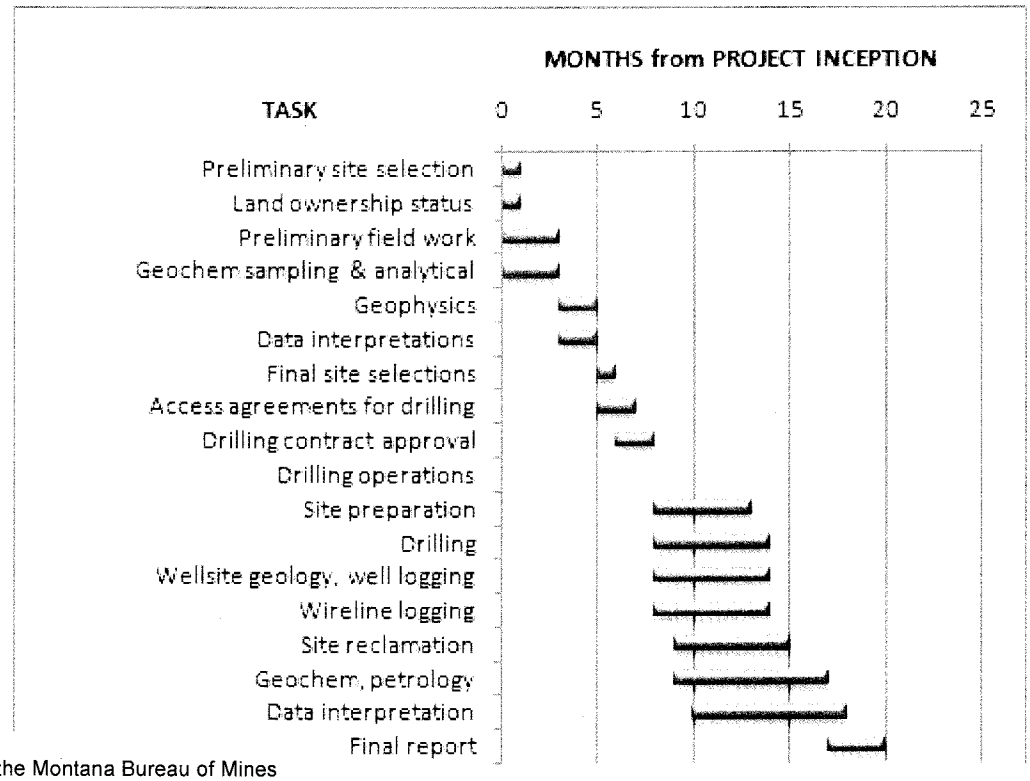
Senate Energy
Exhibit No. 2
Date 3-31-2009
Bill No. HB 333

HB333
Geothermal Research and Development

The MBMG has gathered temperature, depth, flow, and chemistry for nearly 300 warm wells and springs throughout Montana. Sonderegger and Bergantino (MBMG publication Hydrogeologic Map-HM4: Geothermal Resources of Montana, 1981) presented the range of data and sites on a statewide map showing areas of potential development. Metesh re-compiled those data and updated the information on springs and wells in 2000 (MBMG Open-file report 415: Geothermal Springs and Wells in Montana).

HB333 will provide the opportunity to explore the potential for geothermal development for 5 sites in Montana. Depending on costs, 1 to 3 sites will be selected for exploration drilling.



During the 2011 biennium the Montana Bureau of Mines and Geology shall conduct geothermal research that:
(a) characterizes the geothermal resource base in Montana;
(b) tests high-temperature and high-pressure drilling technologies benefiting geothermal well construction; and
(c) determines reservoir characterization, monitoring, and modeling necessary for commercial application in Montana.

The MBMG shall submit a report to the Energy and Telecommunications Interim Committee. The report, based on research conducted, must include:
(a) a ranking of the top five locations in Montana that offer the best opportunity for near-term development of geothermal energy; and
(b) an estimate of the cost associated with development of each site.

Budget

Distribution of expenditures is largely dependent on drilling costs. The estimates provided here are based on typical prices in late 2008. The cost per well includes drilling, fuel, mud/mud logging, casing, and materials to a total depth of 6,000 to 8,000 feet.

MBMG Personnel (includes benefits)	1.5FTE	year 1: 121,500 year 2: 124,538	
travel		5,600	
subtotal MBMG			251,638
Mobilization			120,000
Drilling (4 wells $600,000 per well)			2,400,000
Geophysics/Geochemistry			225,000
TOTAL			2,996,638

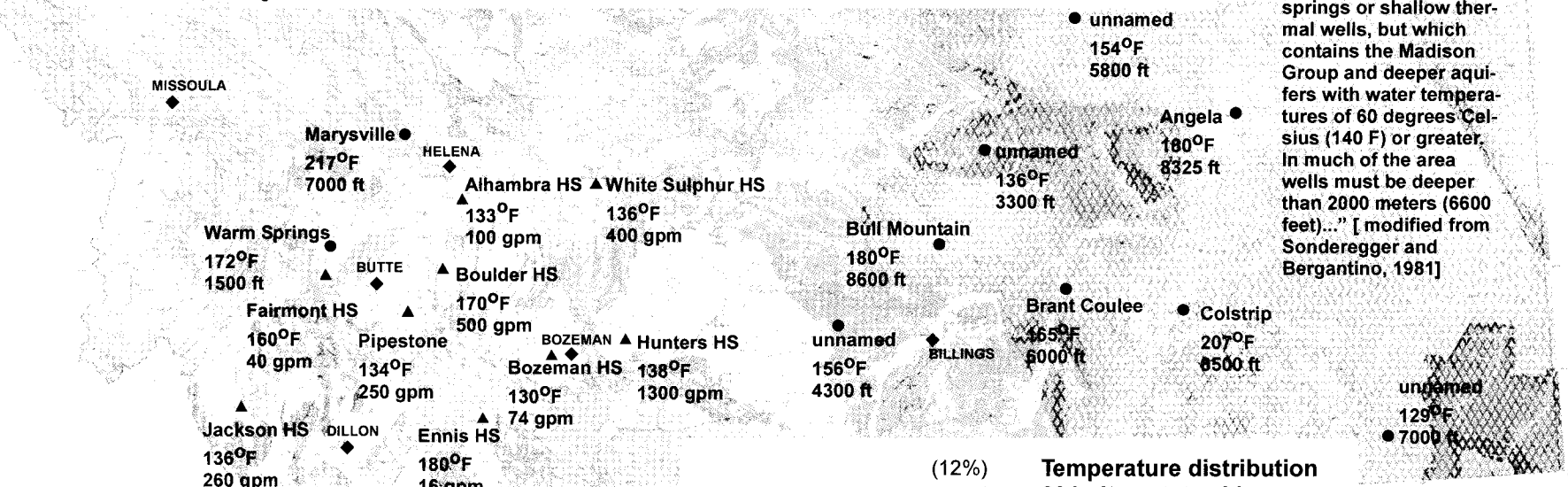
Geothermal Potential in Montana

The heat source for geothermal wells and springs broadly fall into one of three categories:

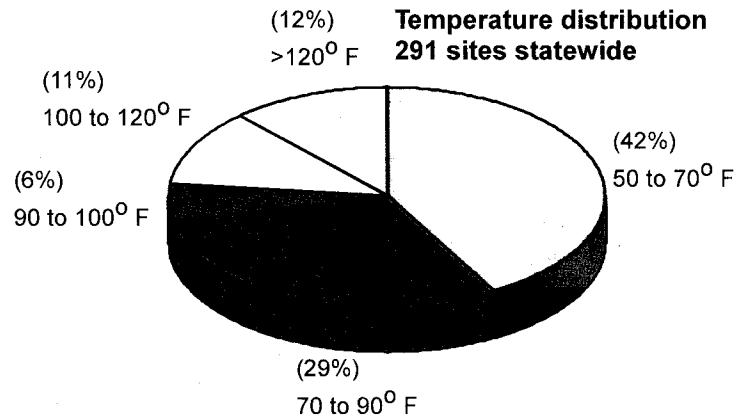
The most obvious heat sources are those related to "young" igneous intrusives, which commonly are associated with volcanic activity. In other parts of the world these generate very high temperature water and steam. In Montana, the immediate area that borders Yellowstone National Park exhibits high heat and water flow, but is protected from development. The Boulder Batholith in west-central Montana between Butte and Helena provides moderate heat from uranium decay. Many springs and wells are found on the edges of the batholith (for example, Boulder, Alhambra, Pipestone, and Fairmont).

Many of the springs in southwest Montana are the result of ground water flowing through deep geologic formations. The water is heated by the normal geothermal gradient (about 2 degrees Fahrenheit for each 100 feet of depth) and then is rapidly brought to the surface along faults. These types of geothermal features tend to be directly related to faults, and are generally smaller in size, lower in temperature, and harder to identify, explore and exploit than the larger, hotter features related to igneous rocks.

The eastern third of Montana is underlain by deeply buried layers of sedimentary rocks. Some of these layers transmit ground water from near the surface to depths of over 6,000 feet. As with western Montana, the geothermal gradient heats the water, but the lack of conductive faults prevent the water from coming to the surface. Oil and gas wells drilled into the Madison Aquifer in central and eastern Montana have shown temperatures well over 200 degrees Fahrenheit.



"Area without thermal springs or shallow thermal wells, but which contains the Madison Group and deeper aquifers with water temperatures of 60 degrees Celsius (140 F) or greater. In much of the area wells must be deeper than 2000 meters (6600 feet)..." [modified from Sonderegger and Bergantino, 1981]

▲ Spring
Surface temperature (°F)
surface flow gallons per minute (gpm)

● Well
downhole temperature (°F)
depth of well (feet below ground surface)