THE CAPITOL MALL PROJECT, OR HOW THE STATE GOT INTO HOT WATER

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ABSTRACT

The State of Idaho now has two wells, one capable of delivering a minimum of 810 gpm of 160°F water to the Capitol Mall Geothermal Space Heating System and one of reinjecting the spent water. Final design is now underway on retrofit of the eight buildings involved and on the distribution pipeline, with geothermal heat expected to be on line by the next heating season.

This system represents the culmination of several years of study and is the result of close cooperation among three state agencies. The history of the project up to the present is outlined, along with the details of the final system, and of obstacles encountered along the way.

The State of Idaho now has in place both wells necessary to make the Capitol Mall Geothermal System a reality. One well, 2150 ft. deep with a temperature of 153°F and a pumping flow of 750 gpm, was completed in December. The other, 3030 ft. deep with a temperature of 160°F and an artesian flow of 810 gpm, was completed in August. Comprehensive pump testing has just been completed and shows minimal interference between the State of Idaho wells and other wells in the vicinity, particularly those belonging to Boise Geothermal. This hydrologic information will provide a basis for deciding which well should be the production well and which should be used for injection, as well as providing the data needed for final design of the pipelines and individual building retrofits.

The Capitol Mall consists of eight major state structures near the Capitol - several office buildings, the Capitol itself, and the State Library and Supreme Court - totaling about 600,000 square feet. They are now heated with natural gas fired boilers from a central heating plant. The newest building was designed for easy conversion to geothermal heat and several other buildings already have had alterations made in anticipation of geothermal as the heat source.

Distribution pipeline will run through existing utility tunnels, hung from overhead brackets, and carry two sets of pipe, one for inlet of geothermal water and the other for disposal. It appears that we will use individual heat exchangers in each building rather than a single central exchanger. Pipe will be preinsulated asbestos cement type, with 8" mains and 4" or 6" branches to individual buildings. Utilization of geothermal requires basically the placement of heat exchangers in each building to provide geothermally heated water to the coils in the air handling system, rather than water heated by natural gas.

Costs involved in the project are as follows. $88,000 of the cost of the well #1 came from an EDA grant. The rest of the money already spent and budgeted for the future has come directly from the Idaho Legislature through the medium of the Permanent Building Fund Advisory Council which approves actual disbursement of previously budgeted funds. The production schedule calls for completion by late summer of 1982 and we have kept very close to schedule under the able direction of CH2M Hill, our consulting engineer on the project.

The completion of this project, along with Boise Geothermal's system, will return Boise to the lead in geothermal space heating in the U.S., which it once enjoyed. Boise had geothermal heat beginning in the 1890's and the remnants of that system still are in operation. For people worried about the lifetime of geothermal systems, I can report that the old one is full of holes, after only half a century. What is remarkable is not that it leaks often but that old black iron pipe lasted so long, uninsulated and buried in a wet trench. Modern materials and more attention to trenching should make new systems last indefinitely.

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Our new geothermal system will not meet peak flow requirements but will displace approximately 90% of our yearly natural gas bills and is expected to save the State of Idaho about $140,000 per year (340,000 therms). These figures are based on a temperature drop of 30°F and a flow rate of 750 gpm. Use of the existing gas-fired system for peaking during those several cold weeks each year will be much more cost effective than investing in another production well which would be used far below capacity. Subtracting operation and maintenance and electric pumping costs from the gas savings leaves a net savings of about $90,000 per year, for a payback of investment in slighlty over 20 years. I found that original cost estimates, especially for retrofit and for drilling costs, were optimistically low. Original heat load estimates for the Mall were extraordinarily high. Large measures of conservation over the last few years have dramatically reduced the natural gas usage of the Mall. For both these reasons, our earlier projections of savings as high as $260,000 per year and paybacks as short as 4 years have not and will not come to pass.

This current project really began in late 1973 when then-Governor Cecil Andrus sought the aid of the Energy Research and Development Administration(ERDA) in assessing the potential for retrofit of state buildings in Boise to geothermal energy. In early 1974 ERDA contracted with the Idaho National Engineering Laboratory (INEL) for work on resource exploration and engineering along the Boise front. The engineering work resulted in several feasibility studies published by late 1975, one on conceptual design of a space heating project involving the Capitol Mall and Boise State University and the other involving retrofit of existing HVAC systems in those buildings. The final report, issued in April of 1976 (Schmitt, 1976), concluded that "No major resource or engineering difficulties exist which would prevent this project from being completed successfully."

Subsequently the State sought and was awarded a $300,000 grant from the Pacific Northwest Regional Commission to convert the Agricultural and Health Lab to geothermal and to continue engineering and environmental work in connection with conversion to geothermal. Disposal studies were begun and a contract was signed with Warm Springs Water District to buy hot water at 45¢ per 100 cubic feet. The State Agricultural and Health Lab went on line in late 1977 and has since provided an excellent demonstration of the viability of geothermal space heat, as well as a testing place for system control mechanisms. Further details can be found in Austin, 1978. This system achieved over 50% cost savings immediately and further refinements of the control system have cut geothermal water usage to a minimum while still allowing the addition of a large new lab wing and a new Department of Agriculture office building to the original system. Adding a few new plates to the heat exchanger is all that was needed to expand its heating capacity.

This demonstration project stimulated renewed interest in conversion of state buildings to geothermal, to the extent that the Legislature appropriated $190,000 for retrofit of the Capitol Mall in early 1979. In February Governor Evans created a State Geothermal Task Force to advise on conversion of state buildings. The Idaho Department of Water Resources provided expertise on leasing, water rights, and geology. The Department of Administration supervised actual construction, and the Office of Energy provided technical staff.

My first task after joining the office was to advise on the economic feasibility of converting the Capitol Mall to geothermal. I examined several options, all of which were preferable to continued use of natural gas. One option was for the State to buy water from the proposed Boise Geothermal system, at a public rate or a private rate or a rate similar to our contract with Warm Springs Water District. The favored option, however, was for the State to drill its own wells in the Mall area (Eastlake, 1979).

This recommendation lay dormant until December of 1979 when John Anderson of Water Resources was asked to delineate the expected subsurface geology and pick a specific range of depths where temperatures hot enough for space heating might be encountered. Suddenly, for reasons I still do not know, things were rolling. The Task Force made a recommendation to the Governor to drill a well and by late February, 1980, the State had all leases and permits in place and was ready to drill.

After two attempts at securing bids within budget for a Capitol Mall geothermal exploration well the State hired Hiddleston and Sons of Mountain Home, Idaho on a day rate. The well was spudded in August and completed in December.

At this point it appeared we were out of money. Since we had a successful first well we now needed a second well for injection plus funds to put in pipelines and complete the retrofits. Much to my surprise, the Permanent Building Fund Advisory Council and then the full Legislature, made a wholesale commitment to the Capitol Mall System and appropriated the remaining $1.6 million needed to complete the entire project. The Office of Energy has always had difficulty with our conservative legislature, but this project, once it was underway and in the hands of the Department of Administration, has been treated like just another bridge or high school. It does, after all, sou d like a sensible building project.

Late spring found the Office of Energy contracting with Morrison-Knudsen to do a study of alternate disposal methods for the spent water. They recommended injection and also recommended well specifications for our second well which would allow its possible use as the production well. The first well's production rate was limited by casing size so the second was cased large enough (12" to 1260') to allow more flow if the aquifer permitted.

The second well went out for bid in May and was begun in June and completed in early August by Holman Drilling Company of Spokane. Both wells were drilled with cable tools for about 200 feet, then rotary rigs were moved in. No unusual problems were encountered in either effort. The second well showed me how quickly sentiments change. With the first well, all of us who had been pushing this project were a bit, well, a lot, apprehensive about spending $200,000 and coming up dry. No one had ever drilled so deep in the Boise area so we were going only on our geologist's extrapolation of underlying structure between known points along the foothills a mile northeast and in the Nampa-Caldwell area fifteen miles west.

As it happens, both wells were situated in parking lots, owned by the State and only four blocks apart. They all laughed when we targeted a convenient parking lot for our first well but it now appears that Anderson's Parking Lot Theory of Well-Siting has been vindicated.

The major environmental impacts of the project so far are both connected to our selection of parking lots as well sites. The larger (8000 foot capacity) drilling rig used for the second well was bothersome to neighbors who had a tough time seeing the rationale for our choice of a short period of round-the-clock drilling instead of several months of day shift drilling. Not living nearby, I was amazed at how relatively quiet such a huge piece of machinery could be. The greatest outcry came from forward-looking state employees who were infuriated that a geothermal drilling operation designed to provide cheap heat to the State for years was stealing their parking spaces for a month. The very day the drill rig moved out, the Public Works was resurfacing the lot to its present condition.

Preliminary talks have just begun between Boise Geothermal and the State about the possibility of combining our separate geothermal systems. (For further background on both systems, see Eastlake, 1981). Interest in both systems really started simultaneously but they have pushed off on their own over the last years for a variety of reasons. Now that the pace of geothermal development in Boise has quickened there is growing recognition that some sort of combined system may be the most effective way to utilize what appears to be the same resource and deal with common problems like disposal. Whether both systems have gone their own way too long to

work out something at this late date remains an open question.

REFERENCES

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