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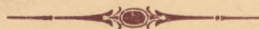
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HEAT FROM THE EARTH'S SURFACE:

Early Development of Western Geothermal Resources

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COMMERCIAL DISTRIBUTION of geothermal resources commenced around the turn of the century on a modest scale in two different kinds of enterprise and in two widely separated areas. These interesting contributions to economic geology represented a major divergence from traditional exploitation of hot springs for resort and recreational purpose in the form of natatorium and tourist attractions. In one case, artesian hot water came into commercial use in the Western United States for heating of houses and buildings in 1892. In the other, geothermal power development got underway in Italy in 1904. Whether in the form of space heating and distribution of domestic hot water (that otherwise would have to be heated from some other power source) or of power for general commercial purposes (such as generation of electricity), these two uses of geothermal power pointed the way toward more widespread applications by the middle of the twentieth century. Unlike fossil fuels, geothermal power (whether used for heating or for other purposes), if developed wisely, won't be exhausted too easily. Anyway, it would take quite an ambitious enterprise to cool off the middle of the earth. Although pollution problems sometimes are associated with utilization of geothermal power, other nineteenth century heat sources (mostly coal and wood in Western frontier communities) could not begin to compare with pure artesian hot water for cleanliness and convenience.

But in spite of important and undeniable advantages, geothermal power has been developed quite slowly for commercial purposes. Except for space heating, most commercial utilization of geothermal energy takes the form of steam generating plants for electric power. In recent years, New Zealand (1950) and a number of other countries (Iceland, Mexico, the United States, Salvador, Japan, and Russia) have

commenced to exploit or at least to explore their steam fields.¹ But hot water heating, except for Iceland, has proceeded more slowly. In the widespread current interest in geothermal power, in fact, hot water heating is still almost overlooked outside that one island.

A large zone of major hot springs extends from the Yellowstone Park country westward to Mount Lassen and the Pacific Coast. Boise grew into a frontier city near the center of this geothermically favored zone. Hot springs occur over much of southern Idaho, and emigrants headed west on the Oregon Trail used to enjoy cooking meals in hot springs about half-way between Snake River crossing (near modern Glenns Ferry) and Boise. Commercial development of a number of hot springs in the Boise and Wood River mining regions began right after the 1862 gold rush: most of the mining camps in the area (Idaho City, Rocky Bar, Atlanta, Hailey, and Ketchum primarily) had hot springs somewhere nearby, and their possibilities for resorts were realized early in the mining era. Commercial use of hot springs near Idaho City still continues more than a century after that resort provided the scene for some of the exciting episodes in Idaho's early territorial history, and the development of a major Western ski resort (as well as summer resort) at Sun Valley since 1936 makes good use of some of the large Wood River hot springs that had proved to be a great attraction for early developers. Andrew Mellon, Jay Gould, and the Harrimans of the Union Pacific were connected in one way or another with promotion of these Wood River hot springs, and before the end of the nineteenth century, Boise and Wood River hot springs were attracting a lot of attention.

Artesian water possibilities were recognized around Boise when drillers went to work only eight years after settlement began. Exploring for a water company, they did not know precisely what to expect. According to a press report,

The Artesian well boring was commenced. The apparatus works all right. They are bound to strike something. It is a mooted question whether they will strike cold water, oil, or hot water. There is thought to be some danger of the latter catastrophe. The boiling spring, a few miles up the valley, is on the same side, and the well at the penitentiary yields warm water. There is one consolation for us, in case they do tap a boiling spring, we can commence raising crops in the winter.²

Hot water did not materialize from that early effort: an equipment failure left the drillers unable to discover anything at all.³ But the possibility for hot water remained.

Not too many years after most of the modern conveniences of the time (telegraph and telephone service, railway transportation, electric

1. James R. McNitt, *EXPLORATION AND DEVELOPMENT OF GEOTHERMAL POWER IN CALIFORNIA* (San Francisco, 1963), p. 8.

2. *Idaho Statesman*, July 15, 1871, p. 3, c. 2.

3. *Ibid.* July 27, 1871, p. 3, c. 2.

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power and lights, for example) had been introduced, community leaders in Boise concluded that the time had come to install an adequate city water system. Before Idaho became a state in the summer of 1890, no one could recommend Boise's water supply, either for domestic use or for fire protection. A limited amount of water was available from existing wells serving individual owners. Others got water out of various small springs or out of the river. Irrigation ditches ran through town, but altogether the domestic water supply remained far from adequate. Some kind of community system clearly was needed. Then in the spring of 1890, Boise suddenly had an opportunity to get a complete city water system. In fact, for those who thought that only one city water system might not be enough, rival groups of investors organized two competitive companies that June. Right at the beginning, the evils of monopoly (which were receiving a lot of attention that year, when Congress was busy adopting the Sherman anti-trust act) had become apparent. When the original company demanded three dollars per month per faucet, this rate was considered exorbitant.⁴ So an opposition group decided to offer competition at a lower price.

Acting from a need to obtain better water for their Overland Hotel — a well known Boise landmark since 1864 — the owners had decided to expand their supply system. For years they had offered a limited water service to their neighbors as well as for their hotel from Hull's Gulch, a mile or more away on the north side of town. With permission obtained from the city council, October 3, 1889, to place a new pipeline in Boise streets, they decided to drill for more water than their springs provided. After some months of work, mostly in the spring of 1890, they developed three artesian wells by the middle of May. Producing 800,000 gallons of cold water a day from a depth of only twenty feet, they had enough water to consider providing a system for the entire city.⁵ When they announced that their existing high charge would apply to their whole new projected system, another water syndicate entered the field. One of Boise's pioneer merchants, who owned a lot of land in Hull's Gulch near the Eastman (Overland Hotel) artesian wells, decided to drill for artesian water on his property, too. Confident of success, he joined a number of other prominent Boise pioneers in incorporating the Artesian Water and Land Improvement Company, June 2, 1890.⁶ Then on June 23, just before the Artesian company struck artesian water in Hull's Gulch near the original Eastman well, the Eastman Overland Hotel interests (who already had arranged to set up Boise's original domestic water system) incorporated the Boise Water Works.⁷ Although the Artesian company was incorporated earlier, it

4. *Ibid.*, July 11, 1891, p. 2, c. 4.

5. *Ibid.*, May 15, 1890, p. 2, c. 1, p. 3, c. 1, *Salt Lake Tribune*, May 27, 1890, p. 1 c. 5. Successful drilling of the original Eastman artesian well in Hull's Gulch was completed by the middle of May, 1890.

6. Records of Incorporation, Idaho Territory, Book C, p. 108 Idaho State Archives.

7. *Ibid.*, p. 140; *Idaho Statesman*, June 28, 1890, p. 3, c. 2.

supplied opposition to the existing Eastman group, and believed in competition as a means of holding down prices in the water business. In contrast, the Eastman Overland Hotel concern preferred a single water system for the entire community, with monopoly an inherent feature of the system.

In the race to install pipes from cold artesian wells that both companies developed in Hull's Gulch on the north edge of town, the opposition concern took advantage of its head start. But by August 12, when the Artesian company began to install pipe, the Overland Hotel's Boise Water Works had pipe on hand.⁸ That summer and fall Boise was growing rapidly, in spite of the inconvenience of having the streets torn up by two rival water companies. (The companies got into right-of-way trouble and litigation, as might be imagined. They also had problems of damages when breaks in one company's pipe led to erosion of the other's uncompleted excavations for water lines.)⁹ From a population of 2,500 when the United States census was taken June 1, Boise grew to 4,026 by September 19 when the Board of Trade (not content with an optimistic but unverified estimate) prepared a signed registry of the inhabitants.¹⁰

Major irrigation canal construction underway next to town that summer accounted for much of the expansion. In addition, a substantial city building boom, unmatched up to that time, was transforming the appearance of the capital city of the new state of Idaho. Aside from an outburst of optimism that came with state admission, Boise served as a stage coach manufacturing center (an industry without a long range future, but good for more than another decade) as well as a popular camping spot for emigrant wagons that still came by in large numbers on the Oregon Trail.¹¹ Automobiles which would put the emigrant wagons and stage coaches off the roads had not yet materialized, and with preparations under way in the summer of 1890 to install an electric street car system, Boise expected to have all the conveniences of any progressive city within a year or two.¹² James J. Hill was reported as prepared to build a railroad from San Francisco through Boise to Butte as a major expansion of the Great Northern, so that Idaho's capital would not have to depend entirely upon the Union Pacific.¹³ The two water companies looked with confidence toward rapid expansion to serve a growing community that would thrive with major irrigation projects which would make farming more important as a regional economic base.

8. *Idaho Statesman*, August 12, 1890, p. 4, c. 1.

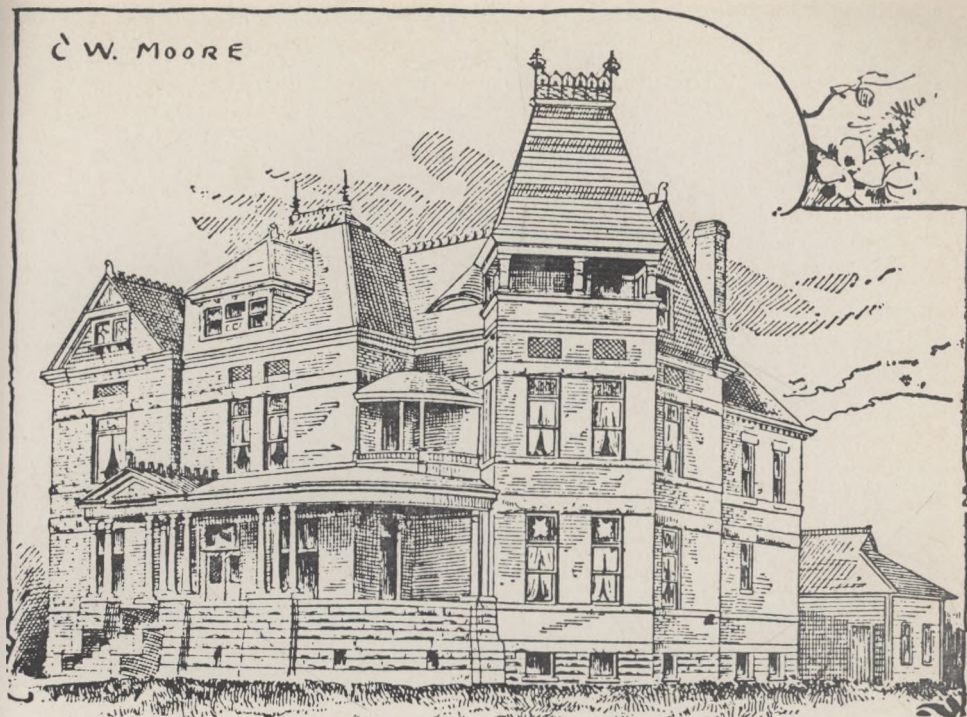
9. *Ibid.*, August 28, 1890 p. 4, c. 1, September 3, 1890, p. 4, c. 1, September 4, 1890, p. f, c. 3, September 14, 1890, p. 4 c. 1.

10. *Ibid.*, September 20, 1890, p. 4, c. 1, October 4, 1890, p. 4, c. 2.

11. *Ibid.*, July 22 1890, p. 4, c. 1, August 13, 1890, p. 4, c. 1.

12. *Ibid.*, August 13, 1890, p. 4, c. 1, August 14 1890, p. 2, c. 1, August 16, 1890, p. 4, c. 2-3. Articles of Incorporation were drafted for the Boise Rapid Transit Company, August 12 and notice for bids for rails and ties for an electric street railway was given at the same meeting.

13. *Ibid.*, July 20, 1890, p. 2, c. 2.



VANDERCOOK-CO. ENG. CHICAGO.

— Photograph courtesy Idaho State Historical Society

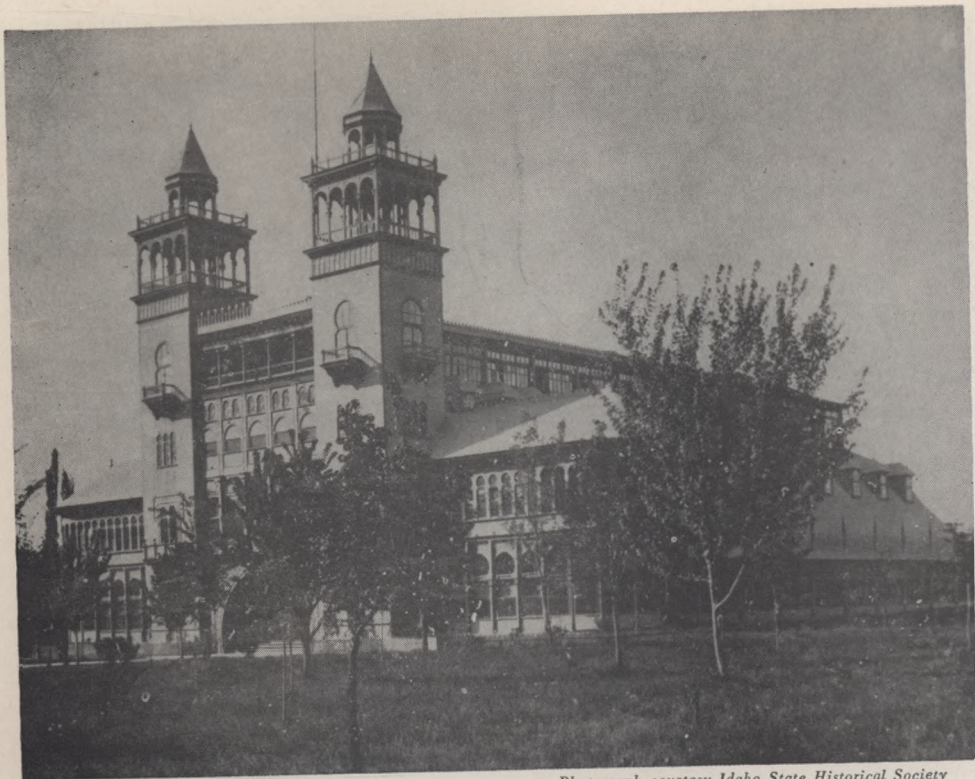
FIRST GEOTHERMAL HOME

The new home of C. W. Moore, one of the early advocates of using geothermal heating in homes and office buildings, was the first residence in Boise, Idaho, to employ the method.

Nearby lode mining camps, for which Boise originally had been established as a service community a generation before, were approaching their maximum development. Part of the mining era fortune that some of Idaho's pioneer settlers had accumulated was available for investment, and the Boise water works and electric street car projects provided good outlets for local capital in 1890.

As soon as service became available in the two competing water systems, a bitter fight for supremacy gave prospective customers some exceptionally good offers. The opposition company, anxious to hold back potential customers from the Overland Hotel group, advertised early in October that no one should sign a service contract without considering the Artesian offer. Not to be outdone, the Boise Water Works announced that they would provide free water until 1892 to those who would contract for their service.¹⁴ The Overland group obviously preferred to operate as a monopoly. Fearing that they would be cut out

14. *Ibid.*, October 8, 1890, p. 4, c. 2, October 11, 1890, p. 4, c. 3.



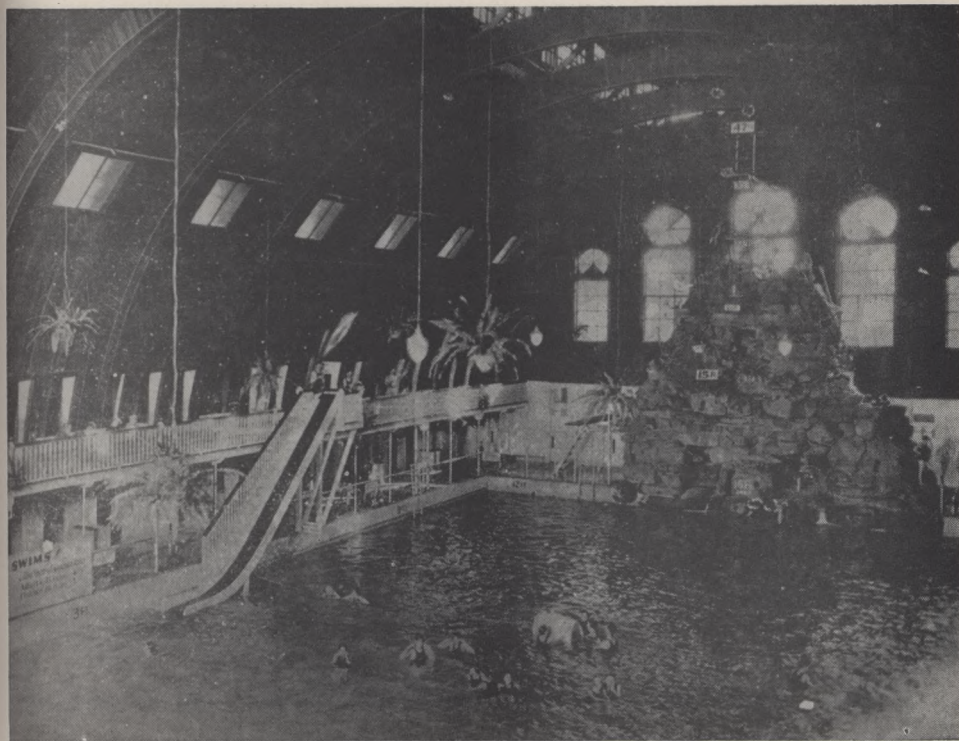
— Photograph courtesy Idaho State Historical Society

EXTERIOR VIEW OF THE FAMOUS NATATORIUM

altogether, the opposition syndicate continued to advocate the merit of maintaining two independent community water systems, asserting that two competing companies would be required to preserve a low-rate structure. Duplicate pipe systems in the same streets would offer customers a free choice; in no other way would Boise be assured the low cost water supply that the community deserved.

Competing for contracts to supply city fire hydrants as well as to gain private customers, the two water companies took their fight to the city council on November 6, 1890. After successful testing of a fire hydrant on their new system the Artesian Water and Land Improvement Company offered to place twenty-five fire plugs (owned and supplied by the city) on their lines, and to provide service for all of them for \$600 a year. This rate ran \$22.50 annually for each fire hydrant. At the same meeting, the older and larger Boise Water Works asked permission to bid on the fire hydrants before a contract should be let to their competitors.¹⁵ No one doubted the inadequacy of the existing system, but the city council held up proceedings for a few days, when the matter

15. *Ibid.*, November 7, 1890 p. 4, c. 2.



— Photograph courtesy Idaho State Historical Society

INTERIOR VIEW OF THE NATATORIUM

might be resolved in a special meeting. Some of Boise's most prominent and successful pioneers, represented by "a stunning array of legal lights," turned out for the shown-down on November 8. At this point the Artesian crew suggested that each company assume half of the fire hydrant contract at whatever rate the city might specify. With representation on the council (no one seemed to worry too much about conflict of interest right then), the Artesian company had little fear that the charge would be set too low. All along, the newer Artesian company, in order to stay in business at all, had to argue that the community interest demanded preservation of two competing water systems, and that their fire protection proposal would help insure their survival so that competition could be assured. But the delegation "upholding the dignity of the Waterworks" declined to concur. They wanted time to prepare a counter offer which would restore their monopoly. A "dense silence" ensued.¹⁶

After a taxpayers' petition requested further tests of the two companies' capabilities, negotiations for a division of the fire hydrants continued. An inspection of both companies' facilities, November 13, con-

16. *Ibid.*, November 9, 1890, p. 4, c. 4.



— Photograph courtesy Idaho State Historical Society

WARM SPRINGS AVENUE STREET CAR

This line served the residents of fashionable Warm Springs Avenue and the citizens of Boise who spent their recreation hours at the Natatorium. Note the unpaved street.

vinced the city council that each was adequate.¹⁷ Adopting the position of the competitive Artesian company, the council proposed an equal division of the fire hydrants. But the original monopoly Boise Water Works dissented again. Objecting to the refusal of the council to accept bids for service by only one company, the Water Works formally offered, November 21, to supply the fire hydrants at eight dollars each. Compared with the \$22.50 Artesian company offer, this bid appeared to be low enough to support quite adequately the monopoly company's original request for the entire city patronage.¹⁸ Eventually, the council decided, December 4, 1890, to allot thirty hydrants to the larger Boise Water Works at their bid price of eight dollars each, and to contract with the smaller Artesian company for twenty hydrants at twenty-five dollars each. (This figure exceeded the latter's original bid of \$22.50 only slightly.) The eight dollar suggestion appeared to be a low initial bid to capture business, and the council's excuse for offering a rate more than three times as high had to be justified on the grounds of preserving competition.¹⁹ Considering that the larger Boise Water Works was offering free water to everyone else, something had to be done if the Artesian company were to overcome the disadvantage of having to charge

17. *Ibid.*, November 14, 1890, p. 4, c. 2.

18. *Ibid.*, November 21, 1890, p. 4, c. 2 November 23, 1890, p. 6, c. 3.

19. *Ibid.*, December 5, 1890, p. 4, c. 2.

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at least a nominal rate for service. No one expected the unrealistic low bid of the Water Works to be renewed after the initial year. And no one expected the initial free water service to continue indefinitely for other customers. If the council played a mean trick on the Boise Water Works by accepting their astonishingly low bid while paying the Artesian company more than three times as much, an explanation could be found in the council's interest in protecting the city from a still higher monopoly rate in a subsequent year. Since the Water Works refrained from entering the Artesian company's proposal to divide the market at a higher rate, the council hardly had any other choice if both companies were to be preserved to maintain competition. The way things turned out, the Boise Water Works never got around to supplying any eight dollar hydrants and sustained no loss in the matter.²⁰

"Hatred and strife" were rampant — "in the fierce factional fight" for mastery over Boise's water system;²¹ in their search for a way to gain control, some of the major Water Works investors decided to go into the hot water business as well. They chose to investigate a potential artesian well site where hot water seepage made a swamp at the edge of a hill northwest of the state penitentiary. Drilling commenced shortly before Christmas, in time for an announcement on December 24, 1890, that warm water (92°) had been struck at a depth of eighty feet.²² That was only the beginning. After penetrating a hard rock formation, December 27, a much stronger flow was encountered at 112 feet. Here the water temperature had risen to 112° with enough sulphur that the whole supply was identified as coming "right from Hades."

This hot water overflowed the top of [the] well casing to such an extent that it became necessary to tap the pipe several feet below in order to draw off this overflow so as not to interfere with the drill. The company will continue to sink the well in the hope that at a greater depth a higher temperature may be obtained. The outcome of this experiment is of course problematical, depending entirely on this desired result. The water is clear, but strongly impregnated with sulphur. A large number of curious people visited the well yesterday afternoon. The company will sink two more wells very shortly.²³

Before the year's end, the driller's five inch pipe delivered a still warmer, larger flow from 168 feet: during the first week of January, both the supply and the temperature increased daily as drilling progressed.²⁴ Then at 308 feet on January 13, the Boise Water Work's stockholders were jubilant to find a "greatly augmented" flow with the "tem-

20. Minutes of the Boise City Council, January 8, June 4, July 6, 1891, in the office of the city clerk; this and much of the information concerning early activity of these companies has been supplied by Thomas G. McFadden of the Idaho State Historical Society, a Rhodes Scholar whose current research interest is Boise's water system in the nineteenth century.

21. *Idaho Statesman* March 29, 1891, p. 8, c. 1.

22. *Ibid.*, December 24, 1890, p. 8, 1-2.

23. *Ibid.*, December 28, 1890, p. 8, c. 1.

24. *Ibid.*, December 31, 1890, p. 8, c. 1, January 1, 1891 p. 8, c. 2, January 8, 1891, p. 8, c. 1.

perature very materially raised" that gave them 150 gallons a minute of 154° water. "The water now is hotter than that in any of the famous hot springs in Arkansas, and visions of bath houses and all the paraphernalia of a springs resort are already forcing themselves in the minds of the fortunate possessors of the well."²⁵ Encouraged by these promising results, the drillers went on until January 22, when their equipment failed. Pressure got so great that their light drill could be used no longer. Sending out for a heavier drill, they struck their real bonanza, January 24. At a depth of nearly 400 feet "a tremendous flow of water was encountered, and further operations were necessarily discontinued."²⁶

During February, the company sank another well through harder rock about fifty feet from the first one. Here the results were almost as spectacular. Going through the same stages as the first, the new well had higher temperatures as the drillers worked their way down. When the main source was reached at 404 feet, March 12, large chunks of rock were forced up, and the total volume (at 170°) exceeded 800,000 gallons daily.²⁷ While the second well was being drilled, a Union Pacific chemist who tested the water pronounced it excellent for boiler purposes.²⁸ Then one of the company stockholders, United States Senator George L. Shoup, got the United States Department of Agriculture to undertake careful chemical tests of the water. When it turned out to be more than pure enough for household use, the company knew that in addition to a resort (for which they had more than enough hot water already), they had a truly colossal hot water heater for domestic consumption.²⁹

Satisfied with these reports, the owners immediately purchased a site for a natatorium on Warm Springs Road and began to consider going into the hot water business. Although they would be competing with Kelly's Hot Springs — a resort on the other side of Table Rock, a few miles farther away — which had opened in a big way in the summer of 1890, their natatorium had more definite promise than their domestic hot water system.³⁰ Some pessimists doubted that their hot artesian water would stay hot, or that the supply would last indefinitely. But the company went right ahead, and the promise of being able to provide both hot and cold water for domestic use gave the Boise Water Works the upper hand in their battle for the city market. Within weeks the Artesian company gave up the fight, conceding monopoly to be superior to competition after all. The Boise Water Works absorbed their rival

25. *Ibid.*, January 14, 1891, p. 8, c. 2.

26. *Ibid.*, January 30, 1891, p. 8, c. 2.

27. *Ibid.* February 5, 1891, p. 8, c. 1, February 11, 1891, p. 8, c. 1, February 24, 1891, p. 8, c. 1, March 11, 1891, p. 8, c. 1, March 13, 1891, p. 8, c. 1, March 14, 1891, p. 8, c. 1.

28. *Ibid.*, February 28 1891, p. 8, c. 2.

29. J. M. Rusk to George L. Shoup, February 25, in the *Idaho Statesman*, March 7, 1891, p. 8, c. 2.

30. *Idaho Statesman*, August 9, 1890, p. 4, c. 1, March 24, 1891, p. 8, c. 1.

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in a consolidation completed March 28. Yet the name under which the new corporation emerged, the Artesian Hot and Cold Water Company, suggested the opposition company. Stock was exchanged on a basis favoring the company that had the hot water, two shares to one.³¹ As a consequence of the artesian hot water discovery the corporate purposes were expanded: in addition to the original "municipal, fire, sanitary and mechanical purposes," and "domestic and ornamental uses," the consolidated venture assumed authority to "furnish steam for heating, motive power and mechanical purposes." In addition the new enterprise proposed to "maintain sanitariums, hotels, baths, bath houses, and all other necessary or convenient buildings at or near said Boise City."³²

Concerned over the effect of the merger on the rate structure, the customers of the two companies wondered whether they would have to go back to the original high water cost proposed before competition had altered the situation. The merger had been anticipated for months. After all, neither company could be expected to supply water indefinitely at a loss. Because the competitive Artesian company had offered nominal rates until 1892 (the same period that the Boise Water Works charged nothing at all) and reasonable rates in the future, hope was expressed that the Artesian element in the combine might try to keep the price reasonable after the merger. However, the original monopoly company which absorbed its competition had been smart enough not to promise anything like low charges in the future. Moreover, their offer of free water until 1892 was

... a good one for the public, but a bad one for the company. Nobody demanded it, nobody thought that it was meant in good faith, but all felt that it was a bluff at the rival company and would last only until a consolidation was effected; hence, as they were giving something for nothing, that company [which had discovered hot artesian water] may not be blamed if its promise is not kept.

But the Artesian Water and Land Improvement company offered, in the language of its card, to "furnish water at reasonable rates until that time, and continue to do the same thereafter." By virtue of that offer it made a contract to furnish water at "reasonable rates." The rates were established and people accepted them and placed the pipes in their houses. Those contracts were understood to hold good until January 1, 1892. Will the Hot and Cold water people [the new consolidated company], about one-half of whom were stock holders in the Artesian company, see to it that the old rates are maintained.

The amount invested by the two water companies was a large sum. Nobody will deny that a reasonable profit should be derived from the investment. Money placed in works of this character does not belong to the public but to the individual. The investment helped the city and added permanently to the assessed valuation, thereby, in a measure, decreasing the rate of taxation. That, we believe, is the argument which the company will use when they fix the new rates.

31. *Ibid.*, March 29, 1891, p. 8, c. 1, April 1, 1891, p. 2 c. 1-2, April 2, 1891, p. 2, c. 1.

32. Record of Incorporations, State of Idaho, Book A, p. 300, Idaho State Archives.

But the rate-payer has some rights also. The rate should be a reasonable one. It should be such that the company may receive fair returns upon the investment, and one also which the rate-payer may meet without inconvenience. Pure mountain water is a luxury, and many can live without it. If the rates are placed too high the company will find a decrease of patronage, but if a reasonable rate is maintained, and the promises made to the public are kept, there will be no trouble about it and no grumbling from the people.³³

Although the consolidated company held off for a while, a modest increase to a third of the earlier three-dollar monopoly rate was imposed before the municipal election in July.

During the campaign for mayor and city council, a combine of the new water company and the new electric street car company intervened in an unexpected way. In addition to the regular Republican and Democratic tickets, these utilities offered a third party with a Citizens' ticket. With many of Idaho's most prominent political leaders joined (as utility investors) in supporting this independent slate, the regular party organization candidates felt threatened. In desperation, the Republicans (who normally might have been expected to triumph) appealed to the Democrats to stay with their own party ticket rather than to desert to the water works and street car party. The utility interests went to the trouble of starting a daily newspaper of their own — the *Boise Citizen* — as a campaign organ "with seven editors, and gratuitous circulation of several hundred copies. . . ."³⁴ They had to reply to charges from the *Idaho Daily Statesman* (the city's long established Republican organ) "against rapacity of these water fiends and money cormorants."³⁵

As a campaign issue, the Republicans focussed upon the evils of having the city council composed of owners and agents of the water company with which the city would have to contract for water. Similar opposition was voiced against the electric street car candidates. (They actually were mostly the same people.) Problems of conflict of interest were pointed out clearly and specifically. On top of that, the utilities faced other disparaging accusations: "It is notorious that the saloons on Main street are amply supplied with funds" from the utilities to swing the election, "and that these saloons are now reaping a harvest."³⁶ Perhaps the water and street car combine succeeded in corraling the Main Street vote. At least enough of the electorate was unimpressed by the possible danger of making the city council the agent of the water and street car companies. After all, these concerns were established by some of the leading citizens of Boise in order to bring progress and prosperity to the community. When the votes were counted, the water company's Citizens' ticket emerged on top. W. E. Borah, who had settled

33. *Idaho Statesman*, March 31, 1891, p. 2 c. 1.

34. *Ibid.*, July 10, 1891, p. 2, c. 1.

35. *Ibid.*, July 11, 1891, p. 2, c. 2.

36. *Ibid.*, July 10, 1891 p. 2 c. .

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in Boise in the fall of 1890, led the Republican ticket as candidate for city attorney and was nearly elected. But the rest of a strong party ticket faltered against the assault of the water forces.³⁷

Fears that domestic and municipal rates would soar after the water company took over the city council (along with the rest of Boise's city government) failed to materialize. Since the eight-dollar a year fire hydrant bargain never had materialized either, all the city business had gone to the opposition company which the council had upheld in an unsuccessful arrangement to divide the fire contract. So the new city council stabilized the city's monthly bill at \$114.58 — a figure close to what the earlier council had figured was fair when the two companies had been competing.³⁸

Meanwhile the consolidated water company went right ahead with plans to enter the hot water business. Engaging the services of John C. Paulsen, a talented Helena architect who also was designing mansions for some of the wealthy water company investors, the company hastened to build Boise's widely admired natatorium.³⁹ This became a show place of the Northwest. While construction was underway, interest was mounting in the prospect of hot-water heating. (Until the water could be used at the "Nat" and for domestic heating, the company had to resort to such undistinguished outlets as street sprinkling.⁴⁰ A better disposal of the immense hot water supply certainly was needed.) A large number of houses were being built along Warm Springs Avenue, where hot water service was expected.⁴¹ The company really needed a reliable test of hot water heating, though. Conscious that theirs was a pioneer effort in an entirely untried enterprise, these natural hot water experimenters decided to see how their system worked in some of the owner's homes. They started with the company president.

C. W. Moore, who had joined B. M. DuRell in founding the First National Bank of Idaho in 1867, set up the initial test. He had a sub-

37. *Ibid.*, July 14, 1891, p. 8, c. 1. In the election returns, Borah was reported as losing to C. C. Stevenson, 372 to 369, but a few years later he was told that he actually had had more votes: the canvassers simply had decided they had better make sure that the utility ticket candidate became city attorney. Claudius O. Johnson, *BORAH OF IDAHO* (New York, 1936), 40.

38. Council Minutes, September 24, 1891-November 3 1892, February '2-July 6, 1893.

39. C. W. Moore went to Helena in April, 1891, to examine the natatorium there and to engage Paulsen's services. Work on the Boise "Nat" proceeded rapidly, with the pool section built before the rest of the design was even finished. Paulsen came to Boise, September 22-24, after the building contract was let. *Idaho Statesman*, April 4, 1891, p. 8, c. 3, May 26, 1891, p. 8, c. 1, June 30 1891, p. 8, c. 3, July 2, 1891, p. 8, c. 3, September 7, 1891, p. 8, c. 1, September 15, 1891, p. 8, c. 3, September 23 1891, p. 8, c. 1, September 25, 1891, p. 8, c. 3, October 14, 1891 p. 5, c. 1-2, October 23, 1891, p. 8, c. 3. A biographical notice of Paulsen, from the *Helena Daily Independent*, April 1, 1897, appears in Fred Whiteside, "The Graft that Failed," *Montana Magazine* (Autumn 1959), p. 10. Arthur A. Hart director of the Idaho State Historical Museum, is engaged in research on Paulsen and Boise architecture, and supplied most of this information.

40. *Idaho Statesman*, August 28, 1891, p. 8, c. 3; *Idaho Democrat* (Boise), quoted in the *Caldwell Tribune*, January 3, 1893, p. 6, c. 3.

41. *Idaho Statesman*, October 5, 1891, p. 8 c. 3, May 24, 1892, p. 5, c. 4-6.

stantial new "elegant mansion" completed at the beginning of 1892. During February and March he found that his novel heating system of natural hot water performed beautifully.⁴² Next door, H. B. Eastman of the Overland Hotel followed up with similar success when his new house was done. Eastman's company already had suggested that the new city hall, as well as the fire station, resort to natural hot water heating: now that feasibility was being demonstrated, at "least one-third of the Main street property owners" had "evinced their willingness to become the patrons of the company" for heat as well as for water by the end of March.⁴³ Special costs for installation of the hot water lines were expected to bring the community heating investment to \$20,000. But fuel savings, figured for the community at \$50,000 a year, would more than justify the expense. Fire insurance savings offered an additional incentive. With little heat loss expected in several miles of pipe, and with a head "sufficient to force the water into pipes upon the top floor of an ordinary four or five-story building," success for the enterprise was assured.

A full explanation of the merits of natural hot water heating appeared in the *Idaho Daily Statesman*, April 2:

It is probable that Boise people do not fully realize the value of the hot water that flows in such abundance from the artesian wells. It is understood in a general way to be a nice idea to have houses heated by such an agency, but very few whose attention has not been called to the subject appreciate what the influence of this method of heating will be upon the future of the city.

There are several things that can make a great city, but of not the least importance is that it should be a desirable place of residence. Business advantages build up a community, but it is often found that people, while making their money in one city, will live in another, because of superior attractions of the place that they select for their residence. When business advantages are equal, the city that offers the greatest inducements as a city of homes, forges ahead of its rivals; where business and residence advantages are combined, as in the case of Boise, the city must make great progress.

The hot water supply gives the city a leverage that no other place in the country enjoys; when we stop to consider what the possibilities of the system of heating are, that fact immediately appears. So far as we know, coal will always be expensive; so also will wood. At best, both wood and coal are expensive, and create dirt and smoke. Those who have always had them about the house may have become accustomed to their litter, but there is no one who would not appreciate a heating system that would be free from all the objectionable features of the stove and fireplace.

In time, this hot water will come into general use. All houses will be heated by it, and the heating will be done without care or annoyance on the part of the occupants, while the savings in expense will be enormous.

42. *Ibid.*, October 14, 1891, p. 8, c. 1, February 3, 1892, p. 8, c. 1, March 20, 1892, p. 8 c. 2.
43. *Ibid.*, March 30, 1892, p. 5, c. 1, November 22, 1892, p. 4, c. 1.

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The poorest family with cultured tastes will be able to maintain a conservatory filled with flowers the year round.

Housework will be made easy, because of the wonderful cleansing power of the water.

Every family will be able to maintain a bath, without the expense and danger incurred in putting in water-backs and boilers, and it will be a life-giving mineral bath into the bargain.

The new well which is proposed will probably bring boiling water, and this, used for flushing the sewers, will make the health conditions of the city perfect.

Under glass in his back yard, every resident can produce a constant supply of delicate garden products, gathering lettuce and radishes for his table in the coldest weather.

Such are a few of the advantages that the hot water brings to Boise.

It requires no stretch of the imagination to foresee that they will make this place the favorite residence city of the intermountain country. It is a great point to be able to say to the people whose business is in these mountains. "We can afford you the finest residence conditions that exist in the country."

People quickly appreciate such conditions; and we have but to get along a little further and take on more metropolitan airs, to line these streets for miles with the homes of men whose business reaches from Bear Lake County in the southeast to Kootenai County in the northwest.

While the citizens of Boise were anticipating the wonders of natural hot water heating, they had a chance to try out the large indoor swimming pool that artesian hot water also made possible. Completed in time to commence business on May 25, 1892, the "Nat" (as the Natatorium was known) immediately became a great attraction. A grand dedication ball, June 2, demonstrated that the new building was good for more than swimming and bathing. A special ballroom floor could be installed over the pool, converting the plunge area into quite a different kind of establishment.⁴⁴ Many important social affairs were held there, including a number of inaugural balls. Aside from the pool or ballroom area, this large structure (100 by 150 feet in ground area) contained "fifty bath and dressing rooms."⁴⁵ A special system of wooden pipe brought hot water one-half mile or more to the "Nat," and for heating purposes was extended down Warm Springs Avenue into the business district. The wooden pipe, chosen to provide insulation, was no innovation: the Helena Natatorium (which the architect had designed previously) used that arrangement.⁴⁶ But from there on, the Boise natural hot water heating pioneers went on their own.

With no experience or precedent to guide them, the developers of Boise's hot water system had to go to considerable expense to solve their supply and distribution problems. By 1894, their two hot water wells leaked so badly that they required packing. This reduced their size so

44. *Ibid.*, May 26, 1892, p. 8, c. 1, June 3, 1892, p. 8, c. 1.

45. *Ibid.*, May 8, 1891, p. 15 c. 1-2.

46. *Ibid.*, May 27, 1891, p. 8, c. 2.

much that a third well (450 feet deep) had to be installed to restore the original 800,000 gallon daily flow.⁴⁷ (Yet with 550 gallons a minute, their hot water supply was almost as large as all of their cold artesian water obtained from Hull's Gulch.)⁴⁸ Wooden piping had to be abandoned in 1896 "as dangerous and useless," and some of the other experiments proved futile as well as expensive.⁴⁹

Capturing enough hot water heating business to absorb their supply, the company at least refrained from going to the effort of developing boiler technology and natural hot water power. Their chief innovation turned out to be commercial utilization and distribution of hot water along lines quite different from the traditional resort and natatorium development that required little or no imagination to work out. Boise's needs gave them a good outlet for household and commercial heating, but did not encourage power generation that the company had considered along with the other possibilities. Conversion of Cyrus Jacobs' flour mill water power system into a hydroelectric plant to operate city street car service came just at the same time that artesian hot water became available.⁵⁰ Cold water out of the river provided more than enough electrical generating capacity to meet current needs, and cold river water had no application for heating houses or anything else. A little over a decade after Boise's Artesian Hot and Cold Water Company began to provide commercial distribution of geothermal resources, an Italian enterprise undertook geothermal power generation in 1904.⁵¹ Both of these novel contributions to economic geology — commercial geothermal heating and commercial geothermal power — are closely related, and both commenced at close to the same time, if in widely separated places.

Efforts to increase the hot water flow led to a lot of trouble before they proved successful. With three wells of 394, 404, and 450 feet in depth, the company spent a lot of money on additional new wells, but the flow did not change.⁵² Then air pumps increased the hot water supply by twenty-five percent. But the original pumps proved unreliable, and within four years the air had rusted out the metal pipes of the entire system. At that point, the company drilled a new sixteen-inch well, enlarged one of the others to sixteen inches, "and installed two ten-inch Byron Jackson Five Stage Perpendicular Centrifugal Pumps, both electrically driven and placed one hundred and fifty feet down each

47. Boise Artesian Hot and Cold Water Company, *Tariff Rules and Regulations Governing the Use of Hot and Cold Water* (Boise, 1918), pp. 14-16.

48. Israel C. Russell, PRELIMINARY REPORT ON ARTESIAN BASINS IN SOUTHWESTERN IDAHO AND SOUTHEASTERN OREGON (Washington, 1903), 29-30.

49. *Tariff Rules*, 16.

50. *Idaho Statesman* October 31, 1891, p. 8, c. 2, November 21, 1891, p. 8, c. 2. The *Statesman* reported that "Cy Jacobs says it takes less water to run the street railroad than it did his grist mill which has been converted into the powerhouse."

51. McNitt, 8.

52. Waldemar Lindgren, GEOLOGICAL ATLAS OF THE UNITED STATES, *Boise Folio* (Washington, 1898), 9.

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well."⁵³ These new pumps succeeded perfectly, bringing the total flow to 1,200,000 gallons a day. Natural flow, however, remained at the original 800,000 gallons that had been constant from the beginning. In spite of some early doubt, water temperature never changed, so the company's hot water resource proved quite stable over the years.

Aside from technological problems, the company also had difficulty in getting customers to conserve hot water. Cold water meters enabled the company to abandon a complex rate system based upon house size or, for commercial customers, the kind of business. Hot water meters proved ineffective, although the flat rate of two dollars a month was modest indeed for homes of eight rooms, or less. Larger houses ran as high as three dollars a month, certainly a competitive rate when coal cost seven or eight dollars a ton. Yet the way the company explained matters, all kinds of unfortunate practices had to be curbed:

The waste and unauthorized use of the natural hot water is enormous, and has become a menace to the efficiency of the service. In very cold weather this waste amounts to a large percentage of the whole and practically all of it is unnecessary.

Some of the most prominent ways in which the water is wasted are:

Opening the faucet and letting the water run continuously, with the hope of getting more heat.

Attaching a towel or other fabric to a faucet and allowing it to hang into a wash bowl, sink, bathtub or other set fixture, turning the water on, and allowing the cloth to smother the steam and noise.

Using hose for the same purpose.

Having openings not authorized.

Having a toilet attached, and similar other ways.

All of the above practices waste much water, and most of them weaken the service that is expected to be benefited.

Letting the water run a very short time will get as hot as it ever will be. In a house that is heated with natural hot water it will not take over two minutes to obtain hot water at the faucets.⁵⁴

With nine miles of hot water pipe, about half in large (four to twelve inch) main lines and the other half in smaller feeders, the Boise hot water heating system emerged as a stable, unvarying enterprise.⁵⁵ The heating system, in fact, turned out to be far more durable than the traditional natatorium development. Construction materials (but not design) of the "Nat" proved unequal to the strain of supporting a large building in damp surroundings. After forty years the framework and trusses got into "an extremely rotten and decaying condition."⁵⁶ Moisture from the pool was blamed for the decay. This unsatisfactory situation came rather abruptly to public notice, July 30, 1934, when part of the roof blew in during a sudden twenty-minute afternoon thunder-

53. *Tariff Rules*, 16.

54. *Ibid.*, 22.

55. *Ibid.*, 16-17.

56. *Idaho Statesman*, August 2, 1934, p. 6, c. 1.

storm. A twenty-six-mile an hour wind (about as strong as Boise ever gets) and a deluge of rain brought havoc over the community, mainly to trees. The city building inspector, who thought he was lucky to get out of the building alive, found the "Nat" "in an extreme state of decay and deterioration, rendering it unsafe and extremely hazardous. . . ." when he examined the situation, August 1. He concluded that "the only thing that is holding the roof together is the shape of the arch which puts pressure on broken beams and prevents them from caving in."⁵⁷ The building could not be saved under such conditions, but the city took over the pool (which never had been especially profitable by itself) and preserved it as a regular outdoor cold water plunge.⁵⁸ Still in operation, the pool serves as a reminder of a bygone time when the "Nat" was one of the real attractions of the Northwest.

Hot water heating quietly continues to serve a section of the city that the warm water system did so much to develop after 1890. Warm Springs Avenue, which the hot water heat line made into the community's most important residential street (in place of Grove Street, where only one of the old mansions has survived) still has most of its outstanding houses, including C. W. Moore's home that pioneered the natural hot water system. Artesian hot water heating continues to be practical, and more than economically competitive. Rates are determined by the size of the hot water discharge outlet, and run around two hundred dollars a winter for an average house on the system. This price includes hot water for domestic use (making a hot water heater unnecessary) as well as for heat.⁵⁹ Except for the coldest weather, natural hot water heat is adequate, although an auxiliary system is necessary for large stores and buildings when conditions get severe. Such conditions do not occur too often: although a prolonged stretch of sub-zero weather would put a strain on an artesian hot water heating system, Boise has gone eight years now since the temperature got down to zero, and even when a severe cold wave strikes, the number of hours in a year that the temperature runs below zero is very small. In a more extreme climate, such a heating system might not be so practical.

Expansion of the artesian heating system cannot be managed on any major scale because of the 1,200,000 daily gallon limit. In the past decade, in fact, a gradual decline in patronage has set in. As late as 1958, 244 customers used artesian hot water to heat their houses or businesses; by 1970 about 200 houses and ten or a dozen business establishments remained. New developments in the city, with some of the old houses giving way to commercial development, with other natural hot water houses displaced by the state capitol complex (heated and

57. *Ibid.*, and see also *Idaho Statesman*, July 31 1934, p. 1, c. 1, p. 2, c. 1-2, August 2, 1970, p. D1, c. 1-3.

58. *Idaho Statesman*, August 3, 1934, p. 1, c. 1-2, August 4, 1934, p. 5, c. 1-3.

59. Information concerning current service and rates comes from the staff of the company, December 18, 1970.

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cooled by an unnatural hot and cold water system), and with urban renewal projects taking out some of the established business customers, disrupt the artesian heating system. No new establishments have adopted natural hot water heat for at least several years. In spite of inflation, though, rates have not risen; those fortunate enough to be in the system have a pretty good and convenient heating bargain that promises to last a long time.

Boise no longer can boast of being unique in utilizing natural hot water for space heating. Most notable of such geothermal enterprises has been widespread use in Iceland. Large volumes of natural hot water, along with important steam fields, give geothermal heating a great boost there. Lack of any other fuel in abundance also enhances natural hot water as a domestic and commercial heat source. Reykjavik, the capital, with a population close to that of Boise, commenced natural hot water heating in 1928 and expanded the system greatly in 1942. (In connection with the expansion project, engineers came from Iceland to examine the Boise system.) One half of all of Iceland's heating now comes from hot springs water, and ninety percent of Reykjavik depends upon geothermal heat. Some water comes ten miles to help heat Iceland's capital, and drilling projects continue to expand the system. That way less oil has to be imported for heating.⁶⁰ Geothermal heating has come a long way since some Boise pioneers commenced to experiment with a natural hot water system. And with rapidly mounting concern for environmental pollution, geothermal heating is likely to expand substantially in order to give more people the advantage that its Boise promoters saw so clearly back in 1892.

Recent underground nuclear tests in Nevada have developed a system by which massive geothermal plants might be installed in a favored location where magma (hot underground rock) might occur near the earth's surface. A nuclear device exploded at a depth of 2,000 to 3,000 feet would blast a large cavity but leave it full of loose rock into which water could be piped down from the surface. Steam (to supply a generating plant in a closed system) would rise through a separate vent. Installation costs (of one million dollars or so) would be competitive, and Western state nuclear commissions would be interested. A practical site should be in a dry area, away from springs and other underground water to avoid widespread contamination. So far, no satisfactory site is known: the vast lava beds of the Snake River Plains, for example, have far too much underground water to qualify.⁶¹ Subject to discovery of a suitable location, geothermal energy in the future will not be restricted to natural steam and hot water sites of the kind presently used.

60. Wright Britton, "Sailing Iceland's Rugged Coasts," *National Geographic* (August, 1969), 136:240.

61. S. M. Barton, a Boise mining engineer and a member of the Idaho State Nuclear Energy Commission, mentioned this kind of possibility to the Idaho Commission, on January 19, 1971, after returning from an inspection of the 900-foot cavity in the Nevada test site.