASSESSMENT OF GEOPRESSURED ENERGY RECOVERY AND CONVERSION	711
Finger, John T.: LABORATORY TESTING OF PERCUSSION DRILLS FOR GEOTHERMAL APPLICATIONS	289
Finn, Donald F. X.: GEOTHERMAL DEVELOPMENTS IN THE PHILIPPINES - 1980	771
Finn, Donald F. X.: U.S. GAO STUDIES OF GEOTHERMAL ENERGY	775
Fiore, Joseph N.: OVERVIEW AND STATUS OF THE U.S. DEPARTMENT OF ENERGY'S INDUSTRY - COUPLED GEOTHERMAL RESERVOIR ASSESSMENT PROGRAM	201
Flynn, Thomas, Brian A. Koenig, Dennis T. Trexler and James L. Bruce: AREA SPECIFIC INVESTIGATIONS OF THREE LOW- TO MODERATE-TEMPERATURE GEOTHERMAL RESOURCE AREAS IN NEVADA	41
Foley, Duncan, Gerald P. Brophy, Leland L. Mink and Robert E. Blackett: THE STATE COUPLED PROGRAM - A NEW EMPHASIS	779
Foster, John W.: A PRIVATE COMMERCIAL HDR ENERGY EXTRACTION PROGRAM: TECHNICAL DETAILS, EXPECTATIONS FOR POWER GENERATION AND PROPRIETARY PROCEDURES	503
Fritz, Peter, Ian D. Clark, Frederick A. Michel and Jack G. Souther: ISOTOPE HYDROGEOLOGY AND GEOTHERMOMETRY OF THE MOUNT MEAGER GEOTHERMAL AREA	161
Fritzler, Eugene A. and Glenn E. Coury: GEOTHERMAL APPLICATION OF HEAT EXCHANGER DESIGN FOR DESALINATION PLANTS	561
Fritzler, Eugene A. and Glenn E. Coury: PRELIMINARY PROCESS AND COST ANALYSIS OF A MULTIPURPOSE GEOTHERMAL POWER AND DESALINATION PLANT	507
Garg, S. K.: SHALE RECHARGE AND PRODUCTION BEHAVIOR OF GEOPRESSURED RESERVOIRS	325
Garney, T. A. and R. E. Roesner: DEVELOPMENT OF A WIRELINE SERVICE FOR USE IN PRODUCING GEOTHERMAL WELLS	329
Gobran, Brian D., William E. Brigham and Subir K. Sanyal: THE TEMPERATURE DEPENDENCE OF PERMEABILITY	397
Goering, Steven W. and Frances R. Connor: GEOTHERMAL-BASED INDUSTRIAL PARK DEVELOPMENT IN SOUTH-CENTRAL COLORADO	565
Goldsmith, Louis H.: REGIONAL AND LOCAL GEOLOGIC STRUCTURE OF THE MOMOTOMBO FIELD, NICARAGUA	125

Goodman, Allen C.: GEOTHERMAL MARKET PENETRATION IN THE RESIDENTIAL SECTOR: CAPITAL STOCK IMPEDIMENTS AND COMPENSATORY INCENTIVES	715
Gosnold, William D.: PRELIMINARY REPORT ON THE GEOTHERMAL RESOURCE POTENTIAL OF NEBRASKA	45
Grannell, Roswitha B.: THE USE OF SURFACE GRAVITY METHODS IN MONITORING SUBSURFACE RESERVOIR CHANGES, WITH CASE STUDIES AT CERRO PRIETO, MEXICO, AND HEBER, CALIFORNIA	49
Grant, Malcolm A. and Roland N. Horne: THE INITIAL STATE AND RESPONSE TO EXPLOITATION OF WAIRAKEI GEOTHERMAL FIELD	333
Gray, Robert A., Susan M. Prestwich, Phillip M. Wright and Max R. Dolenc: USER-COUPLED CONFIRMATION DRILLING PROGRAM	783
Grogger, Paul K.: THE UTILIZATION OF GEOTHERMAL RESOURCES AT UNITED STATES AIR FORCE BASES	787
Guffanti, Marianne and Manuel Nathenson: PRELIMINARY MAP OF TEMPERATURE GRADIENTS IN THE CONTERMINOUS UNITED STATES	53
Gupta, Harsh K., Tzeu-Lie Lin and Ronald W. Ward: INVESTIGATION OF THE SEISMIC WAVE VELOCITIES AT THE GEYSERS GEOTHERMAL FIELD, CALIFORNIA	57
Gutmann, James T., Carlos L. V. Aiken, Mark E. Ander and Randy T. Laney: PRELIMINARY GEOLOGICAL AND GEOPHYSICAL EVALUATION OF THE CASTLE DOME HDR GEOTHERMAL PROSPECT, SOUTHWESTERN ARIZONA	205
Hanson, Jonathan M.: RESERVOIR RESPONSE TO TIDAL AND BAROMETRIC EFFECTS	337
Harder, Vicki, Paul Morgan and Chandler A. Swanberg: GEOTHERMAL RESOURCES IN THE RIO GRANDE RIFT: ORIGINS AND POTENTIAL	61
Heard, Fred E.: UPGRADING THE ACOUSTIC BOREHOLE TELEVIEWER FOR GEOTHERMAL FRACTURE MAPPING	341
Hendrickson, R. R. and R. W. Winzenried: DEVELOPMENT AND TESTING OF SEALS AND LUBRICANTS FOR GEOTHERMAL ROCK BITS	293
Higbee, Charles V.: PRICING DIRECT-USE GEOTHERMAL ENERGY	719
Hilfiker, Kenneth, Carol Hanley, Dennis Hodge, Paul Morgan, James Maxwell and Chandler Swanberg: CORRELATION OF SILICA HEAT FLOW AND TEMPERATURE GRADIENTS, CENTRAL AND WESTERN NEW YORK	209
Horne, Roland N.: DESIGN CONSIDERATIONS OF A DOWN-HOLE COAXIAL GEOTHERMAL HEAT EXCHANGER	569
Horne, Roland N. and Abdurrahman Satman: A STUDY OF DRAWDOWN AND BUILDUP TESTS IN WELLS WITH PHASE BOUNDARIES	345
Howard, J. H.: PRICE AND COST ESTIMATES FOR HOT WATER GEOTHERMAL ENERGY	723
Hutchinson, R. A.: BOUNDARY CREEK THERMAL AREAS OF YELLOWSTONE NATIONAL PARK: I. THERMAL ACTIVITY AND GEOLOGIC SETTING	129
Huxtable, D., R. Szymanek and B. A. Housse: DIRECT USE OF DEEP LOW ENTHALPY FRESH WATERS FOR DISTRICT HEATING IN FRANCE	573
Ireland, Robert R. and James L. Carter: CHEMICAL ECOLOGY INVESTIGATIONS AT THE GEYSERS, CALIFORNIA	675
James, Russell: VERTICAL TEMPERATURE GRADIENTS WITHIN DISCHARGING STEAM-WATER BOREHOLES CAN INDICATE FLOW-RATE	349
Julian, R. Keith and Arrie Bachrach: PUBLIC ACCEPTANCE AND SUPPORT FOR GEOTHERMAL DEVELOPMENT IN THE 1980'S--AN ISSUE DESERVING INDUSTRY CONCERN AND ACTION	791
Julian, R. Keith and Louise W. Hall: ENVIRONMENTAL ATTITUDES AND PUBLIC CONCERNS REGARDING LARGE-SCALE GEOTHERMAL DEVELOPMENT: THE COSO GEOTHERMAL AREA AS CASE STUDY	679

Kandarpa, Viv and O. J. Vetter: DEGRADATION CHARACTERISTICS OF COTTON SEED HULLS AND SAWDUST IN HIGH TEMPERATURE GEOTHERMAL BRINES	297
Kauahikaua, James, Mark Mattice and Dallas Jackson: MISE-A-LA-MASSE MAPPING OF THE HGP-A GEOTHERMAL RESERVOIR, HAWAII	65
Kauffman, David, Arthur V. Houghton and Stephen B. Brotzman: DIMENSIONAL ANALYSIS OF AN ECONOMIC MODEL FOR A HOT-WATER GEOTHERMAL HEATING SYSTEM	727
Kauffman, David, Arthur V. Houghton, Jay C. Cortner, M. C. Lee, Charles F. Moyers, Aydin Urgan and John E. Vogel: FEASIBILITY OF RETROFIT GEOTHERMAL HEATING SYSTEM FOR THE UNIVERSITY OF NEW MEXICO CAMPUS	577
Kindle, C. H.: INSTITUTIONAL STANDARDIZATION OF GEOTHERMAL FLUID CHARACTERIZATION TECHNIQUES	795
King, Diana: THE ROLE OF GAS AND ELECTRIC UTILITIES IN DIRECT APPLICATIONS OF GEOTHERMAL ENERGY	799
Knirsch, Karen F. and Daniel D. Carda: GEOCHEMICAL INVESTIGATIONS AT EDMONT, SOUTH DAKOTA	165
Koenig, Brian A., Dennis T. Trexler and Thomas Flynn: FLUID CHEMISTRY STUDIES OF THREE LOW- TO MODERATE-TEMPERATURE GEOTHERMAL RESOURCE AREAS IN NEVADA	169
Kron, Andrea and Grant Heiken: GEOTHERMAL GRADIENT MAP OF THE UNITED STATES	69
Kruger, Paul and Vasek Roberts: UTILITY INDUSTRY ESTIMATES OF GEOTHERMAL ELECTRICITY	511
Ladd, Thomas A.: INSTITUTIONAL PROBLEMS RELATED TO DEVELOPMENT OF GEOTHERMAL RESOURCES LOCATED WITHIN DEPARTMENT OF DEFENSE LAND HOLDINGS	803
Lansford, Robert R., Lokesh N. Chaturvedi, George H. Abernathy, Bobby J. Creel, Dale C. Nelson, Donald J. Cotter, Noel R. Gollehon, Tom S. Clevenger and R. C. Patterson: UTILIZATION OF GEOTHERMAL ENERGY FOR AGRIBUSINESS DEVELOPMENT IN SOUTHWESTERN NEW MEXICO	581
Larson, Tod and Syd Willard: MARKET SURVEY FOR INDUSTRIAL AND COMMERCIAL USES OF GEOTHERMAL ENERGY IN CALIFORNIA	731
Lau, K. H.: THE EFFECT OF PERMEABILITY ON COOLING OF MAGMATIC INTRUSION IN A GEOTHERMAL RESERVOIR	133
Lee, Ching-Ray, Ching-Fang Lee and Weng-Tse Cheng: APPLICATION OF ROVING BIPOLE-DIPOLE MAPPING METHOD TO THE CHINGSHUI GEOTHERMAL AREA, TAIWAN	73
Li, Charles T.: REMOVAL OF H ₂ S FROM GEYSERS' STACKING GEOTHERMAL STEAM	683
Little, Nathan H.: PIPELINE SIZING AND SELECTION	641
Little, Nathan H. and Roger R. Bissell: BOISE GEOTHERMAL DISTRICT HEATING SYSTEM - TECHNICAL DESIGN	585
Lockhart, Andrew and Juergen Kienle: SEISMIC REFRACTION AND GRAVITY SURVEYS OF PILGRIM SPRINGS KGRA, ALASKA	213
Lockner, David A. and James D. Byerlee: STRENGTH MEASUREMENTS OF THE GEYSERS RESERVOIR ROCK	353
Lohse, Richard L.: GEOTHERMAL ASSESSMENT OF DOÑA ANA COUNTY, NEW MEXICO	217
Lopez, Albert F., Daniel J. Entingh and Edward A. Neham: THE GEOTHERMAL PROGRESS MONITOR	807
Lopez, Carlos V. and Yoram Eckstein: SIX MONTH PRODUCTION TEST AT MOMOTOMBO, NICARAGUA: PRELIMINARY RESULTS	357
Lopez, Carlos V., Brian R. Hoyt and Yoram Eckstein: SUBSURFACE TEMPERATURE DISTRIBUTION AND STRUCTURE OF THE GEOTHERMAL RESERVOIR AT MOMOTOMBO, NICARAGUA	459
Mabey, Don R.: THE GEOTHERMAL RESOURCES OF SOUTHERN IDAHO	77

Mackelprang, Claron E., Joseph N. Moore and Howard P. Ross: A SUMMARY OF THE GEOLOGY AND GEOPHYSICS OF THE SAN EMIDIO KGRA, WASHOE COUNTY, NEVADA	221
Major, Bruce H. and Clifford L. Witten: UPGRADING AMERADA-TYPE SURVEY CLOCKS FOR HIGH-TEMPERATURE GEOTHERMAL SERVICE	361
Mathews, Mark: CALIBRATION MODELS FOR FRACTURED IGNEOUS ROCK ENVIRONMENTS	81
Mattice, Mark D. and Barry R. Lienert: SCHLUMBERGER SURVEY OF MAUI ISLAND, STATE OF HAWAII	85
McConnell, Thomas D.: PRESSURE INSTRUMENTATION FOR GEOTHERMAL BOREHOLE LOGGING	365
McCright, R. D., W. F. Frey and G. E. Tardiff: LOCALIZED CORROSION OF STEELS IN GEOTHERMAL STEAM/BRINE MIXTURES	645
McDonald, William J., William C. Maurer, Joseph W. Neudecker, Jr. and Harold D. Shoemaker: DEVELOPMENT OF TURBODRILL TACHOMETER	301
McReynolds, Angus S. and Herb L. Maxson: THE UTILIZATION OF ENDLESS COILED TUBING AND NITROGEN GAS IN GEOTHERMAL WELL SYSTEM MAINTENANCE	417
Meal, Harlan C. and Higinio Guillamon-Duch: A COST COMPARISON BETWEEN GEOTHERMAL AND COGENERATION SOURCES OF PROCESS HEAT	735
Metzler, John E.: STATUS OF DOE'S INTERNATIONAL COOPERATIVE EFFORTS IN GEOTHERMAL ENERGY	811
Meyer, Richard T.: TARGET INDUSTRIES FOR GEOTHERMAL DIRECT HEAT APPLICATIONS	589
Meyer, Richard T. and Leonard D. Bronder: EVALUATION OF STATE TAXES AND TAX INCENTIVES AND THEIR IMPACT ON THE DEVELOPMENT OF GEOTHERMAL ENERGY IN WESTERN STATES	739
Meyer, Richard T., Barbara A. Coe, Louise H. Nasr and Matthew Bixler: THE GEOTHERMAL LOAN GUARANTY PROGRAM: RECOMMENDATIONS FOR IMPROVEMENT INCLUDING NEW SIMPLIFIED APPLICATION PROCEDURES FOR SMALL PROJECTS	751
Mezga, L. J. and R. A. Brechbill: RELATIONSHIP BETWEEN THE DOE LOAN GUARANTY AND CALIFORNIA ENVIRONMENTAL QUALITY ACT ENVIRONMENTAL REVIEW PROCESSES	687
Michaelides, Efstathios E.: SEPARATION OF NONCONDENSABLES IN GEOTHERMAL INSTALLATIONS BY MEANS OF PRIMARY FLASHING	515
Michels, Donald E.: A COMPACT INLINE SEPARATOR FOR SAMPLING LIQUID AND VAPOR FROM A 2-PHASE FLOWLINE	173
Michels, Donald E.: DEPOSITION OF CaCO ₃ IN POROUS MATERIALS BY FLASHING GEOTHERMAL FLUID	463
Mikić, Borivoje, Harlan C. Meal, Higinio Guillamon-Duch and Michael B. Packer: THERMAL DESIGN OPTIMIZATION OF INDUSTRIAL PROCESSES WHEN GEOTHERMAL ENERGY IS AVAILABLE	593
Moreau, Jim and W. Lloyd Jones: DIRECT HEAT GEOTHERMAL OPPORTUNITIES AT PAHOA, HAWAII	597
Morita, Nobuo, Brian W. Roberts, Kenneth E. Gray and Irwin H. Silberberg: RELATIVE PERMEABILITY MEASUREMENTS OF ROCKS FROM THE TEXAS GULF COAST GEOPRESSURED-GEOTHERMAL RESERVOIR AT LOW FREE GAS SATURATIONS	369
Morris, C. W., R. V. Verity and A. R. Sinclair: RAFT RIVER WELL STIMULATION EXPERIMENTS	419
Nichols, Kenneth E., Robert G. Olander and James L. Lobach: TEST RESULTS FROM THE 500 KW DIRECT CONTACT PILOT PLANT AT EAST MESA	519
O'Sullivan, Michael and Karsten Pruess: ANALYSIS OF INJECTION TESTING OF GEOTHERMAL RESERVOIRS	401
Olson, Deborah M. and Russ H. Robinson: EXPLORATION MODEL FOR POSSIBLE GEOTHERMAL RESERVOIR, COSO HOT SPRINGS KGRA, INYO CO., CALIFORNIA	225
Parker, Mark D. and George R. Jiracek: PROGRESS TOWARD EVALUATING THE GEOTHERMAL RESOURCE IN THE ALBUQUERQUE, NEW MEXICO AREA	229

Pettitt, Roland A.: MONITORING AND REPAIRING GEOTHERMAL CASING CEMENT: A CASE HISTORY	649
Pettitt, Roland A., Randy Laney, Dan George and Gary Clemens: EVOLUTION OF A HYBRID ROLLER CONE/PDC CORE BIT	305
Pick, James B. and Edgar W. Butler: BEGINNINGS OF GEOTHERMAL IMPACT ON COUNTY POPULATION AND LEADERSHIP, IMPERIAL COUNTY, CALIFORNIA	815
Pilkington, H. Dean, Arthur L. Lange and Fred E. Berkman: GEOTHERMAL EXPLORATION AT THE TUSCARORA PROSPECT IN ELKO COUNTY, NEVADA	233
Pope, William L., Padraic A. Doyle, Robert L. Fulton and Lenard F. Silvester: THE IMPORTANCE OF THE SPECIFIC HEAT ANOMALY IN THE DESIGN OF BINARY RANKINE CYCLE POWER PLANTS	523
Prestwood, Donna C. L., JoAnn M. Duffy, Michael Stone and John H. Vanston, Jr.: ALTERNATE ENERGY INVESTMENT DECISION MODELLING: THE CASE OF GEOPRESSURED-GEOTHERMAL INVESTMENT DECISIONS	755
Quong, Roland, L. B. Owen, F. E. Locke, C. H. Otto, R. Netherton and L. E. Lorenson: METHANE EXTRACTION FROM GEOPRESSURED-GEOTHERMAL BRINE AT WELLHEAD CONDITIONS	819
Radja, Vincent T.: RESULT OF THE PRELIMINARY GEOTHERMAL INVESTIGATION AT THE ISLAND OF FLORES, NUSATENGARA TIMUR, INDONESIA	237
Rasmussen, T. L. and J. F. Whitbeck: RAFT RIVER 5 MW(e) GEOTHERMAL PILOT PLANT PROJECT	527
Reeder, John W., Roman J. Motyka and Milton A. Wiltse: THE STATE OF ALASKA GEOTHERMAL PROGRAM	823
Reistad, Gordon M. and Paul Means: UNITARY WATER-SOURCE HEAT PUMPS FOR GEOTHERMAL APPLICATIONS: AVAILABILITY, PERFORMANCE AND DESIGN	601
Riney, T. D., J. W. Pritchett and L. F. Rice: THREE-DIMENSIONAL MODEL OF EAST MESA HYDROTHERMAL SYSTEM	467
Robinson, Frank E., Kirpal Singh, Wade Berry and Terry R. Thomas: PLANT SUPPORT CAPABILITIES OF A GEOTHERMAL FLUID	691
Rudisill, Jacob M. and Roy C. Skinner: A RPN COMPUTER SOLUTION OF THE JAMES' METHOD OF METERING TWO-PHASE FLOW	373
Ryan, Gene P.: HEATING FACILITIES FOR THE CITY SCHOOLS--EPHRATA, WASHINGTON	605
Sanyal, S. K., M. Gardner, J. B. Koenig and J. McIntyre: WELL-SITE EVALUATION OF LOGS FROM A GEOTHERMAL WELL	471
Sanyal, Subir K., Larry E. Wells, Charles Cloney and Mark Mathews: COMPUTER ANALYSIS OF A LIMITED WELL LOG SUITE IN A GEOTHERMAL WELL - A CASE HISTORY	475
Satkin, Richard L., Kenneth H. Wohletz and Michael F. Sheridan: WATER GEOCHEMISTRY AT CASTLE HOT SPRINGS, ARIZONA	177
Schatz, J. F., K. M. Wolgemuth and S. Vonder Haar: EVIDENCE OF PRESSURE SOLUTION IN GEOTHERMAL RESERVOIR SANDSTONE	377
Schmitt, R. C. and V. G. Murphy: AUTOHYDROLYSIS - A PROCESS SYSTEM FOR UTILIZING GEOTHERMAL FLUIDS IN CONVERTING LIGNOCELLULOSE BIOMASS TO ALCOHOL FUELS	609
Schoderbek, Stephen E., Dennis J. Anderson and Jean M. Miewald: COST UNCERTAINTY AND SIMPLE MODELING FOR DIRECT USE GEOTHERMAL RESOURCES	743
Schubert, Carl E., James C. Maxwell and William J. Johnson: THE EASTERN HOT DRY ROCK TARGET PROSPECT - A CASE HISTORY	241
Shan-yao, Huang, Wang Ji-yang, Wang Jun and Huang Go-shan: OUTLINE OF MULTIPURPOSE UTILIZATION OF GEOTHERMAL RESOURCES IN CHINA	479
Sherwood, P. B. and M. A. Marquis: THE BACA DATA DISSEMINATION PROGRAM	531

Simmons, George M. and James A. Batdorf: APPLICATION OF COMPUTER SIMULATION TO GEOTHERMAL HEATING SYSTEMS	613
Sinclair, A. Richard , Frederick J. Pittard and Robert J. Hanold: GEOTHERMAL WELL STIMULATION	423
Slatter, A.: A SIMPLE FLOW-METER FOR USE IN GEOTHERMAL WELLS	245
Smith, Roger Norman: HEAT FLOW OF THE WESTERN SNAKE RIVER PLAIN	89
Spencer, S. G. and D. Goldman: NUMERICAL SIMULATION OF THE IMPACT OF FLUID INJECTION IN THE RAFT RIVER GEOTHERMAL AREA	405
Standley, Larry E. and John C. Austin: GEOTHERMAL ENERGY FOR COLLEGE CAMPUS SPACE HEATING AND AGRICULTURAL DEMONSTRATION	617
Staub, W. P.: A PRELIMINARY DIRECT HEAT GEOTHERMAL RESOURCE ASSESSMENT OF THE TENNESSEE VALLEY REGION	137
Stiger, Robert R.: ALCOHOL PRODUCTION: AN APPROPRIATE USE OF HYDROTHERMAL ENERGY	621
Strawn, J. A.: RESULTS OF ACID TREATMENTS IN HYDROTHERMAL DIRECT HEAT EXPERIMENT WELLS	427
Struhsacker, E. M. and Christian Smith: MODEL FOR A DEEP CONDUIT TO THE BEOWAWE GEOTHERMAL SYSTEM, EUREKA AND LANDER COUNTIES, NEVADA	249
Studt, F. E. and P. G. M. Imrie: A STUDY OF FURTHER POWER GENERATION DEVELOPMENT AT TONGONAN LEYTE PHILIPPINES	483
Taylor, Bruce, Robert F. Roy and Jerry M. Hoffer: HUECO TANKS: AN INITIAL EVALUATION OF A POTENTIAL GEOTHERMAL AREA NEAR EL PASO, TEXAS	253
Thomas, Donald M.: WATER AND GAS CHEMISTRY FROM HGP-A GEOTHERMAL WELL: JANUARY 1980 FLOW TEST	181
Thomas, Donald M., Malcolm E. Cox, Barry R. Lienert, James P. Kauahikaua and Mark D. Mattice: PRELIMINARY GEOTHERMAL ASSESSMENT SURVEYS FOR THE STATE OF HAWAII	185
Thompson, J. M. and R. A. Hutchinson: BOUNDARY CREEK THERMAL AREAS OF YELLOWSTONE NATIONAL PARK: II. THERMAL WATER ANALYSES	189
Tonani, Franco B. and Maren A. Teilman: GEOCHEMISTRY AT MOMOTOMBO, NICARAGUA: ONE ASPECT IN A GEOTHERMAL FIELD CASE HISTORY	193
Toth, William J., William F. Barron, Sally Kane and Bruce Milo: GRITS: A COMPUTER MODEL FOR ECONOMIC EVALUATIONS OF DIRECT-USES OF GEOTHERMAL ENERGY	747
Treat, Ned L. and Catherine H. Levison: A PRELIMINARY IDENTIFICATION OF POTENTIAL GEOTHERMAL ENERGY USES IN THE TENNESSEE VALLEY REGION	625
Tucker, Robert E., Paul V. Kleinhaus, Jr. and L. R. Keilman: SMUDGE #1: ECONOMIC IMPACTS ON GEOTHERMAL POWER PLANT DESIGN	533
Turner, Donald L., Robert B. Forbes, Eugene M. Wescott, Juergen Kienle, Thomas Osterkamp, Samuel Swanson, Daniel Hawkins, William Harrison, Joan Gosink, Jeffrey Kline, Roman Motyka, Richard Reger and Mary Moorman: SUMMARY OF RESULTS OF A GEOLOGICAL AND GEOPHYSICAL INVESTIGATION OF THE GEOTHERMAL ENERGY POTENTIAL OF THE PILGRIM SPRINGS KGRA, ALASKA	93
Ushijima, Keisuke: AUTOMATIC INTERPRETATION OF SCHLUMBERGER SOUNDINGS	97
Vetter, O. J. and R. W. Nicholson: GRAND SCHEME FOR THE GEOTHERMAL INDUSTRY IN THE IMPERIAL VALLEY	695
Wehlage, Edward F.: NEW MATERIAL - COPOLYMER CARBON COMPOSITE (CCC) FOR HYDROTHERMAL PIPING	653
Wehlage, Edward F.: THE PRODUCTION OF "FOOD GRADE" (CULINARY) STEAM WITH GEOTHERMAL (GEO-HEAT) FOR INDUSTRIAL USE	657

Wescott, Eugene, Richard Sydora, Jerry Peace and Andrew Lockhart: ELECTRICAL RESISTIVITY SURVEY OF THE PILGRIM SPRINGS GEOTHERMAL AREA, ALASKA	257
Whelan, J., C. Halsey and B. Jackson: GEOTHERMAL EVALUATION OF RANGE BRAVO 19, NAVAL AIR STATION, FALLON, NEVADA	261
Wiggins, D. J. and C. J. Bliem: OPERATIONAL UPSET TRANSIENTS IN A DUAL BOILING BINARY CYCLE GEOTHERMAL POWER PLANT	537
Wilt, M., J. H. Beyer and N. E. Goldstein: A COMPARISON OF DIPOLE-DIPOLE RESISTIVITY AND ELECTROMAGNETIC INDUCTION SOUNDING OVER THE PANTHER CANYON THERMAL ANOMALY, GRASS VALLEY, NEVADA	101
Wolgemuth, K. M., A. S. Abou-Sayed, U. Ahmed, J. F. Schatz and A. H. Jones: FRACTURE ACIDIZATION STUDY OF CALCAREOUS SILTSTONE FROM A GEOTHERMAL RESERVOIR	431
Wonstolen, Kenneth A.: GEOTHERMAL ENERGY: BASIC LEGAL PARAMETERS	661
Wood, Spencer H., John C. Mitchell and John Anderson: SUBSURFACE GEOLOGY AND GEOTHERMAL PROSPECTS IN THE NAMPA-CALDWELL AREA OF THE WESTERN SNAKE RIVER PLAIN, IDAHO	265
Young, Charles: GEOTHERMAL RECONNAISSANCE ON THE FORT APACHE INDIAN RESERVATION USING ELECTRICAL METHODS	269
Yu, K. and F. C. Paddison: TECHNICAL ASSISTANCE - HYDROTHERMAL RESOURCE APPLICATION IN THE EASTERN U. S.	629
Zais, Elliot J. and Gunnar Bodvarsson: PRODUCTION DECLINE ANALYSIS	381
Zeller, Thomas J., William H. Grams and Stanley M. Howard: DIRECT UTILIZATION OF A MODERATE TEMPERATURE GEOTHERMAL RESOURCE IN AGRIBUSINESS	633