News of Science

Geothermal Power in New Zealand

Atomic energy for power is being considered by many nations including New Zealand, but its practical application is generally conceded to be many years in the future. Therefore, to fulfill immediate needs, the New Zealand Government has committed itself to an energy source almost as spectacular as atomic power and certainly more unique—subterranean steam.

New Zealand has not suffered from a shortage of power in the modern era, despite a complete lack of significant petroleum deposits and only modest coal reserves, both low in quality and costly to extract. Rather, to compensate for these inadequacies New Zealand has bent her efforts to the development of her considerable hydroelectric potential, and the resulting energy, distributed widely among her 2 million people, has placed the country first (along with Norway in some years) in per capita consumption of electric power.

But a crisis in the offing has been apparent to observers ever since World War II, for, although both of the main islands are mountainous and well watered, most of the practical dam sites in the North Island have been developed in recent years, and the remaining large potential in the snow-fed streams of the central and southern sections of the South Island is not available to the major consuming centers of the north.

And yet the demand for power continues to grow, as does the population, which is increasing at the phenomenal rate of 2 percent per year. Obviously, if New Zealand is to keep her living standard at its present high level and maintain her economic momentum, new sources of energy must be tapped.

In the center of the North Island is one of the world's rare geothermal regions, where ground water comes into extensive contact with hot subterranean rocks and manifests itself at the surface in the form of geyser basins, boiling mud pools. hot springs, and steam jets. Only in Yellowstone National Park and in Iceland are comparable phenomena known, but nowhere is so much activity concentrated in so small an area that is accessible to large population concentrations as in New Zealand. At the northern end of this region is the tourist center of Rotorua, renowned for its geysers and hot springs, its charm enhanced by Maori villagers who act as hosts and guides.

But, farther south in the Wairakei Valley near Lake Taupo, even more violent activity is apparent. Karapiti blowhole, a powerful jet of dry steam, erupts continuously at a pressure of about 180 pounds per square inch and, according to Maori legend, has done so with undiminished force for at least 500 years. Such evidence of subterranean energy has led naturally to speculation on the feasibility of harnessing it for productive purposes.

In 1950 several experimental bores were authorized. This was not entirely a pioneer venture in the utilization of subterranean steam. For years natural steam has been used on a modest scale, both in New Zealand and Iceland, for the heating of homes and domestic water. In Tuscany, Italy, such steam has even been harnessed to generate limited amounts of electricity, and when geothermal power development was first seriously considered in New Zealand, a team of engineers was sent to Italy to study the application of Italian techniques to the local problem. However, the New Zealand project is unique in its scope.

For several years now test bores have been put down over a large area aimed at delimiting the extent of natural steam occurrence, estimated now to be an area of more than 3000 square miles. At present at least 50 bores have been drilled to depths ranging from 500 to 3000 feet, and new equipment has been brought in recently to test even greater depths. There have been no "dry wells." In every case steam has been encountered at head pressures of anywhere from 100 to 430 pounds per square inch. One relatively small and shallow bore, 4 inches in diameter at 575 feet, discharges 130,000 pounds of water and steam every hour, and the roar of the jet can be heard 4 miles away.

The quality of the steam, as well as its quantity, is important. It must be free of impurities which could clog or corrode delicate machinery, and for the best results superheated or dry steam is required, to eliminate as far as possible excessive condensation on turbine blades. Fortunately, New Zealand steam has been shown to contain no harmful chemicals, but some of the early bores at the ground-water level emitted wet steam. However, more recent deeper drilling has tapped large sources of dry steam.

Results of these test bores have been so encouraging that the government has definitely decided to go ahead with a large-scale power development based on geothermal steam. Early in 1957 four construction firms from New Zealand, Scotland, Great Britain, and Switzer-

View of the Wairakei Valley in New Zealand.

land contracted to erect a power station on the banks of the Waikato River near its source at the north end of Lake Taupo, a cooling pump house in the river, and five 20-inch steam pipes to bring the steam from about a mile away.

Originally the £6-million project was to produce not only electricity but also heavy water for the British Atomic Energy Authority, but the authority withdrew from the scheme in 1955 for reasons which have not been made public. Nevertheless, the New Zealand Government has proceeded and expects to feed 69,000 kilowatts of electricity into the North Island power grid by the winter (June, July, and August) of 1958. In the meantime, a firm of London consulting engineers has submitted a report indicating that the plant can be expanded easily to produce 82,000 kilowatts and, if wet steam and hot water converted to steam prove to be practical, can develop a maximum of 250,000 kilowatts. The total cost of this expanded scheme is expected to run to somewhere in the neighborhood of £22 million to £25 million.

It is hardly likely that such a combination of natural and economic circumstances exists anywhere else in the world, and probably the New Zealand experiment cannot be repeated. Nevertheless, it is being watched with interest from many quarters as the first large-scale use of an entirely new source of energy.

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U.S. Mission to the U.S.S.R.

L. L. Newman, assistant chief coal technologist for the U.S. Bureau of Mines, was one of five American specialists in peat who recently visited the U.S.S.R. Five Soviet mining engineers and peat specialists have, in turn, toured Minnesota peat and iron mining sites in an unusual exchange between the state of Minnesota—not the United States Government—and the Soviet Union. Minnesota has an estimated 6 billion tons of peat reserves.

Newman reports as follows: "Impressive machinery of unique and advanced design used in the production of peat in Russia and the warm friendly and cordial reception accorded our mission were beyond all my expectations." The Russians were "not only friendly but eager" to show the American mission their peat production operations around Moscow and Leningrad. The Soviet Union is an acknowledged leader in the chemical aspects of peat use.

There were no restrictions on photographing plant sites or equipment. Newman himself exposed 22 rolls of colored film and four rolls of black and white. In addition, Soviet officials supplied the American mission with four reels of movies about peat operations. Photographs, blueprints, specifications, and brochures were supplied "on any item in which the [group] expressed an interest."

The American visitors were surprised to learn that the chemical aspects of peat use comprise only about 1.5 percent of the Soviet peat program. Eighty percent of the 56 million tons of peat processed each year in the U.S.S.R. goes for power production, and 18 percent is used for fertilizer and soil conditioning.

Newman also reported that in the U.S.S.R. the entire production process is mechanized, with huge, intricate machines preparing the peat bogs and removing the peat. Trees are cut, stumps removed, drainage ditches dug, and the peat itself placed in railroad cars without a human hand touching it.

High-School Teachers Attend M.I.T.

High-school science and mathematics teachers from New England, the Middle Atlantic States, and the South worked for 8 weeks this summer with the research staff at Massachusetts Institute of Technology's School of Science under a $20,000 general assistance program of the Westinghouse Educational Foundation, which is supported by the Westinghouse Electric Corporation. In a new type of program offered for the first time this year, teachers were able to choose research projects in biology, chemistry, food technology, geology and geophysics, mathematics, meteorology, and physics. The program, which has been sponsored by the Westinghouse Educational Foundation for 9 years, provides for grants of $800 for each participating teacher.

In the past, summer activities for science teachers centered around special lectures and laboratory exercises by members of the M.I.T. faculty. These activities were designed to review fundamental science projects and to survey recent developments. However, this year's program allowed teachers to participate directly in the institute's regular research work.

Whitney Opportunity Fellowships

The John Hay Whitney Foundation has announced its Opportunity Fellowships for 1958–59. These awards are open to any citizen of the United States (including residents of territories) who has given evidence of special ability and who has not had full opportunity to develop his talents because of arbitrary barriers, such as racial or cultural background or region of residence. Awards have been made to the following groups: Negroes, Spanish-Americans, Chinese- and Japanese-Americans, American Indians, residents of the Virgin Islands, Puerto Rico, Hawaii, Guam, Alaska, Samoa, and the Appalachian Mountain area.

Candidates are expected to be mature enough to have given positive evidence of superior promise, yet young enough to have their careers before them; in general, they should be between 22 and 35 years old and should have completed their undergraduate college education. Candidates under 35 are given decided preference.

The fellowships are open not only for academic study (graduate) but for any kind of training or experience (journalism, industry, labor, the arts, and so forth) that may be most useful in developing varied talents and varied forms of leadership. Applicants for apprenticeships in such areas as agriculture, industry, and labor will be welcomed. Persons interested in programs of this type should write to the foundation for additional information.

Awards are expected usually to range from $1000 to $3000, depending on the nature of the proposed project and the financial need of the candidate. Applications may be obtained from the John Hay Whitney Foundation, 630 Fifth Ave., New York 20, N.Y. Completed forms must be filed *not later than 30 Nov.*

U.S. Student Enrollment

The U.S. Office of Education reports that for the 13th consecutive year the nation's total school and college enrollment will increase, reaching a new all-time peak of approximately 43,135,000 in 1957–58. Enrollment will be about 1,796,000 higher than the previous record enrollment of 41,366,000 last school year. One of every four persons in the United States will attend school or college.

Public and private school enrollment in kindergarten through grade 8 is expected to total about 30,670,000, nearly 1 million over last year's elementary-school enrollment of 29,711,000. High-school (grades 9 through 12) enrollment for 1957–58 is expected to be 8,424,000, a gain of 604,000 over last year's 7,820,000. For every 100 persons aged 14–17 years, 83 will be enrolled in high school; 10 years ago 74 in 100 were enrolled.

Colleges and universities will enroll about 206,000 more students during the coming academic year than they did in 1956–57—3,450,000 this year compared with 3,244,000 last year. Colleges and