Geothermal Small Business Workbook

By Liz Battocletti, Bob Lawrence & Associates, Inc.

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# Geothermal Small Business Workbook

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</tbody>
</table>
Introduction

“To accomplish great things, we must not only act, but also dream; not only plan, but also believe.”

— Anatole France

Small businesses¹ are the cornerstone of the American economy. Over 22 million small businesses account for approximately 99% of employers, employ about half of the private sector workforce, and are responsible for about two-thirds of net new jobs.² Many small businesses fared better than the Fortune 500 in 2001. Non-farm proprietors’ income rose 2.4% in 2001 while corporate profits declined 7.2%.

Yet not all is rosy for small businesses, particularly new ones. One-third close within two years of opening. From 1989 to 1992, almost half closed within four years; only 39.5% were still open after six years.³ Why do some new businesses thrive and some fail? What helps a new business succeed? Industry knowledge, business and financial planning, and good management. Small geothermal businesses are no different.

Low- and medium-temperature geothermal resources exist throughout the western United States, the majority not yet tapped. A recent survey of ten western states identified more than 9,000 thermal wells and springs, over 900 low- to moderate-temperature geothermal resource areas, and hundreds of direct-use sites.⁴ Many opportunities exist for geothermal entrepreneurs to develop many of these sites into thriving small businesses.

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¹ A small business is defined as a business with less than 500 employees.


⁴ Geo-Heat Center, <http://geoheat.oit.edu/>. The database includes 404 western-U.S. communities with a combined population of 9.2 million that could potentially utilize geothermal energy for district heating and other applications. Of the total 2,479 thermal wells that were identified as having temperatures greater than or equal to 50°C (122°F), 1,722 are located within five miles of a community. If these collocated resources were used only to heat buildings, the cities have the potential to displace 50 million barrels of oil per year.
The *Geothermal Small Business Workbook* (“Workbook”) was written to give geothermal entrepreneurs, small businesses, and developers the tools they need to understand geothermal applications—both direct use and small-scale power generation—and to write a business and financing plan.

The Workbook will:

- Provide background, market, and regulatory data for direct use and small-scale (< 1 megawatt) power generation geothermal projects;
- Refer you to several sources of useful information including owners of existing geothermal businesses, trade associations, and other organizations;
- Break down the complicated and sometimes tedious process of writing a business plan into five easy steps;
- Lead you—the geothermal entrepreneur, small company, or project developer—step-by-step through the process needed to structure a business and financing plan for a small geothermal project; and
- Help you develop a financing plan that can be adapted and taken to potential financing sources.

The Workbook will not:

- Substitute for financial advice;
- Overcome the high exploration, development, and financing costs associated with smaller geothermal projects;\(^5\)
- Remedy the lack of financing for the exploration stage of a geothermal project; or
- Solve financing problems that are not related to the economic soundness of your project or are caused by things outside of your control.

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\(^5\) “Unfortunately for smaller and medium sized projects, development costs are not proportionate to the size for the project...Legal costs in particular are not linearly related to project size.” *Draft Financing Readiness: A Handbook for Energy Project Developers*, for the California Energy Commission by Power Project Financing, Inc., December 11, 1997, pp 4-1 and 4-2.
Supported by the U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, Geothermal Technologies Program under Contract No.  DE-FG03-01SF22365, the *Geothermal Small Business Workbook* is the first of two. The second workbook will describe various types of financing sources for geothermal entrepreneurs, small companies, and developers, and explain their financing criteria. It is expected to be available at the end of 2003.

Special appreciation for their help goes to Allan Jelacic, Roy Mink, and Susan Norwood of DOE’s Geothermal Technologies Program; Toni Boyd, John Lund, and Kevin Rafferty of the Geo-Heat Center at the Oregon Institute of Technology (OIT); Jamie Albert of OIT’s Small Business Development Center; Marilyn Nemzer of the Geothermal Education Office; and Roger Hill of Sandia National Laboratories. The author would also like to thank the businesses which responded to the Small Geothermal Business Survey and agreed to be listed as contacts in the Workbook.

All photographs unless otherwise noted come from the National Renewable Energy Laboratory Photographic Information eXchange collection. Cover photographs of geothermal sites are clockwise from left to right, Pagosa Springs in Colorado, a fish farm in Colorado, the Wineagle plant in California, and Valley Fresh Greenhouse in Colorado.

The *Geothermal Small Business Workbook* was written under the aegis of GeoPowering the West (GPW). GPW is a DOE-sponsored activity to dramatically increase the use of geothermal energy in the 19 western United States.

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7 See the GeoPowering the West website, <http://www.eere.energy.gov/geopoweringthewest/geopowering.html>.

8 The 19 western states targeted by GPW are Alaska, Arizona, California, Colorado, Hawaii, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.
Geothermal Projects

“The price of success is hard work, dedication to the job at hand, and the determination that whether we win or lose, we have applied the best of ourselves to the task at hand.”

— Vince Lombardi

Geothermal energy is heat (thermal) derived from the earth (geo). It is the thermal energy contained in the rock and fluid in the earth’s crust. Geothermal resources come in all shapes, sizes, locations, and temperatures. A geothermal resource’s temperature usually determines how it is used.

<table>
<thead>
<tr>
<th>POTENTIAL USE</th>
<th>RESOURCE TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground-source heat pumps</td>
<td>4°C to 38°C / 40°F to 100°F</td>
</tr>
<tr>
<td>Direct use</td>
<td>38°C to 150°C / 100°F to 302°F</td>
</tr>
<tr>
<td>Electricity generation</td>
<td>&gt; 150°C / 302°F</td>
</tr>
</tbody>
</table>

Highest temperature geothermal resources are generally used only for electric power generation. Current U.S. geothermal electric power generation totals approximately 2,800 MWe, equivalent to about four large nuclear power plants. Geothermal power plants range in size from a 350-kWe unit at the Wineagle plant to the proposed 187-MWe Salton Sea Unit 6 plant.

Lowest temperature geothermal resources are harnessed by ground-source heat pumps. Heat pumps transfer heat from the soil to the house in winter and from the house to the soil in summer.9

9 For more information on geothermal heat pumps, see the GeoExchange Geothermal Heat Pump Consortium website: <http://www.ghpc.org/home.htm>, and “An Information Survival Kit for the Prospective Geothermal Heat Pump Owner,” by Kevin Rafferty, Geo-Heat Center,
Direct use projects have temperatures between those of heat pumps and electric power generation. They use heat in the water directly for a variety of purposes including to grow flowers, raise fish, heat buildings, or dry vegetables. The current U.S. installed capacity of direct use systems totals 600 MWt, enough to heat 115,000 average-sized houses.

Geothermal projects can be “cascaded,” e.g., use the same geothermal resource for multiple purposes, thereby increasing the operation’s economics. Empire Foods in Nevada uses geothermal resources to generate electricity and dehydrate 26 million pounds of dried onion and garlic annually. Many spas and resorts use geothermal resources for heat, hot water, and pools, not necessarily in that order. And Liskey Farms in Oregon has used its geothermal resource to grow bedding plants and perennials, heat buildings and greenhouses, wash equipment, mix with chopped hay to feed calves, raise tropical fish, and water cattle.

There are five basic types of direct use geothermal projects:

1. Aquaculture,
2. Greenhouses,
3. Industrial and agricultural processes,
4. Resorts and spas, and
5. Space and district heating.

Direct-use systems are typically composed of three components:

1. A production facility – usually a well, to bring the hot water to the surface;
2. A mechanical system – piping, heat exchanger, controls, to deliver the heat to the space or process; and
3. A disposal system – injection well or storage pond, to receive the cooled geothermal fluid.  

The following section gives a brief description of each type of direct use project, as well as small-scale (< 1 MWe) geothermal power plants, and provides market data


when available.\textsuperscript{11} It ends with a list of useful contacts and a brief discussion of relevant regulatory and environmental issues.

\textbf{Aquaculture}

Aquaculture is “the production and sale of farm-raised aquatic plants and animals.”\textsuperscript{12} Geothermal aquaculture uses naturally occurring warm water to accelerate the growth of fish, shellfish, reptiles, amphibians, and aquatic plants. Rearing fish in controlled temperatures can boost growth rates by 50 to 100\%, dramatically increasing the number of harvests possible each year. Aquaculture is a high potential development area for low-temperature geothermal resources.\textsuperscript{13}

Aqua-farmers in the United States grow alligators, bass, catfish, giant fresh water prawns, gold fish, koi, lobster, snails, sturgeon, tilapia, tropical fish, trout, turtles, and water lilies. There are currently 48 geothermal aquaculture operations in 11 Western states.\textsuperscript{14}

\begin{center}
\begin{tabular}{|l|c|}
\hline
\textbf{STATE} & \textbf{NUMBER OF GEOTHERMAL AQUACULTURE OPERATIONS} \\
\hline
Arizona & 4 \\
California & 16 \\
Colorado & 4 \\
Idaho & 8 \\
\hline
\end{tabular}
\end{center}

### Table: State Number of Geothermal Aquaculture Operations

<table>
<thead>
<tr>
<th>State</th>
<th>Number of Geothermal Aquaculture Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montana</td>
<td>1</td>
</tr>
<tr>
<td>Nevada</td>
<td>5</td>
</tr>
<tr>
<td>New Mexico</td>
<td>2</td>
</tr>
<tr>
<td>Oregon</td>
<td>2</td>
</tr>
<tr>
<td>South Dakota</td>
<td>1</td>
</tr>
<tr>
<td>Utah</td>
<td>4</td>
</tr>
<tr>
<td>Wyoming</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
</tr>
</tbody>
</table>

Fish and other species can be raised in simple open air earthen ponds or sophisticated fiberglass tanks. In addition to the materials used, the cost of a geothermal aquaculture project depends on the size of the project, the species raised, and whether a well already exists. Well depths and drilling costs vary widely from $30-$200 per foot; most common well drilling costs are $50-$100/foot. Ninety percent of direct use wells are less than 1,800 feet deep. Land cost is a significant portion of the total capital investment.

As one might suspect, water quality is extremely critical in aquaculture. Some of the water quality factors that can affect the growth of an aquaculture species are:

- Temperature,
- Dissolved oxygen,
- Nitrogenous wastes,
- pH,
- Alkalinity,
- Hardness,
- Carbon dioxide,
- Salinity,
- Chlorine, and
- Hydrogen sulfide.

The maximum pond area that can be developed depends on the maximum heat available from the resource. The resource temperature also determines what

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16 Boyd and Rafferty, p. 2.1.
species can be raised. Each species has an optimum temperature at which it grows best. The following table shows the temperature requirements and growth periods for several aquaculture species. Growth periods to market vary, depending on the desired size of the fish.

**Temperature Requirements and Growth Periods for Selected Aquaculture Species**

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>TOLERABLE EXTREMES (ºF)</th>
<th>OPTIMUM GROWTH (ºF)</th>
<th>GROWTH PERIOD TO MARKET SIZE (MONTHS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oysters</td>
<td>32-97 typ</td>
<td>76-78 typ</td>
<td>24</td>
</tr>
<tr>
<td>Lobsters</td>
<td>32-88</td>
<td>72-75</td>
<td>24</td>
</tr>
<tr>
<td>Penaeid Shrimp</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kuruma</td>
<td>40-72</td>
<td>77-87</td>
<td>6-8 typ</td>
</tr>
<tr>
<td>Pink</td>
<td>52-104</td>
<td>75-85</td>
<td>6-8</td>
</tr>
<tr>
<td>Salmon (Pacific)</td>
<td>40-77</td>
<td>59</td>
<td>6-12</td>
</tr>
<tr>
<td>Freshwater Prawns</td>
<td>75-90</td>
<td>83-87</td>
<td>6-12</td>
</tr>
<tr>
<td>Catfish</td>
<td>35-95</td>
<td>82-87</td>
<td>6-24</td>
</tr>
<tr>
<td>Eels</td>
<td>32-97</td>
<td>73-86</td>
<td>12-24</td>
</tr>
<tr>
<td>Tilapia</td>
<td>47-106</td>
<td>72-86</td>
<td>12</td>
</tr>
<tr>
<td>Carp</td>
<td>40-100</td>
<td>68-90</td>
<td></td>
</tr>
<tr>
<td>Trout</td>
<td>32-89</td>
<td>63</td>
<td>6-8</td>
</tr>
<tr>
<td>Yellow Perch</td>
<td>32-86</td>
<td>72-82</td>
<td>10</td>
</tr>
<tr>
<td>Striped Bass</td>
<td>?-86</td>
<td>61-66</td>
<td>6-8</td>
</tr>
</tbody>
</table>

The U.S. had a huge $7.1 billion trade deficit in edible fishery products in 2002. U.S. imports of edible fishery products in 2002 were 2 million metric tons valued at $10.1 billion. Shrimp imports, valued at $3.4 billion, accounted for 34% of the value of total edible imports. U.S. exports of edible fishery products of domestic origin were valued at $3.0 billion.

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Aquaculture is a fairly depressed industry at the moment. Imports are rising but mainly in those products in which U.S. growers don’t compete too well—particularly tilapia. Virtually all of the imports are in processed products; U.S. growers do best in the live market. The catfish industry has been hit hard by imports too and prices have been flat for years. Successful aquaculture operators are those who identify a niche market and serve it consistently and with a superior quality product.¹⁹

An important source of market information on the aquaculture industry, both domestic and import, is the *Aquaculture Outlook* which is published twice a year by the Economic Research Service of the U.S. Department of Agriculture. The data below is from the 14 March 2003 report:²⁰

- The percentage of total U.S. seafood consumption coming from aquaculture has continued to rise over the last several years. The bulk of the increase has come from higher imports of farm-raised products.

- The U.S. imports several billion dollars of aquaculture products every year, e.g., tilapia, salmon, shrimp, mollusks, and ornamental fish.

- With greater international trade in food products, domestic aquaculture producers are expected to more often come into direct competition with aquacultural producers around the globe.

- The worldwide increases in production are likely to be accompanied by declining real prices.

- Domestic outlook:
  - Catfish sales and prices are higher in 2003.
  - Commercial trout sales dropped to $70 million in 2002.

- International outlook:

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¹⁹ Per correspondence from Kevin Rafferty, Geo-Heat Center, 15 April 2003.

○ Quantity and value of tilapia imports are up and expected to continue to rise.
○ Atlantic salmon imports up 15% in 2002.
○ Shrimp imports: volume up, prices down.

The following statistics are for Animal Aquaculture (SIC 0273).21 While they include non-geothermal aquaculture, they are representative of the overall industry. Not all establishments indicated a specialty.

<table>
<thead>
<tr>
<th>SIC Code</th>
<th>Description</th>
<th>No. Bus.</th>
<th>% Total</th>
<th>Total Emp.</th>
<th>Total Sales (Million)</th>
<th>Average Emp.</th>
<th>Average Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>0273-0000</td>
<td>Animal aquaculture</td>
<td>236</td>
<td>27.1</td>
<td>1,481</td>
<td>56.9</td>
<td>6</td>
<td>$300,000</td>
</tr>
<tr>
<td>0273-0100</td>
<td>Finfish farm</td>
<td>163</td>
<td>18.7</td>
<td>638</td>
<td>63.1</td>
<td>4</td>
<td>$400,000</td>
</tr>
<tr>
<td>0273-0101</td>
<td>Catfish farm</td>
<td>171</td>
<td>19.6</td>
<td>1,462</td>
<td>92.7</td>
<td>9</td>
<td>$600,000</td>
</tr>
<tr>
<td>0273-0102</td>
<td>Goldfish farm</td>
<td>5</td>
<td>0.6</td>
<td>24</td>
<td>0.9</td>
<td>5</td>
<td>$200,000</td>
</tr>
<tr>
<td>0273-0103</td>
<td>Minnow farm</td>
<td>21</td>
<td>2.4</td>
<td>121</td>
<td>9.7</td>
<td>6</td>
<td>$500,000</td>
</tr>
<tr>
<td>0273-0104</td>
<td>Tropical fish farm</td>
<td>81</td>
<td>9.3</td>
<td>243</td>
<td>16.3</td>
<td>3</td>
<td>$200,000</td>
</tr>
<tr>
<td>0273-0105</td>
<td>Trout farm</td>
<td>140</td>
<td>16.1</td>
<td>897</td>
<td>57.7</td>
<td>6</td>
<td>$500,000</td>
</tr>
<tr>
<td>0273-0200</td>
<td>Shellfish farm</td>
<td>42</td>
<td>4.8</td>
<td>217</td>
<td>23.1</td>
<td>5</td>
<td>$600,000</td>
</tr>
<tr>
<td>0273-0201</td>
<td>Crustacean farm</td>
<td>9</td>
<td>1</td>
<td>80</td>
<td>22.1</td>
<td>9</td>
<td>$2.5 M</td>
</tr>
<tr>
<td>0273-0202</td>
<td>Mollusk farm</td>
<td>4</td>
<td>0.5</td>
<td>68</td>
<td>3.6</td>
<td>17</td>
<td>$900,000</td>
</tr>
<tr>
<td></td>
<td>Total/Average</td>
<td>872</td>
<td>100.1</td>
<td>5,231</td>
<td>346.1</td>
<td>6</td>
<td>$400,000</td>
</tr>
</tbody>
</table>

The National Aquaculture Act of 198022 provides for the development of aquaculture in the United States, stating that:

Congress declares that aquaculture has the potential for reducing the United States trade deficit in fisheries products, for augmenting

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21 Standard Industrial Classification (SIC) code.

existing commercial and recreational fisheries and for producing other renewable resources, thereby assisting the United States in meeting its future food needs and contributing to the solution of world resource problems. It is, therefore, in the national interest, and it is the national policy, to encourage the development of aquaculture in the United States.

Most states require from four to ten permits or licenses for an aquaculture project. Texas requires over 20. Permits which impact the aquaculture industry involve four basic issues:

1. Water use,
2. Effluent discharge,
3. Production, and

The Environmental Protection Agency (EPA) proposed new effluent limitations guidelines and standards for the Concentrated Aquatic Animals Production (CAAP) Category on 12 September 2002. The proposed regulations apply to facilities which produce at least 100,000 pounds annually in recirculating, flow through, or net pens. Ponds, lobster pounds, crawfish ponds, open water production of mollusc and shellfish, alligators, and Alaska net pen production of salmon are not subject to the proposal. Final action is scheduled for June 2004.23

For more information on your state’s required permits and licenses, refer to the State/Territory Permits and Regulations Impacting the Aquaculture Industry. Prepared for the Joint Subcommittee on Agriculture by the Maryland Department of Agriculture and the National Association of State Aquaculture Coordinators, the publication lists permits and regulations by state, state aquaculture coordinators and contacts, and federal aquaculture legislation and regulations. It is available online from the AquaNIC website.24

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23 For more information on the new regulations, see the EPA Aquatic Animal Production Industry Effluent Guideline website at <http://epa.gov/guide/aquaculture/>.

Useful Contacts

The following individuals have expressed their willingness to be included in this Workbook as a resource for potential entrepreneurs.

**Belmont Springs Hatchery**
John McClellan,  
Project Manager  
P.O. Box 31  
Fielding, UT 84311  
Tel: (435) 279-0074  
Fax: (435) 458-2200  
Email: belmontspringshatchery@frontiernet.net  
– Uses a 127ºF (53ºC) artesian well with a flow rate of 3,500 gallons per second, to raise channel catfish and Australian red claw lobster.

**Colorado Gators**
Erwin Young,  
Owner  
Box 1052  
Alamesa, CO 81101  
Tel: (719) 378-2050  
Fax: (719) 378-2050  
Email: lynne@gatorfarm.com  
Website: http://www.gatorfarm.com/  
– Raises tilapia and other fish, alligators, and turtles; also grows flowers, tropical plants, and herbs (small scale); in business since 1979.  
– Advice to new business: Research the particular business, visit existing business owners, and look for answers.
Fish Breeders of Idaho
Leo Ray
P.O. Box 479
4647-C River Rd.
Hagerman, ID 83332
Tel: (208) 837-6114
Fax: (208) 837-6254
Email: jkray@pmt.org

– Started business 35 years ago; raises alligators, trout, catfish, sturgeon, and tilapia; got alligators to clean up waste; now sell for meat and hides.

Wayne Rasmussen
2981 Little Valley Hot Springs
Harper, OR 97906
Email: littleval@ruralnetwork.net

– In business from 1993-1998; raised water lilies, koi, and gold fish; currently retired.

– Advice to new business: Make sure of your resource and laws; it is the energy of the future and it’s free. Future Hydrogen will be produced with free Geothermal heat.

There is certainly no lack of information about aquaculture and aquaculture-related issues. In addition to species-specific trade associations, many states have aquaculture associations. The following is a sample of useful organizations. For those which do not have a website, addresses and phone numbers are provided.25

Alaskan Shellfish Growers Association
http://alaskashellfish.com/

Alternative Aquaculture Association
http://www.altaqua.com/

American Alligator Farmers Association
5145 Harvey Tew Road
Plant City, FL 33565
Tel: (813) 752-2836
Fax: (813) 754-3595

American Fisheries Society
http://www.fisheries.org/

American Tilapia Association
http://ag.arizona.edu/azaqua/ata.html

Aquaculture Briefing Room
http://www.ers.usda.gov/briefing/aquaculture

AFSIC Aquaculture-Related Internet Sites
http://www.nal.usda.gov/afsic/aquasite.htm

25 Inclusion of a website or organization does not represent endorsement by the author or the U.S. Government.
Aquaculture in Hawaii
Department of Agriculture
State of Hawaii
http://www.hawaiiaquaculture.org/

Aquaculture Network Information Center (AquaNIC)
http://aquanic.org/index.htm

Arizona Aquaculture Association
http://ag.arizona.edu/azaqua/azaqua_assos/azaqua_assoc.htm

California Aquaculture Association
http://aqua.ucdavis.edu/organizations/caa.html

Chilean Seafood Exchange: Internet Resources
http://www.csx.org/resources/aqua.htm

Colorado Aquaculture Association
http://colaqua.org/

Geothermal Aquaculture Research Foundation (GARF)
http://www.garf.org/

Global Aquaculture Alliance
http://www.gaalliance.org/

Hawaii Aquaculture Association
Linden Burzell
335 Merchant Street, Room 348
Honolulu, HI 96813
Tel: (808) 587-0030
Fax: (808) 587-0033

Kansas Commercial Fish Growers Association
Mark Hajek
RR 1, Box 216
Marion, KS 66861
Tel: (316) 382-2321

Louisiana Alligator Farmers and Ranchers Association
1105 W. Port
Abbeville, LA 70510
Tel: (318) 898-4335
Fax: (318) 898-4309

National Aquaculture Association
http://www.natlaquaculture.org/

National Oceanic and Atmospheric Administration (NOAA) Fisheries: Aquaculture
http://www.nmfs.noaa.gov/aquaculture.htm

National Ornamental Goldfish Growers Association
Billy Bland’s Fishery, Inc.
P.O. Box 430
Taylor, AR 71861
Tel: (501) 694-4811
Fax: (501) 694-2034

National Shellfisheries Association
http://www.shellfish.org/

Nebraska Fish Farmers Association Inc.
Wilbur G. Epp
Rt. 1, Box 199
Henderson, NE 68371
Tel: (402) 723-4210
Greenhouses

Greenhouse heating is one of the most common uses of geothermal resources. Because of the significant heating requirements of greenhouses and their ability to use very low-temperature fluids, they are a natural application. A wide variety of plants are grown in geothermal greenhouses including tree seedlings; roses, carnations, lilies, and other flowers; tomatoes, lettuce, cucumbers, and other vegetables (hydroponic and otherwise); poinsettias; potted plants; and flower and vegetable bedding plants.

Commercial greenhouses offer investment and career possibilities. Typical barriers to entry are relatively low, and net investment levels are not prohibitive. The industry is also highly fragmented, without any dominant leaders in terms of size or net sales. Markets appear to be plentiful throughout the country, and metropolitan markets are readily served from outlying rural areas.

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There are currently 41 geothermal greenhouse operations in nine Western states.28

<table>
<thead>
<tr>
<th>STATE</th>
<th>NUMBER OF GEOTHERMAL GREENHOUSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>4</td>
</tr>
<tr>
<td>California</td>
<td>4</td>
</tr>
<tr>
<td>Colorado</td>
<td>1</td>
</tr>
<tr>
<td>Idaho</td>
<td>13</td>
</tr>
<tr>
<td>Montana</td>
<td>4</td>
</tr>
<tr>
<td>New Mexico</td>
<td>5</td>
</tr>
<tr>
<td>Oregon</td>
<td>4</td>
</tr>
<tr>
<td>Utah</td>
<td>5</td>
</tr>
<tr>
<td>Wyoming</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>41</td>
</tr>
</tbody>
</table>

The first step in designing a greenhouse is to determine the heating requirements which is primarily a function of the temperature difference between the inside and the outside, and construction materials. Six different geothermal heating systems may be applied to greenhouses:

1. Finned pipe,
2. Standard unit heaters,
3. Low-temperature unit heaters,
4. Fan coil units,
5. Soil heating, and
6. Bare tube.29

For a small “backyard” greenhouse, the simplest heating system is the hot water unit heater. Unit heaters are a practical method of greenhouse heating at supply water temperatures down to 60-65°C (140-150°F).30
Greenhouses can be made of glass, plastic film, fiberglass or rigid plastics, or a combination of materials. Glass greenhouses are the most expensive to build because of the glazing material and the need for a stronger framework to support the glass. Glass offers the highest light quality but the lowest energy efficiency.\(^\text{31}\)

One of the most common small greenhouse structures is a 30-foot wide, Quonset-style\(^\text{32}\) covered with a double layer of plastic sheet. The length of the house can be adjusted to accommodate the needs of the grower—96 feet is a common length. Assuming an 18°C (65°F) inside temperature, and a -12°C (10°F) outside temperature, a greenhouse this size would have a heating load of approximately 90 Bru/hr per square foot of floor area.\(^\text{33}\)

The heating system also depends on the grower’s preference and the type of crop or possible disease problems. Roses and mums need closely controlled humidity and air circulation; tropical and subtropical plants need high humidity and high soil temperatures.\(^\text{34}\)

Capital costs vary by project size, location, material used, and whether a well currently exists. Northern climates have higher costs due to the need for additional thermal curtains.\(^\text{35}\) Commercial greenhouses range from 1 to 30 acres in size (1 acre = 43,560 ft\(^2\)). Total greenhouse costs, including the greenhouse and operating equipment, are $12.84-$16.12/ft\(^2\) of greenhouse, with an average cost of $14.32/ft\(^2\). A “backyard”-

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\(^{33}\) Rafferty, 2001, p. 22.

\(^{34}\) Rafferty, 1998, p. 310.

\(^{35}\) Boyd and Rafferty, 1997, p. 2.1.
1,000 ft² greenhouse would cost approximately $14,320. A one-acre greenhouse would cost about $624,000, excluding economies of scale. Of the total, construction costs alone are $8.26-9.11/ft² with an average of $8.42/ft². Land cost is a significant portion of the total capital investment.36

IFA Nurseries, Inc. has invested $3 million to date on three 50,000 ft² state-of-the-art geothermal greenhouses in Oregon, at a cost of approximately $20/ft². The cost does not include well drilling; the company tapped into an existing city well. The company is “still not done investing.”37

Based on an economic model developed by the Southwest Technology Development Institute of New Mexico State University, depending on the region, a geothermal greenhouse’s operating budget might look like the pie chart below. Annual water consumption is approximately 5 million gallons per acre per year.38

Most greenhouse operators estimate that using geothermal resources instead of traditional energy sources saves about 80% of fuel costs—about 5% to 8% of total operating costs. The relatively rural location of most geothermal resources also offers advantages, including clean air, few disease problems, clean water, a stable workforce, and, often, low taxes.39

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37 Per conversation with Dave Stearns; IFA Nurseries, Inc.; 19 March 2003.
38 Boyd and Rafferty, pp. 2.1-2.2.
The following statistics are for Ornamental Nursery Products (SIC 0181). They include products grown in all types of cover, e.g., greenhouse, frame, cloth house, lath house, or outdoors. Not all establishments indicated a specialty.

<table>
<thead>
<tr>
<th>SIC CODE</th>
<th>DESCRIPTION</th>
<th>NO. BUS.</th>
<th>% TOTAL</th>
<th>TOTAL EMP.</th>
<th>TOTAL SALES (MILLION)</th>
<th>AVERAGE EMP.</th>
<th>AVERAGE SALES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0181-0000</td>
<td>Ornamental nursery products</td>
<td>3,194</td>
<td>26.8</td>
<td>21,680</td>
<td>1,335.9</td>
<td>7</td>
<td>$500,000</td>
</tr>
<tr>
<td>0181-0100</td>
<td>Plants, foliage, and shrubberies</td>
<td>274</td>
<td>2.3</td>
<td>2,638</td>
<td>245.5</td>
<td>10</td>
<td>$1 M</td>
</tr>
<tr>
<td>0181-0101</td>
<td>Bedding plants, growing of</td>
<td>448</td>
<td>3.8</td>
<td>5,050</td>
<td>382.5</td>
<td>11</td>
<td>$900,000</td>
</tr>
<tr>
<td>0181-0102</td>
<td>Foliage, growing of</td>
<td>153</td>
<td>1.3</td>
<td>2,383</td>
<td>168.0</td>
<td>16</td>
<td>$1.2 M</td>
</tr>
<tr>
<td>0181-0103</td>
<td>Mats, pre-seeded: soil erosion, growing of</td>
<td>36</td>
<td>0.3</td>
<td>127</td>
<td>5.9</td>
<td>4</td>
<td>$200,000</td>
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<tr>
<td>0181-0104</td>
<td>Nursery stock, growing of</td>
<td>2,267</td>
<td>19.1</td>
<td>31,690</td>
<td>2,026.5</td>
<td>14</td>
<td>$1 M</td>
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<tr>
<td>0181-0105</td>
<td>Plants, potted: growing of</td>
<td>410</td>
<td>3.4</td>
<td>5,902</td>
<td>536.2</td>
<td>14</td>
<td>$1.4 M</td>
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<tr>
<td>0181-0106</td>
<td>Shrubberies, grown in field nurseries</td>
<td>160</td>
<td>1.3</td>
<td>1,094</td>
<td>47.9</td>
<td>7</td>
<td>$300,000</td>
</tr>
<tr>
<td>0181-0107</td>
<td>Shrubberies grown under cover (e.g. greenhouse production)</td>
<td>181</td>
<td>1.5</td>
<td>1,182</td>
<td>60.1</td>
<td>7</td>
<td>$400,000</td>
</tr>
<tr>
<td>0181-0200</td>
<td>Florists’ greens and flowers</td>
<td>579</td>
<td>4.9</td>
<td>2,678</td>
<td>150.1</td>
<td>5</td>
<td>$300,000</td>
</tr>
<tr>
<td>0181-0201</td>
<td>Florists’ greens cultivated: growing of</td>
<td>92</td>
<td>0.8</td>
<td>623</td>
<td>33.0</td>
<td>7</td>
<td>$400,000</td>
</tr>
<tr>
<td>SIC Code</td>
<td>Description</td>
<td>No. Bus.</td>
<td>% Total</td>
<td>Total Emp.</td>
<td>Total Sales (Million)</td>
<td>Average Emp.</td>
<td>Average Sales</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------</td>
<td>---------</td>
<td>---------</td>
<td>------------</td>
<td>-----------------------</td>
<td>--------------</td>
<td>---------------</td>
</tr>
<tr>
<td>0181-0202</td>
<td>Flowers, grown in field nurseries</td>
<td>636</td>
<td>5.3</td>
<td>6,356</td>
<td>345.9</td>
<td>10</td>
<td>$600,000</td>
</tr>
<tr>
<td>0181-0203</td>
<td>Flowers: grown under cover (e.g. greenhouse production)</td>
<td>1,698</td>
<td>14.3</td>
<td>12,157</td>
<td>776.0</td>
<td>7</td>
<td>$500,000</td>
</tr>
<tr>
<td>0181-0204</td>
<td>Roses, growing of</td>
<td>112</td>
<td>0.9</td>
<td>1,942</td>
<td>142.9</td>
<td>17</td>
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<tr>
<td>0181-0300</td>
<td>Bulbs and seeds</td>
<td>73</td>
<td>0.6</td>
<td>1,161</td>
<td>72.5</td>
<td>17</td>
<td>$1.4 M</td>
</tr>
<tr>
<td>0181-0301</td>
<td>Bulbs, growing of</td>
<td>53</td>
<td>0.4</td>
<td>873</td>
<td>34.2</td>
<td>16</td>
<td>$700,000</td>
</tr>
<tr>
<td>0181-0302</td>
<td>Seeds, flower: growing of</td>
<td>134</td>
<td>1.1</td>
<td>646</td>
<td>34.1</td>
<td>5</td>
<td>$300,000</td>
</tr>
<tr>
<td>0181-0303</td>
<td>Seeds, vegetable: growing of</td>
<td>192</td>
<td>1.6</td>
<td>2,271</td>
<td>200.7</td>
<td>12</td>
<td>$1.2 M</td>
</tr>
<tr>
<td>0181-9901</td>
<td>Fruit stocks, growing of</td>
<td>121</td>
<td>1</td>
<td>1,280</td>
<td>35.7</td>
<td>11</td>
<td>$300,000</td>
</tr>
<tr>
<td>0181-9902</td>
<td>Sod farms</td>
<td>1,086</td>
<td>9.1</td>
<td>9,563</td>
<td>681.1</td>
<td>9</td>
<td>$700,000</td>
</tr>
<tr>
<td><strong>Total/Average</strong></td>
<td></td>
<td><strong>11,899</strong></td>
<td><strong>99.8</strong></td>
<td><strong>111,296</strong></td>
<td><strong>7,314.7</strong></td>
<td><strong>9</strong></td>
<td><strong>$700,000</strong></td>
</tr>
</tbody>
</table>
Useful Contacts

The following individuals have expressed their willingness to be included in this Workbook as a resource for potential entrepreneurs.

**Burgett Geothermal Greenhouses**
Dale Burgett, CEO
P.O. Box 265A
Animas, NM 88020
Tel: (800) 695-3325 or (505) 548-2353
Fax: (505) 548-2293

– The largest geothermal greenhouse in the nation; 32-acre facility produces high-quality cut roses which are marketed widely; in business since 1977.

– Advice to new business: “Location, location, location. Legal, legal, legal.”

**Colorado Gators**
Erwin Young, Owner
Box 1052
Alamesa, CO 81101
Tel: (719) 378-2050
Fax: (719) 378-2050
Email: lynne@gatorfarm.com
Website: [http://www.gatorfarm.com/](http://www.gatorfarm.com/)

– Raises tilapia and other fish, alligators, and turtles; also grows flowers, tropical plants, and herbs (small scale); in business since 1979.

– Advice to new business: Research the particular business, visit existing business owners, and look for answers.

**IFA Nurseries, Inc.**
Dave Stearns, CEO
136 NE Territorial Road
Canby, OR 97013
Tel: (503) 266-1940
Fax: (503) 266-1754
Website: [http://ifanurseries.com/](http://ifanurseries.com/)

– Built three 500,000 ft² geothermal greenhouses in Klamath Falls using existing city well; grows tree seedlings for sale to larger-end timber companies for reforestation.

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*Photo: Toni Boyd, Geo-Heat Center*
In addition to the businesses listed above, there are numerous other sources of information, including greenhouse and equipment manufacturers, trade associations, agricultural extension services, and other organizations and websites. A sample are listed below.

Adams County Cooperative Extension Commercial Greenhouses:
An Overview of Colorado’s Current Greenhouse Industry
http://www.colostate.edu/Depts/CoopExt/Adams/gh/ghoverview.htm

Colorado Greenhouse Growers Association
7475 Dakin Street, Suite 540
Denver, CO 80221-6919
Tel: (303) 427-8132 or (800) 748-3744
Fax: (303) 427-8139
http://www.cgga.org

Hobby Greenhouse Association
http://www.hobbygreenhouse.org/links.htm

Idaho Department of Water Resources:
A Brief History of Geothermal Greenhouses in Idaho
http://www.idwr.state.id.us/energy/alternative_fuels/geothermal/greenhouse.htm

International Greenhouse Company
http://www.igcusa.com

Iowa Greenhouse Growers Association
Des Moines, IA
Tel: (515) 282-8192
http://www.cbsc.org/ibp/home_en.cfm

National Greenhouse Manufacturers Association
http://www.ngma.com/
Industrial or Agricultural Processes

Geothermal fluid can be used for a wide range of industrial and agricultural processes. Industrial applications include food dehydration, laundries, gold mining, and milk pasteurization. Dehydration of vegetables and fruits is the most common industrial use of geothermal energy.

A new development in the use of geothermal fluids is the enhanced heap leaching of precious metals in Nevada by applying heat to the cyanide process. Using geothermal energy increases the efficiency of the process and extends the production into the winter months.40

The “Geothermal Energy Uses” illustration on the following page graphically shows the wide range of the temperatures at which geothermal resources are

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typically used for many industrial and agricultural processes, e.g., beet sugar evaporation, pulp and paper processing, lumber drying, and soil warming.\textsuperscript{41}

\textsuperscript{41} The “Geothermal Energy Uses” illustration was developed by the Geothermal Education Office in conjunction with the Geo-Heat Center.
There are currently 12 geothermal industrial and agricultural processing operations in six Western states.\(^{42}\)

<table>
<thead>
<tr>
<th>State</th>
<th>Number of Industrial &amp; Agricultural Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>1</td>
</tr>
<tr>
<td>Hawaii</td>
<td>1</td>
</tr>
<tr>
<td>Montana</td>
<td>1</td>
</tr>
<tr>
<td>Nevada</td>
<td>2</td>
</tr>
<tr>
<td>Oregon</td>
<td>5</td>
</tr>
<tr>
<td>Wyoming</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

**Useful Contact**

The following individual has expressed his willingness to be included in this Workbook as a resource for potential entrepreneurs.

**Empire Foods, LLC**
Dennis T. Trexler  
1755 Purina Way  
Sparks, NV 89431  
Tel: (775) 829-2821  
Fax: (775) 829-2821  
Email: dtrexler@charter.net  
Website: [http://empirellc.com/](http://empirellc.com/)

- Established in 1994, Nevada-based Empire Foods’ dehydration plant utilizes renewable heat from their 307°F geothermal resource.
- **Advice to new business:** Know your market.

\(^{42}\) Geo-Heat Center, [http://geoheat.oit.edu/directuse](http://geoheat.oit.edu/directuse). Includes Industrial, Agricultural Drying, and Snowmelt direct use projects.
Resorts and Spas

People have enjoyed soaking in warm geothermal water and mineral waters for centuries. The earliest commercial use of geothermal energy was for swimming pools and spas. Based on archeological finds in Asia, mineral water has been used for bathing since the Bronze Age, about 5000 years ago. The Greeks, Turks, and Romans were famous for their spa development.

Closer to home, Native Americans considered hot springs sacred; every major hot spring in the U.S. has some record of use by the Indians. Early European settlers found and used these natural hot springs. Realizing their commercial value, they developed many into spas after the European tradition. Most recently, the health and fitness craze has made spas a high growth industry. The most traditional type of health spa is the geothermal spa, featuring baths and pools of natural hot mineral waters.

Spa design depends on the local culture, the unique character of the location, and what the developer is trying to achieve in terms of atmosphere, service, and type of clientele. There are currently 236 geothermal resorts and spas in 14 Western states:

<table>
<thead>
<tr>
<th>STATE</th>
<th>NUMBER OF GEOTHERMAL RESORTS &amp; SPAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>10</td>
</tr>
<tr>
<td>Arizona</td>
<td>7</td>
</tr>
<tr>
<td>California</td>
<td>57</td>
</tr>
<tr>
<td>Colorado</td>
<td>18</td>
</tr>
<tr>
<td>Idaho</td>
<td>36</td>
</tr>
<tr>
<td>Montana</td>
<td>19</td>
</tr>
</tbody>
</table>


Industry information is provided below for several possible classifications of geothermal spas and resorts under Hotels and Motels (SIC 7011) and Physical Fitness Facilities (SIC 7991).

<table>
<thead>
<tr>
<th>SIC Code</th>
<th>Description</th>
<th>No. Bus.</th>
<th>% Total</th>
<th>Total Emp.</th>
<th>Total Sales (Million)</th>
<th>Average Emp.</th>
<th>Average Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>7011-0000</td>
<td>Hotels and motels</td>
<td>17,294</td>
<td>20.4</td>
<td>364,008</td>
<td>39,252</td>
<td>28</td>
<td>$4.0 M</td>
</tr>
<tr>
<td>7011-0200</td>
<td>Vacation lodges</td>
<td>1,513</td>
<td>1.8</td>
<td>12,106</td>
<td>445</td>
<td>12</td>
<td>$500,000</td>
</tr>
<tr>
<td>7011-0201</td>
<td>Ski lodge</td>
<td>461</td>
<td>0.5</td>
<td>17,217</td>
<td>2,177</td>
<td>46</td>
<td>$6.6 M</td>
</tr>
<tr>
<td>7011-0202</td>
<td>Tourist camps, cabins, cottages, and courts</td>
<td>1,435</td>
<td>1.7</td>
<td>8,102</td>
<td>294</td>
<td>6</td>
<td>$200,000</td>
</tr>
<tr>
<td>7011-0303</td>
<td>Resort hotel</td>
<td>3,987</td>
<td>4.7</td>
<td>196,097</td>
<td>9,167</td>
<td>64</td>
<td>$3.4 M</td>
</tr>
<tr>
<td>7011-0305</td>
<td>Seasonal hotel</td>
<td>116</td>
<td>0.1</td>
<td>1,668</td>
<td>67</td>
<td>15</td>
<td>$600,000</td>
</tr>
<tr>
<td>7011-0400</td>
<td>Inns</td>
<td>3,217</td>
<td>3.8</td>
<td>38,869</td>
<td>1,003</td>
<td>17</td>
<td>$500,000</td>
</tr>
<tr>
<td>SIC CODE</td>
<td>DESCRIPTION</td>
<td>NO. BUS.</td>
<td>% TOTAL</td>
<td>TOTAL EMP.</td>
<td>TOTAL SALES (MILLION)</td>
<td>AVERAGE EMP.</td>
<td>AVERAGE SALES</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------</td>
<td>---------</td>
<td>---------</td>
<td>------------</td>
<td>-----------------------</td>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>7991-0000</td>
<td>Physical fitness facilities</td>
<td>7,184</td>
<td>32.3</td>
<td>63,212</td>
<td>2,222</td>
<td>9</td>
<td>$400,000</td>
</tr>
<tr>
<td>7991-0103</td>
<td>Spas</td>
<td>1,839</td>
<td>8.3</td>
<td>14,938</td>
<td>378</td>
<td>8</td>
<td>$200,000</td>
</tr>
</tbody>
</table>

**Useful Contacts**

The following individuals have expressed their willingness to be included in this Workbook as a resource for potential entrepreneurs.

**SKS Management, LLC**  
Miyuki Yoshida,  
Assistant Project Manager  
1532 SE Powell Boulevard  
Portland, OR 97202  
Tel: (503) 239-8529  
Fax: (503) 239-8479  
Email: miyuki@shikosha.com  
Website: [http://www.shikosha.com](http://www.shikosha.com)

– Planning to develop a small-scaled, traditional Japanese-style hot springs Onsen bath and spa in Home Valley, WA; currently delayed in the drilling of re-injection well.

– Advice to new business: Have qualified consultants assist you.

**Chena Hot Springs Resort**  
Bernie Karl  
P.O. Box 58740  
Fairbanks, AK 00711  
Tel: (907) 488-1409  
Fax: (907) 488-4058  
Email: recycle@polarnet.com  
Website: [http://chenahotsprings.com/](http://chenahotsprings.com/)

Chena Hot Springs Resort,  
Fairbanks, Alaska  
(Photo: Chena Hot Springs Resort)
**Space and District Heating**

More than 120 operations, with hundreds of individual systems at some sites, are using geothermal energy for district and space heating in the United States.

Space and district heating are very different animals. Space heating systems use one well per structure. Geothermal district heating (GDH) systems distribute hydrothermal water from one or more geothermal wells to several houses and buildings, or blocks of buildings. In both systems, the geothermal production well and distribution piping replace the fossil-fuel-burning heat source of the traditional heating system. Hot water, rather than steam, is the heat transfer medium.

Geothermal space and district heating systems are widely used across the western United States. There are currently 121 geothermal district and space heating sites in 13 western states:45

<table>
<thead>
<tr>
<th>STATE</th>
<th>NUMBER OF GEOTHERMAL DISTRICT &amp; SPACE HEATING SITES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>7</td>
</tr>
<tr>
<td>Arizona</td>
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</tr>
<tr>
<td>California</td>
<td>21</td>
</tr>
<tr>
<td>Colorado</td>
<td>15</td>
</tr>
<tr>
<td>Idaho</td>
<td>15</td>
</tr>
<tr>
<td>Montana</td>
<td>10</td>
</tr>
<tr>
<td>New Mexico</td>
<td>6</td>
</tr>
<tr>
<td>Nevada</td>
<td>10</td>
</tr>
<tr>
<td>Oregon</td>
<td>24</td>
</tr>
<tr>
<td>South Dakota</td>
<td>4</td>
</tr>
</tbody>
</table>

### Space Heating

In space heating, one well provides heat, hot water, or both to one building. Space heating of an individual building is fairly easy to justify economically, provided the heating load is large enough and there is a geothermal resource.\(^{46}\)

The most common type of space heating system used in homes in the U.S. is forced air. In most cases, the air is heated by a fossil fuel furnace or heat pump. Adapting an existing system to use geothermal heat, or designing a system for new construction, is a straightforward process. The system consists of a finned coil, normally located in the supply air duct, a motorized valve to control the water flow in response to a signal from a thermostat, piping to deliver the water to and from the coil, and a few associated plumbing and electrical components.\(^{47}\)

Domestic hot water heating often requires higher temperature water than space heating. This is because heat is being transferred to a 49°C (120°F) or greater sink rather than the 21°C (70°F) air in a space heating application.\(^{48}\)

<table>
<thead>
<tr>
<th><strong>State</strong></th>
<th><strong>Number of Geothermal District &amp; Space Heating Sites</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas</td>
<td>2</td>
</tr>
<tr>
<td>Utah</td>
<td>5</td>
</tr>
<tr>
<td>Wyoming</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>121</strong></td>
</tr>
</tbody>
</table>

---

\(^{46}\) Per correspondence with Kevin Rafferty 15 April 2003.


District Heating

Most GDH system development has occurred since the late 1970s; approximately 90% of current systems started-up in this period. The Boise Warm Springs Water District, however, began operating in the 1890s, and the system serving the Oregon Institute of Technology campus was constructed in 1963. Many of the newer district systems, e.g., San Bernardino, were developed with DOE assistance in the early 1980s.49

GDH systems typically have six subsystems. All but items 1 and 6 differ from conventionally fueled heating systems.

1. Production facilities,
2. Central plants (in closed-distribution systems only),
3. Distribution,
4. Customer connections,
5. Metering, and
6. Disposal.

Wells used for geothermal district heating systems vary in depth, from 275 feet at Pagosa Springs, to 3,030 feet in Boise. They also range in temperature, from 59ºC to 103ºC (138ºF to 218ºF).50

Fuels costs for geothermal systems consist only of the electrical costs of operating the production well pumps. Once operational, GDH systems can save consumers 30% to 50% per year of the cost of natural gas.51 The major obstacle to developing a GDH system is the cost of the piping necessary to deliver the heat to the customers and, the economics for the customer. The issue is the cost between the heat source and the customer.52


Rafferty, 1990.


51 Per correspondence with Kevin Rafferty 15 April 2003.
An important consideration in GDH projects is the thermal load density, or the heat demand divided by the ground area of the district. A high heat density is required to make district heating economically feasible because the distribution network that transports the hot water to the consumers is expensive.\(^{53}\)

The economics of converting to a GDH system vary depending on the size of the building to be connected, and the existing heating system. In large buildings (>50,000 ft\(^2\)), the economics of connecting to GDH system are often positive.\(^{54}\)

Generally, small buildings (10,000 ft\(^2\)) use heating systems which are not hot water-based and must be retrofitted. An automotive repair shop with three unit heaters would have a retrofit cost of $12,600-$14,390. A small office with two roof top heat pumps would incur a retrofit cost of approximately $9,013.\(^{55}\) The economics of retrofitting may not provide sufficient incentive to the owner to connect to the GDH system.

In the smallest buildings (<5,000 ft\(^2\)), connecting to a GDH system may make economic sense if the GDH system offers heating costs that are substantially lower (40% to 50%), the building has high energy use, and the owner is currently using a high cost fuel (e.g., electric resistance or propane).\(^{56}\)

While most existing GDH systems charge rates which are lower than the most commonly used competing fuels—some as little as 70% of natural gas—the prospects for competing with natural gas appear unfavorable in all cases. Clearly

\(^{53}\) Ibid, p. 4.


\(^{55}\) Ibid.

\(^{56}\) Ibid.
incentives beyond energy cost savings are required to entice small buildings to connect to GDH systems.57

Geothermal energy may also be used for cooling through the absorption cycle process. The equipment, however, is very expensive relative to electric chillers. A high cooling requirement and high electricity rates are needed to make it economically feasible.58

The Oregon Institute of Technology installed a lithium-bromide absorption chiller in 1980. Due to the low cooling requirement in the Klamath Falls climate, substantial advances in the efficiency of electric chillers over the past 25 years, and the area’s low electricity costs, it was replaced by electrical chillers in 2001. Geothermal energy is currently used to run cold storage for a mushroom facility in Vale, Oregon.

Industry statistics are provided below for Steam and Air-conditioning Supply (SIC 4961) for establishments engaged in the production, distribution, or both, of steam and heated or cooled air for sale.

<table>
<thead>
<tr>
<th>SIC CODE</th>
<th>DESCRIPTION</th>
<th>NO. BUS.</th>
<th>% TOTAL</th>
<th>TOTAL EMP.</th>
<th>TOTAL SALES (MILLION)</th>
<th>AVERAGE EMP.</th>
<th>AVERAGE SALES</th>
</tr>
</thead>
<tbody>
<tr>
<td>4961-0000</td>
<td>Steam and air conditioning supply</td>
<td>48</td>
<td>25.7</td>
<td>1,054</td>
<td>223.0</td>
<td>22</td>
<td>$7.2 M</td>
</tr>
<tr>
<td>4961-9901</td>
<td>Air conditioning supply services</td>
<td>38</td>
<td>20.3</td>
<td>507</td>
<td>32.8</td>
<td>13</td>
<td>$1.1 M</td>
</tr>
<tr>
<td>4961-9902</td>
<td>Cooled air supplier</td>
<td>18</td>
<td>9.6</td>
<td>46</td>
<td>8.4</td>
<td>3</td>
<td>$500,000</td>
</tr>
<tr>
<td>4961-9903</td>
<td>Steam heating systems (suppliers of heat)</td>
<td>44</td>
<td>23.5</td>
<td>933</td>
<td>287.4</td>
<td>23</td>
<td>$10.6 M</td>
</tr>
</tbody>
</table>

57 Ibid.
Useful Contacts

Washington State University’s Cooperative Extension Energy Program has developed software to help energy planners design and evaluate district energy systems, including geothermal. HEATMAP 5G\(^59\) for Windows® allows users to analyze the performance of existing networks as well as model proposed systems, expansions, or upgrades for geothermal district energy applications.

HEATMAP software will:

- Analyze feasibility;
- Track performance;
- Help utilities plan electric and gas deregulation strategies;
- Assess upgrades and expansions;
- Evaluate hot-water, steam, and chilled-water distribution;
- Determine viability of steam-to-hot water conversion;
- Evaluate strategies for district energy pipe replacement;
- Estimate system costs;
- Establish valuation of systems for sale; and
- Determine the environmental and energy benefits of proposed or existing district energy systems alone or in combination with cogeneration facilities.

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\(^59\) AutoCAD Release 2000/2000i/2002 for Windows® is required to run HEATMAP.
For more information on HEATMAP, contact:

**Washington State University**  
**Energy Program**  
925 Plum Street  
Town Square, Building #4  
P.O. Box 43165  
Olympia, WA  98504-3165  

Website:  
[http://www.energy.wsu.edu/software/Heatmap/](http://www.energy.wsu.edu/software/Heatmap/)  

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Chief Engineer  
Tel: (360) 956-2014

The following individuals have expressed their willingness to be included in this Workbook as a resource for potential entrepreneurs.

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Boise, ID  83701-0500  
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Fax: (208) 384-3999  
Email: kjohnson@cityofboise.org  
Website:  

**Elko County School District**  
Steve Bowers,  
Building Operations & Construction Manager  
1092 Burns Road  
Elko, NV  89801  
Tel: (775) 738-5196  
Fax: (775) 738-0808  
Email: sbowers@elko.k12.nv.us  
Website:  
[http://www.elko.k12.nv.us/](http://www.elko.k12.nv.us/)  

– Advice to new business: Consult available services from the Oregon Institute of Technology and Washington State University.
– Over three years, a group of residents built a geothermal heating system to heat their community buildings.  

– Advice to new business: More government assistance is needed to overcome drilling and environmental roadblocks for small communities willing to develop geothermal resources.

**Small-scale Power Generation**

The hottest geothermal resources may be used to generate electricity. Unlike fossil fuel power plants, no fuel is burned in a geothermal power plant. Fuel is “free.” There are five types of geothermal power plants:

1. **Dry Steam** – Steam from the resource drives the turbine directly. The Geysers in northern California is the largest known dry steam field in the world, and has been producing electricity since 1960. Dry steam resources are very rare.

2. **Flashed Steam** – Hot water from wells passes through separators where it flashes (explosively boils) to steam. The force of the steam spins the turbine generator. A plant can be single or double flash.

3. **Binary** – The heat of the geothermal water is transferred via a heat exchanger to a second (binary) liquid in an adjacent loop. The second “working” fluid boils to vapor which in turn powers the turbine generator. Binary plants use lower temperature resources (38-149°C or 100-300°F). Binary plants are well suited for small modular units in the 1-3 MWe range.

4. **Hybrid** – A hybrid plant uses a combination of technologies, e.g., Single Flash Binary Plant. Hybrid plants have a higher overall efficiency than plants that use just one technology.

5. **Kalina** – A Kalina cycle plant uses an ammonia-water mixture. Ammonia’s lower boiling point allows additional energy to be obtained on the condenser side of the steam turbine, possibly increasing output by 20-30%. The Kalina cycle is in the prototype stage.

Geothermal power plants generate approximately 2,800 MW of electricity in the United States, primarily from plants with an installed capacity of 5 MW or more. Six plants in the United States are smaller than 5 MW. Only one plant currently in

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*The Workbook defines small-scale geothermal power plants as those with an installed capacity of 1 MWe or less.*

*Advanced Thermal Systems (ATS) has the exclusive U.S. rights to the patented Kalina Cycle technology, [http://advancedthermalsystems.com](http://advancedthermalsystems.com).*
operation has an installed capacity of 1 MWe or less: the 700-kWe Wineagle plant in California.\(^{63}\)

Put into commercial operation in 1985, the Wineagle plant provides electricity from one geothermal well. Two 350-kWe modules use induction generators to drive all auxiliary equipment including the brine pump. Wineagle is an unattended plant; it will start or stop automatically. A plant operator makes a daily inspection and is on call, through an automatic telephone dialer, to respond to any outages due to equipment problems. The plant has demonstrated over 98% availability.

A geothermal power plant costs more up-front than a fossil fuel-powered plant due to the risks and costs associated with exploring and proving the resource. Small plants cost more per kWe than their larger counterparts. The initial cost for a field and small power plant is about $3,000-5,000/installed kWe\(^{64}\), compared to $1,500-$2,500/kWe for a larger plant, depending on the resource temperature and chemistry. Operating and maintenance (O&M) costs range from 1.5-2.5¢/kWh, depending on the contract price for the electricity.\(^{65}\) In general, the cooler the geothermal resource and the smaller the installed capacity of the plant, the more expensive the project. The following table illustrates capital and O&M costs for small binary geothermal plants utilizing various resource temperatures.\(^{66}\)

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\(^{63}\) Burgett Geothermal Greenhouses installed one 350-kWe and two 400-kWe binary units of ORMAT/SPS design in 1995. Due to problems with cooling water and the design of the heat exchangers and evaporators, however, the generators were shut down. James C. Witcher, John W. Lund, and Damon E. Seawright, “Lightning Dock KGRA: New Mexico’s Largest Geothermal Greenhouse, Largest Aquaculture Facility, and First Binary Electrical Power Plant,” *Geo-Heat Center Quarterly Bulletin*, December 2002, Vol. 23, No. 4. To obtain in PDF format, see <http://geoheat.oit.edu/bulletin/bull23-4/art8.pdf>.

\(^{64}\) Excludes soft costs, e.g., permitting, engineering, legal, financing, and interest during construction.

\(^{65}\) Higher-priced electricity justifies running the plant 98% of the time because the resulting higher maintenance costs are recovered.


---
### Capital and O&M Costs for Small Binary Geothermal Plants

<table>
<thead>
<tr>
<th>Net Power (kW)</th>
<th>Resource Temperature, °F</th>
<th>Total O&amp;M Cost ($/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>212</td>
<td>248</td>
</tr>
<tr>
<td></td>
<td>Capital Cost, $/kW</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>2,786</td>
<td>2,429</td>
</tr>
<tr>
<td>200</td>
<td>2,572</td>
<td>2,242</td>
</tr>
<tr>
<td>500</td>
<td>2,357</td>
<td>2,055</td>
</tr>
<tr>
<td>1,000</td>
<td>2,143</td>
<td>1,868</td>
</tr>
</tbody>
</table>

A 250-kWe geothermal power plant would not be a freestanding business. It could be profitable, however, if power generation is linked to a direct use, e.g., aquaculture, greenhouse, dehydration, etc., that has a constant and reliable cash flow. The approximate cost of a 250 kWe-plant is $350,000-$450,000.67

A stand-alone 1-MWe plant could be economically viable if there is potential for commercial sale of the electricity produced, and it can be sold at a competitive rate. The approximate cost of a 1 MWe-plant is $3-$4 million. Assuming the plant can sell power to the grid at 5¢/kWh and has a 90% capacity, annual revenues would be about $450,000.

As a guide, electricity rates for the 19 GPW states are listed below. The wholesale electricity price is closest to the industrial price.

---

Estimated U.S. Electric Utility Average Revenue per kWh (October 2002)  

<table>
<thead>
<tr>
<th>STATE</th>
<th>RESIDENTIAL (¢/kWh)</th>
<th>COMMERCIAL (¢/kWh)</th>
<th>INDUSTRIAL (¢/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>12.1</td>
<td>10.1</td>
<td>7.7</td>
</tr>
<tr>
<td>Arizona</td>
<td>9.0</td>
<td>7.8</td>
<td>5.6</td>
</tr>
<tr>
<td>California</td>
<td>11.6</td>
<td>—</td>
<td>9.2</td>
</tr>
<tr>
<td>Colorado</td>
<td>7.8</td>
<td>6.0</td>
<td>4.5</td>
</tr>
<tr>
<td>Hawaii</td>
<td>15.8</td>
<td>14.2</td>
<td>11.1</td>
</tr>
<tr>
<td>Idaho</td>
<td>6.9</td>
<td>6.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Kansas</td>
<td>8.0</td>
<td>6.3</td>
<td>4.7</td>
</tr>
<tr>
<td>Montana</td>
<td>7.7</td>
<td>6.4</td>
<td>4.0</td>
</tr>
<tr>
<td>Nebraska</td>
<td>6.8</td>
<td>5.4</td>
<td>3.7</td>
</tr>
<tr>
<td>Nevada</td>
<td>9.6</td>
<td>9.8</td>
<td>7.3</td>
</tr>
<tr>
<td>New Mexico</td>
<td>9.0</td>
<td>7.4</td>
<td>4.8</td>
</tr>
<tr>
<td>North Dakota</td>
<td>6.8</td>
<td>5.8</td>
<td>—</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>7.5</td>
<td>6.3</td>
<td>3.6</td>
</tr>
<tr>
<td>Oregon</td>
<td>7.3</td>
<td>6.8</td>
<td>4.9</td>
</tr>
<tr>
<td>South Dakota</td>
<td>7.9</td>
<td>6.4</td>
<td>4.6</td>
</tr>
<tr>
<td>Texas</td>
<td>8.1</td>
<td>6.8</td>
<td>5.0</td>
</tr>
<tr>
<td>Utah</td>
<td>6.7</td>
<td>5.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Washington</td>
<td>6.5</td>
<td>6.4</td>
<td>—</td>
</tr>
<tr>
<td>Wyoming</td>
<td>7.8</td>
<td>5.9</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Small-scale geothermal power plants have the potential for widespread application, including off-grid and distributed energy, but achieving cost effectiveness is a challenge. Under off-grid generation, an “island” of generation and energy service to a limited power distribution system can be provided. In an off-grid system, the need for expensive transmission and interconnections to the larger grid is

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eliminated. Also, diesel generation, generally used for remote power installations, is more expensive than conventional utility generation.\textsuperscript{69}

Achieving cost effectiveness in the production of small plants is a key factor in their increased use. The National Renewable Energy Laboratory (NREL) issued a solicitation in early 2000 to request proposals from industry to design and build plants with installed capacities of 300 kWe to 1 MWe.\textsuperscript{70} Three small-scale geothermal power plants were awarded funding under the “Small-Scale Geothermal Power Plant Field Verification Project” and are moving forward. All are cascaded projects.

| PROJECT NAME          | LOCATION  | NET POWER (kW) | MAX. RESOURCE TEMP. (°F) | TOTAL PROJECT COST (EST.) | DESCRIPTION                                                                 
|-----------------------|-----------|----------------|--------------------------|---------------------------|-----------------------------------------------------------------------------
| Empire Energy         | Empire, NV| 1,000          | 245                      | $2.6 M                    | Binary plant. Uses effluent geothermal fluid from direct heating of dehydration plant. |
| Exergy-AmeriCulture   | Cotton City, NM | 1,000 | 245 | $3.4 M | Water-cooled Kalina cycle. Geothermal fluid exiting plant used to heat fish tanks. |
| Milgro-Newcastle      | Newcastle, UT | 750     | 260                      | $2.5 M                    | Low-pressure flash plant. Plant effluent used to heat greenhouse. |

\textsuperscript{69} Per correspondence from Roger Hill, Technical Director, GeoPowering the West, Sandia National Laboratories, 9 May 2003.

Useful Contacts

The following individuals have expressed their willingness to be included in this Workbook as a resource for potential entrepreneurs.

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Fax: (775) 321-4440  
Email: rwagner@advancedthermalsystems.com  
Website: [http://advancedthermalsystems.com/](http://advancedthermalsystems.com/)

– A 2-MWe Kalina Cycle geothermal power plant has been operating in Husavik, Iceland since July 2000. The plant uses 124°C (255°F) hot water.

**Barber-Nichols, Inc.**  
Ken E. Nichols  
6325 West 55th Avenue  
Arvada, CO  80002  
Tel: (303) 421-8111  
Fax: (303) 420-4679  
Email: knichols@barber-nichols.com  
Website: [http://www.barber-nichols.com/](http://www.barber-nichols.com/)

– Barber-Nichols Inc. has designed and built several small-scale geothermal plants ranging from 350 kWe to 2 MWe, including the Wineagle plant.

**National Renewable Energy Laboratory (NREL)**  
Chuck Kutscher  
Center for Buildings and Thermal Systems  
1617 Cole Boulevard  
Golden, CO  80401  
Tel: (303) 384-7521  
Fax: (303) 384-7540  
Email: chuck_kutscher@nrel.gov

– NREL manages the Empire project under the Small-Scale Geothermal Power Plant Field Verification Program.

**Ormat International, Inc.**  
Daniel N. Schochet,  
Vice President  
980 Greg Street  
Sparks, NV  89431-6039  
Tel: (775) 356-9029  
Fax: (775) 356-9039  
Email: dschochet@ormat.com  
Website: [http://www.ormat.com/](http://www.ormat.com/)

Geothermal Small Business Workbook
Ormat’s 250 kWe air-cooled geothermal Combined Heat and Power (CHP) plant generates electrical power as well as district heating for the Rogner Spa Hotel in Austria. The power plant has been in commercial operation since July 2001.

**Hot Contacts**

Perhaps the best overall, “one-stop shop” for information on geothermal direct use projects in the world is the Geo-Heat Center located at the Oregon Institute of Technology in Klamath Falls, Oregon. Established in 1975, and supported by DOE, the Geo-Heat Center is the primary source of data and information on all types of direct use operations. Its experienced staff provides technical assistance to companies and individuals planning such operations.

The Geo-Heat Center maintains a geothermal library of over 5,000 volumes for lay and technical readers, and has published countless documents on geothermal projects with a special focus on low- and moderate-temperature geothermal applications and equipment. The most comprehensive text on the subject is the Geothermal Direct-Use Engineering and Design Guidebook, also known as the “Green Book” because of its cover. The third edition, published in 1998, provides 470 pages of information for engineers and developers, including chapters on:

- Nature of geothermal resources,
- Exploration for direct heat resources,
- Drilling and well construction,
- Well testing and reservoir evaluation,
- Heat exchangers,
- Space heating equipment,
- Greenhouses,
- Aquaculture,
- Industrial applications,
- Engineering cost analysis,
- Regulatory and commercial aspects, and
- Environmental considerations.
For further information about the Geo-Heat Center and the “Green Book”:

**Geo-Heat Center**  
John Lund,  
Director  
Oregon Institute of Technology  
3201 Campus Drive  
Klamath Falls, OR  97601

Tel: (541) 885-1750  
Fax: (541) 885-1754

Email: lundj@oit.edu  
Website: http://geoheat.oit.edu/

Additional excellent sources of general information about geothermal energy and technology are listed below:

**GeoPowering the West**

– GeoPowering the West is a DOE-sponsored activity to dramatically increase the use of geothermal energy in the western United States.  
Website: http://www.eere.energy.gov/geopoweringthewest/

**Geothermal-biz.com**

– Created to help geothermal entrepreneurs develop geothermal direct use and small power generation projects by providing useful information.  
Website: http://www.geothermal-biz.com/

**Geothermal Education Office**

Marilyn L. Nemzer,  
Executive Director  
664 Hillary Drive  
Tiburon, CA  94920  
Tel: (415) 435-4574 or (800) 866-4436  
Fax: (415) 435-7737

**Geothermal Energy Association**

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Washington, D.C.  20003  
Tel: (202) 454-5261  
Fax: (202) 454-5265

Email: Karl@geo-energy.org  
Website: http://www.geo-energy.org/

**Geothermal Resources Council**

Ted J. Clutter,  
Executive Director  
P.O. Box 1350  
2001 2nd Street, Suite 5  
Davis, CA  95617-1350  
Tel: (530) 758-2360  
Fax: (530) 758-2839

Email: tclutter@geothermal.org  
Website: http://www.geothermal.org/index.htm  

– Maintains a comprehensive searchable on-line geothermal library
Geothermal resources are related to water, gas, and minerals; to both the surface and subsurface estates; and to both water rights and mineral titles. Where the resource is located—whether it is located on public or private, Federal or state-owned land—determines what regulations govern its use.

The Bureau of Land Management (BLM), pursuant to the Geothermal Steam Act, of 1970, has jurisdiction for geothermal leasing and permitting on Federal lands. This authority covers about 570 million acres of BLM land, National Forest System lands (with the concurrence of the Forest Service), and other Federal lands, as well as private lands where the mineral rights have been retained by the Federal Government. Federal lands located in a Known Geothermal Resource Area...
(KGRA) are leased competitively, and any Federal lands not located in KGRAs are leased noncompetitively.\textsuperscript{73}

Resources located on non-Federal lands, and utilized for direct use are governed by local permitting and land use ordinances, groundwater law, and the availability of water rights.

Various federal, state, and local laws, and regulations directly and indirectly affect geothermal projects. Many are focused more towards electrical generation projects than to direct use projects. However, the appropriate regulating agencies must be contacted to determine what requirements may apply to a specific project.

The main environmental factors to be considered during the exploration, development, and operation of a direct use geothermal project are:

- Airborne emissions,
- Water contamination,
- Land subsidence,
- Induced seismicity,
- Noise,
- Water availability,
- Solid waste,
- Land use,
- Vegetation and wildlife, and
- Economic and cultural factors.

The degree to which geothermal development affects the environment is, in most cases, proportional to the scale of the development. Direct use projects are often designed to be closed-loop. Low- or moderate-temperature geothermal fluids are circulated through a heat exchanger or heat pump (or flow naturally around downhole heat exchangers), in a small area with limited or no emissions to the atmosphere. The spent geothermal fluids are then injected into or near the production aquifer, or discharged into nearby surface drainage and waterways or both.

The Appendix provides pertinent geothermal definitions, ownership, leasing information, injection requirements, and the agencies involved at the Federal level.

and for 16 of the 19 GPW states. Updated information for direct use projects in Oregon is available from the Geo-Heat Center.

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74 Bloomquist and Lund, pp. 421-442. The Appendix does not include information for Kansas, Nebraska, and Oklahoma.

75 Kevin Rafferty, “Regulatory Issues for Direct-Use Geothermal Resource Development in Oregon” (Klamath Falls, OR, 2002). To obtain in PDF format, see <http://geoheat.oit.edu/pdf/tp114.pdf>.
“Setting a goal is not the main thing. It is deciding how you will go about achieving it and staying with that plan.”

— Tom Landry

Entrepreneurs and business owners cite many reasons for not writing a business plan:

- I don’t need one.
- I have one in my head.
- I don’t know how to begin.
- I don’t have the time.
- I’m not a numbers person.
- I make more than enough money and am immortal.76

Writing a business plan is hard work. It takes time and effort. So, why then should you expend the blood, sweat, and time to write a business plan?

- To make more money.
- To lay out a map and compass for the future.
- To identify and take advantage of opportunities.
- To dazzle your banker.
- To set realistic goals.
- To make more money.

Bob and Sally go into their friendly neighborhood bank. Bob woke up that morning with a brilliant idea for a business. Sally spent the past six months thinking about her brilliant business idea and putting it down on paper. Which person would Ralph, their friendly neighborhood banker, take more seriously? Who is most likely to get a loan?

Most business plans are written to raise money. Investors receive countless requests for financing. The more you can do to answer investors’ questions and

address their concerns up-front, the better their chances of having your project seriously considered for financing.

What is a business plan? A search for “business plan” on Google retrieves a mind numbing 5,640,000 results! In this Information Age, let’s bring it back to the basics. What is a business plan?

- A concise written document.
- A working model of your business.
- A work in progress.
- A road map—how to get “there” from “here.”
- A process of learning more about your business.
- A source of new capital.

Countless books have been written, software designed, and websites launched to help people write business and financing plans. OIT’s Small Business Development Center, which has counseled 10 geothermal businesses, primarily greenhouses and aquaculture, identifies four specific websites as being particularly helpful:

1. **Interactive Business Planner (IBP)**
   
   http://www.cbsc.org/ibp/home_en.cfm
   
   The IBP is the first business planning software product designed specifically to operate on the Internet. The IBP uses the capabilities of the Internet to assist entrepreneurs prepare a three-year business plan for their new or existing business.

2. **Small Business Administration (SBA) – Financing Your Business**
   
   http://sba.gov/financing/

3. **SBA’s Online Women’s Business Center**
   
   http://www.onlinewbc.gov/

4. **SBA’s Online Women’s Business Center: How do I qualify for a loan?**
   
   http://www.onlinewbc.gov/docs/finance/loanqual.html

---

Examples of business plan software are Business Plan Pro, PlanWrite for Business, PlanMagic Business, and BizPlan Builder 8.
This Workbook simplifies the business plan writing process by breaking it down into five components:

1. **Business Description:** Who and why are you?
2. **Product or Service:** What do you do?
3. **Marketing Plan:** Market Cubed
4. **The People:** Management & Personnel
5. **Show Me the Money**

Answer each of the following questions in the following five sections as best you can. Feel free to modify your answers as you go along. Length is not as important as being complete and careful, concise, and conservative with your financial assumptions and forecasts. To see the “big picture,” an outline of a complete Business Plan is included on page 106.78

There is no one “correct” business plan format. Depending on the size and scope of your business, and on your audience, tailor your plan accordingly. Check with your local bank or other financing source to see if they require a specific format.

And away we go...

---

Business Description: Who and why are you?

What is the name of your business?

What is your business’s address?

Telephone number?

Fax number?

Email address?

Website URL?
**What is the status of your business?**
*(Check one)*

- ☐ Seed – initial planning, market research, business planning
- ☐ Startup – new business
- ☐ Expansion – of an established business
- ☐ Takeover – of an existing business
- ☐ Division – of a larger business

---

**When did, or when will your business open?**

---

**What is the structure of your business?**
*(Check one)*

- ☐ Corporation
- ☐ Limited Liability Corporation (LLC)
- ☐ Limited Liability Partnership (LLP)
- ☐ Partnership
- ☐ Sole Proprietorship
- ☐ S Corporation

**Corporation** – Prospective shareholders transfer money, property, or both, for the corporation’s capital stock. A corporation generally takes the same deductions as a sole proprietorship to compute its taxable income. A corporation can also take special deductions.
The profit of a corporation is taxed to both the corporation and to the shareholders when the profit is distributed as dividends. However, shareholders cannot deduct any loss of the corporation.\textsuperscript{79}

**Limited Liability Corporation (LLC)** – A condition in which owners of stock are not held liable for the debts of the corporation beyond the extent of their stockholdings.

An LLC may be a sole proprietorship, a corporation, or a partnership. (A minimum of two members is required for federal tax purposes to operate an LLC as a partnership.) Consequently, the applicable tax forms, estimated tax payment requirements, and related tax publications depend upon whether the LLC operates as a sole proprietorship, corporation, or partnership. The default entity for federal tax treatment of an LLC with two or more members is a partnership.

**Limited Liability Partnership (LLP)** – A condition in which owners of stock are not held liable for the debts of the corporation beyond the extent of their stockholdings.

The default entity of an LLP is a partnership and the partnership tax forms, estimated tax payment requirements, and partnership publications apply.

**Partnership** – The relationship existing between two or more persons who join to carry on a trade or business. Each person contributes money, property, labor, or skill, and expects to share in the profits and losses of the business.

A partnership is not a taxable entity. Each partner includes his or her share of the partnership’s income or loss on his or her tax return.

**Sole Proprietorship** – An unincorporated business that is owned by one individual. It is the simplest form of business organization to start and maintain. The business has no existence apart from you, the owner. Its liabilities are your personal liabilities and you undertake the risks of the business for all assets owned, whether used in the business or personally owned.

**S Corporation** – An eligible domestic corporation can avoid double taxation (once to the shareholders and again to the corporation) by electing to be treated as an \textit{S} corporation. An S corporation generally is exempt from federal income tax. Its


\textit{Geothermal Small Business Workbook} 53
shareholders include on their tax returns their share of the corporation’s separately stated items of income, deduction, loss, and credit, and their share of non-separately stated income or loss.

What are your business hours?

Is your business seasonal?

☐ Yes
☐ No

If yes, what season(s) is it open?

☐ Spring
☐ Summer
☐ Fall
☐ Winter

Notes:
Why did you start the business?

Why will your business grow and be profitable?
Product or Service: What do you do?

What are you selling?
What makes your products or services special?

<table>
<thead>
<tr>
<th>SAMPLE FEATURES</th>
<th>SAMPLE BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Convenience</td>
</tr>
<tr>
<td>Shape</td>
<td>Safety</td>
</tr>
<tr>
<td>Weight</td>
<td>Guaranteed</td>
</tr>
<tr>
<td>Material</td>
<td>Needs no replacement</td>
</tr>
<tr>
<td>Used by Queen Elizabeth</td>
<td>Surety</td>
</tr>
<tr>
<td>As seen on TV!</td>
<td>Sex appeal</td>
</tr>
<tr>
<td>Green</td>
<td>Makes you a good global citizen</td>
</tr>
</tbody>
</table>

There is a difference between a product’s features and a product’s benefits. The typical example is the standard No. 2 yellow pencil.\(^{80}\) How would you try to sell the pencil? You can talk about its features, e.g., it can write, it is portable. More important to the customer, however, are its features; what it does for him or her. If your customer is a crossword puzzler, perhaps a primary feature would be the pencil’s allowing the buyer to do the puzzles he or she so loves whenever and

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\(^{80}\) Mims, 2002.
wherever. Keep this in mind as you define your product’s or service’s features and benefits.

**What are your products’ or services’ features?**

**What are your products’ or services’ benefits?**
How will your customers benefit from buying your product or service?

Will you offer your customers credit?

☐ Yes
☐ No

If yes, on what terms?
How will you handle late payments?

What are the prices of your products or services?
How do you determine what to charge for your product or service? Generally:

\[
\text{Price} = \text{Product} + \text{Service} + \text{Image} + \text{Expenses} + \text{Profit}
\]

The price you set should reflect not only the cost of the product or service itself, but also include the intangible value—also known as “image”—that the customer places on it. The following graphic illustrates the relationship between Quality and Price.\(^{81}\)

![Quality vs. Price Diagram]

Trying to buy market share with low prices does not work. The breakeven analysis below will tell you what your minimum price should be. At the high end, build your desired profit levels into the breakeven equation and compare the prices you arrive at with your sense of what the market will bear.

Most entrepreneurs are reluctant to raise prices because they think that overall business will fall off. More often than not that doesn’t happen. If you are in the typical niche-type small business, you can raise your prices 4–5% percent without much notice of your customers. You cannot afford to be the low-cost producer or cut-rate king or queen.\(^{82}\)

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\(^{82}\) Ibid, p. 32.
Breakeven Analysis

Breakeven analysis provides a sales objective expressed in either dollar or unit sales at which your business will break even, that is, neither make nor lose money. Breakeven analysis will tell you how many units at what price you need to sell to cover your costs. Once you know your breakeven point, you have an objective target that you can plan to reach by carefully reasoned steps.\[^{83,84}\]

The basic breakeven formula is:

\[
S = FC + VC
\]

Where

- \( S \) = Breakeven level of sales in dollars
- \( FC \) = Fixed costs in dollars
- \( VC \) = Variable costs in dollars

<table>
<thead>
<tr>
<th><strong>Fixed Costs</strong></th>
<th><strong>Variable Costs</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities</td>
<td>Payroll taxes and benefits</td>
</tr>
<tr>
<td>Salaries</td>
<td>Sales commissions</td>
</tr>
<tr>
<td>Payroll taxes and benefits</td>
<td>Delivery expenses</td>
</tr>
<tr>
<td>Advertising</td>
<td>Boxes, paper, etc.</td>
</tr>
<tr>
<td>Office supplies</td>
<td>Cost of materials</td>
</tr>
<tr>
<td>Insurance</td>
<td>Variable labor</td>
</tr>
<tr>
<td>Maintenance and cleaning</td>
<td></td>
</tr>
<tr>
<td>Legal and accounting</td>
<td></td>
</tr>
<tr>
<td>Delivery expenses</td>
<td></td>
</tr>
<tr>
<td>Licenses</td>
<td></td>
</tr>
<tr>
<td>Boxes, paper, etc.</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td></td>
</tr>
<tr>
<td>Depreciation</td>
<td></td>
</tr>
<tr>
<td>Rent</td>
<td></td>
</tr>
<tr>
<td>Interest (Mortgage)</td>
<td></td>
</tr>
<tr>
<td>Interest (Term loans)</td>
<td></td>
</tr>
<tr>
<td>Interest (Line of credit)</td>
<td></td>
</tr>
</tbody>
</table>

\[^{83}\] Ibid, pp. 64-65.

\[^{84}\] Many banks do not consider the break-even analysis but micro lenders may (Mims).
**Fixed costs** generally remain the same, no matter what your sales are. They are independent of the sales level. If you have a large increase or decrease in sales, some fixed costs will change.

**Variable costs** are costs associated with cost of goods sold, and costs which change based on your sales. Some costs can be both fixed and variable.

If you do not know what your total variable costs will be, you can use a variation of the basic “S = FC + VC” formula. If you know what gross margin (profit on sales) to expect as a percentage of sales, use the following formula:

\[
S = FC \div GM
\]

Where
- **S** = Breakeven level of sales in dollars
- **FC** = Fixed costs in dollars
- **GM** = Gross Margin expressed as a percent of Sales

**Gross margin** is the profit before expenses expressed as a percentage of sales. The formula for gross margin is:

\[
GM = \frac{(S - COGS)}{S}
\]

Where
- **GM** = Gross Margin
- **S** = Sales
- **COGS** = Cost of goods sold

**Gross profit margin** measures the difference between what it costs to produce a product and what you’re selling it for. It tells you how much of each sales dollar you can expect to use to cover your operating expenses and profit. While some ratios uncover trends by looking at the past, the gross profit margin is a tool you can use to chart your company’s future. A gross profit margin of 0.33 means that for every $1.00 in sales, you have 33¢ to cover your basic operating costs and profit.\(^{85}\)

---

The formula for calculating gross profit margin is:

\[
GPM = \frac{COGS}{NS}
\]

Where

- **GPM** = Gross profit margin
- **COGS** = Cost of goods sold
- **NS** = Net sales

**EXAMPLE:**

- Fixed costs \( FC \) = $50,000
- Sales \( S \) = $175,000
- Cost of goods sold \( COGS \) = $75,000
- Unit price = $10
- Units sold = 17,500
- Gross margin \( GM \) = \( \frac{(175,000 - 75,000)}{175,000} \) = 0.57
- Gross profit margin \( GPM \) = \( \frac{75,000}{175,000} \) = 0.42
- Breakeven Sales \( S \) = \( FC \div GM \)
  = \( 50,000 \div 0.57 \)
  = $87,719 per year
  = $7,310 per month
- Breakeven Units
- Divide the breakeven sales by the unit price:
  = 87,719 ÷ 10
  = 8,772
- Breakeven Price
- Divide the breakeven sales by units sold:
  = 87,719 ÷ 17,500
  = $5.01
To calculate Breakeven plus Profit:

\[ S = \frac{(FC + P)}{GM} \]

Where
- S = Gross sales needed to make desired profit
- FC = Fixed costs in dollars
- P = Desired profit
- GM = Gross Margin expressed as a percent of Sales

There are three ways to lower your break-even volume:

1. Lower direct costs, which will raise the gross margin.
2. Exercise cost controls on your fixed expense, and lower the necessary total dollars.
3. Raise prices.

What are your breakeven sales?

Breakeven sales: $_______________________

At what price and volume will you break even?

Breakeven price: $_______________________
Breakeven units: _______________________

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The **Risk Management Association (RMA)** (formerly known as Robert Morris Associates) is a useful source of information as you develop your pricing strategy and calculate your breakeven sales, prices, and units. Designed as a source of industry-specific data for its risk professional members, in other words, banks, the RMA helps you compare your business’s financial performance, projections, and ratios to others in your same industry.

RMA’s *Annual Statement Studies* contains data which comes directly from the financial statements of RMA member-banks’ customers (primarily small to medium-sized companies) and represents more than 600 industries. More than 150,000 financial statements are coalesced into the publication. These are the figures and ratios that many bankers look at in evaluating your business and determining whether to fund your company.

The *Annual Statement Studies* contains a wide range of data sorted by company assets and sales, including:

- **Assets:**
  - Cash & Equivalents
  - Trade Receivables-(net)
  - Inventory
  - All Other Current
  - Fixed Assets (net)
  - Intangibles (net)
  - All Other Non-Current

- **Liabilities:**
  - Notes Payable-Short Term
  - Current Maturity-Long-term Debt
  - Trade Payables
  - Income Taxes Payable
  - All Other Current
  - Long Term Debt
  - Deferred Taxes
  - All Other Non-Current
  - Net Worth
- Income Data:
  - Net Sales
  - Gross Profit
  - Operating Expenses
  - Operating Profit
  - All Other Expenses (net)
  - Profit Before Taxes

- Ratios:
  - Current
  - Quick
  - Sales/Receivables
  - Cost of Sales/Inventory
  - Cost of Sales/Payables
  - Sales/Working Capital
  - % Profit Before Taxes/Tangible Net Worth
  - % Officers’, Directors’, Owners’ Compensation or Sales.

Annual Statement Studies currently contains both Standard Industrial Classification (SIC) and North American Industry Classification System (NAICS) codes. NAICS was developed jointly by the U.S., Canada, and Mexico to provide new comparability in statistics about business activity across North America. The U.S. Small Business Administration (SBA) adopted the NAICS system in October 2000. You can convert SIC codes into NAICS on the SBA’s website. RMA will use only NAICS codes beginning in Fall 2005.

Entries for a particular SIC or NAICS can be downloaded for a fee from RMA’s website. Your library or bank should also have a copy of the latest book.
Common SIC codes and their NAICS equivalents for various geothermal projects are listed in the table below.

<table>
<thead>
<tr>
<th>INDUSTRY</th>
<th>SIC</th>
<th>NAICS</th>
<th>INDUSTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ornamental Floriculture and Nursery Products</td>
<td>0181</td>
<td>111422</td>
<td>Floriculture Production</td>
</tr>
<tr>
<td>Floriculture Farming</td>
<td></td>
<td>111421</td>
<td>Nursery and Tree Production</td>
</tr>
<tr>
<td>Nursery Farming</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retail Nurseries, Lawn and Garden Supply Stores</td>
<td>5261</td>
<td>444220</td>
<td>Nursery and Garden Centers</td>
</tr>
<tr>
<td>Except Outdoor Power Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal Aquaculture</td>
<td>0273</td>
<td>112511</td>
<td>Finfish Farming and Fish Hatcheries</td>
</tr>
<tr>
<td>Finfish Farms</td>
<td></td>
<td>112512</td>
<td>Shellfish Farming</td>
</tr>
<tr>
<td>Shellfish Farms</td>
<td></td>
<td>112519</td>
<td>Other Animal Aquaculture</td>
</tr>
<tr>
<td>Other Animal Aquaculture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal Specialties, NEC</td>
<td>0279</td>
<td>112519</td>
<td>Other Animal Aquaculture</td>
</tr>
<tr>
<td>Alligator and Frog Production</td>
<td></td>
<td>112990</td>
<td>All Other Animal Production</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hotels and Motels</td>
<td>7011</td>
<td>721110</td>
<td>Health spas (i.e., physical fitness facilities) with accommodations</td>
</tr>
<tr>
<td>Hotels (except Casino Hotels) and Motels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fitness and Recreational Sports Centers</td>
<td>7991</td>
<td>713940</td>
<td>Health spas without accommodations, physical fitness</td>
</tr>
<tr>
<td>Steam and Air-Conditioning Supply</td>
<td>4961</td>
<td>221330</td>
<td>Steam and Air-Conditioning Supply</td>
</tr>
<tr>
<td>Geothermal steam production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam supply systems, including geothermal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric and Other Services Combined</td>
<td>4931</td>
<td>221119</td>
<td>Other Electric Power Generation</td>
</tr>
<tr>
<td>Other Electric Power Generation When Combined with Other Services</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Marketing Plan: Market Cubed

The market is the core and most important component of a successful, thriving business. Put simply: No market, no money, no business.

Marketing plays a vital role in successful business ventures. How well you market your business, along with a few other considerations, will ultimately determine your degree of success or failure. The key element of a successful marketing plan is to know your customers—their likes, dislikes, and expectations. By identifying these factors, you can develop a marketing strategy that will allow you to arouse and fulfill their needs.89

Market can be “cubed” into three interrelated components:

1. **Target Market** – Who are your customers, and why will they buy from you?

2. **Marketing to Your Market** – How do you reach your customers, e.g., through promotion, advertising, word of mouth?

3. **The Big Market** – Who are the other markets, e.g., your competition, and how will you deal with them?

All three components comprise a Marketing Plan. A Marketing Plan contains answers to the following questions:

- Who are your customers? Define your target market(s).
- Are your markets growing? steady? declining?
- Is your market share growing? steady? declining?
- Are your markets large enough to expand?
- How will you attract, hold, increase your market share?

Your Marketing Plan will change depending on your business’s stage. For example, a new business’s marketing plan will focus on raising awareness. An


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established business’s marketing plan, however, might focus on introducing a new product or service.

The Promotion Pyramid illustrates how customers become aware of a new product or service. The purpose of marketing is to get the customer from being unaware of your company to buying your product or service.
**TARGET MARKET**

**Who are your target customers?**

- Age
- Gender
- Educational level
- Income
- Profession
- Marital status
- Location

---

**What are the psychographic characteristics of your target market?**

Psychographics refers to how the customer’s personality and emotions affects his or her purchase choices. For example, is the customer a risk-taker or risk adverse? Does he or she buy on impulse or research purchases carefully.
<table>
<thead>
<tr>
<th><strong>TARGET MARKET</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>How many customers do you have?</td>
</tr>
<tr>
<td>Where are they located?</td>
</tr>
<tr>
<td>What do they buy?</td>
</tr>
<tr>
<td><strong>TARGET MARKET</strong></td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td><strong>When do they buy?</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Why do they buy?</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>How do they buy?</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>TARGET MARKET</strong></td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td><strong>Why will they buy from you?</strong></td>
</tr>
<tr>
<td><strong>What does your product or service do for the customer?</strong></td>
</tr>
<tr>
<td>□ Make the customer money</td>
</tr>
<tr>
<td>□ Save the customer money.</td>
</tr>
<tr>
<td>□ Make the customer time.</td>
</tr>
<tr>
<td>□ Save the customer time.</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
</tr>
</tbody>
</table>
Secondly, your Marketing Plan will discuss how you will reach your target market, e.g., how will you let them know that your product or service exists and meets their needs?

There are five basic types of marketing:

1. You see a gorgeous woman at a party. You go up to her and say, “I’m a great guy.” That’s Direct Marketing.

2. You’re at a party with a bunch of friends and see a gorgeous woman. One of your friends goes up to her and pointing at you says, “He’s a great guy.” That’s Advertising.

3. You see a gorgeous woman at a party. You go up to her and get her telephone number. The next day you call and say, “Hi, I’m a great guy.” That’s Telemarketing.

4. You’re at a party and see a gorgeous woman. You get up and straighten your tie, walk up to her, and pour her a drink. You open the door for her, pick up her bag after she drops it, offer her a ride, and then say, “By the way, I’m a great guy.” That’s Public Relations.

5. You’re at a party and see a gorgeous woman. She walks up to you and says, “I hear you’re a great guy.” That’s Word-of-Mouth.90

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### Marketing to Your Market

**How will you market your product or service?**

- Attend trade shows
- Create a web site
- Direct mail
- Join trade associations
- Place an ad in the local newspaper
- Place an ad in a speciality magazine
- Issue a press release
- Run an ad on T.V.
- Run an ad on the radio
- Other

**Why did you select the above activities?**
There are countless books on marketing for you to consult. Several are written by Jay Conrad Levison who coined the phrase “guerilla marketing.” Guerilla marketing means almost any non-traditional, low-cost, highly effective marketing effort.\(^91\)

In addition to books, there are several free or low cost sources of marketing help for small businesses, many supported by the Small Business Administration and detailed below. Industry trade associations, bankers, vendors, suppliers, and even your competition can also help you gather and assess marketing data, and develop a marketing plan.

**Small Business Institute®**

Established in 1972 as a pilot program, the Small Business Institute® (SBI) program began as a cooperative venture between the SBA and approximately 20 universities. The program developed to include as many as 500 programs at colleges and universities in the 50 states and several U.S. territories. Today, approximately 250 universities participate in the SBI program. The Small Business Institute Director’s Association (SBIDA) has coordinated the SBI program since its inception.

Each SBI program operates within a College or Department of Business or Management. It uses student teams of two to four senior-level or graduate business students, under faculty supervision, to conduct in-depth consulting and field case projects to analyze and create solutions for specific business problems. Each SBI student team meets frequently with the small business owner over the course of the academic term to learn about the owner’s goals and the business’s history, to observe operations, and to identify opportunities and specific problems.\(^92\)

To qualify for participation in the SBI program, you must have an operating business, be willing to meet with the student project team for six to eight 60- to 90-minute meetings, and be willing to provide information about your business operations to the team.

---

\(^91\) For more information, see the Guerilla Marketing website at [http://www.gmarketing.com](http://www.gmarketing.com).

For more information, contact:

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Millersville University  
Department of Business Administration  
Millersville, PA 17551  
Phone: (717) 972-3842  
Fax: (717) 871-2464  
Email: pat.mccaskey@millersville.edu

Small Business Development Centers (SBDC)

The SBA administers the Small Business Development Center Program to provide management assistance to current and prospective small business owners. SBDCs offer one-stop assistance to individuals and small businesses by providing a wide variety of information and guidance in central and easily accessible branch locations. Since 1980, over 8 million entrepreneurs have received services from SBDCs. In FY2002, SBDCs counseled and trained nearly 625,000 clients.

Assistance from an SBDC is available to anyone interested in beginning a small business for the first time or improving or expanding an existing small business, who cannot afford the services of a private consultant.

There are 58 SBDCs in the 50 states and U.S. territories, and a network of more than 1,100 service locations.93 The following table lists the main SBDC locations in the 19 states involved in the GPW effort.94

<table>
<thead>
<tr>
<th>STATE</th>
<th>SBDC LOCATION</th>
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</table>
| Alaska | Jan Fredericks, State Director  
430 West Seventh Avenue, Suite 110  
Anchorage, AK 99501  
Phone: (907) 274-7232  
Fax: (907) 274-9524  
Email: <anjaf@uaa.sbdcc.alaska.edu>  
Website: <http://www.aksbdc.org> |


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<tr>
<td>Arizona</td>
<td>Michael York, State Director&lt;br&gt;2411 West 14th Street, Suite 132&lt;br&gt;Temp, AZ 85281&lt;br&gt;Phone: (480) 731-8720&lt;br&gt;Fax: (480) 731-8729&lt;br&gt;Email: <a href="mailto:mike.york@domail.maricopa.edu">mike.york@domail.maricopa.edu</a>&lt;br&gt;Website: <a href="http://www.dist.maricopa.edu.sbdc">http://www.dist.maricopa.edu.sbdc</a></td>
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<td>California</td>
<td>Nelson Chan, State Director&lt;br&gt;801 K Street, Suite 1700&lt;br&gt;Sacramento, CA 95814&lt;br&gt;Phone: (916)-324-5511&lt;br&gt;Fax: (916)-924-5511&lt;br&gt;Email: <a href="mailto:nchan@commerce.ca.gov">nchan@commerce.ca.gov</a>&lt;br&gt;Website: <a href="http://www.commerce.ca.gov/business/small/starting">http://www.commerce.ca.gov/business/small/starting</a></td>
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<td>Colorado</td>
<td>Kelly Manning, State Director&lt;br&gt;1625 Broadway, Suite 1700&lt;br&gt;Denver, CO 80202&lt;br&gt;Phone: (303) 892-3794&lt;br&gt;Fax: (303) 892-3848&lt;br&gt;Email: <a href="mailto:Kelly.Manning@state.co.us">Kelly.Manning@state.co.us</a>&lt;br&gt;Website: <a href="http://www.state.co.us/oed/sbdc/">http://www.state.co.us/oed/sbdc/</a></td>
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<td>Hawaii</td>
<td>Darryl Mleynek, State Director&lt;br&gt;200 West Kawili Street&lt;br&gt;Hilo, HI 96720&lt;br&gt;Phone: (808) 974-7515&lt;br&gt;Fax: (808) 974-7683&lt;br&gt;Email: <a href="mailto:darrylm@interpac.net">darrylm@interpac.net</a>&lt;br&gt;Website: <a href="http://www.hawaii-sbdc.org">http://www.hawaii-sbdc.org</a></td>
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<td>James Hogge, State Director&lt;br&gt;1910 University Drive&lt;br&gt;Boise, ID 83725&lt;br&gt;Phone: (208) 426-1640&lt;br&gt;Fax: (208) 426-3877&lt;br&gt;Email: <a href="mailto:jhogge@boisestate.edu">jhogge@boisestate.edu</a>&lt;br&gt;Website: <a href="http://www.idahosbdc.org">http://www.idahosbdc.org</a></td>
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<td>Kansas</td>
<td>Wally Kearns, State Director&lt;br&gt;214 SW Sixth Street, Suite 301&lt;br&gt;Topeka, KS 66603&lt;br&gt;Phone: (785) 296-6514&lt;br&gt;Fax: (785) 291-3261&lt;br&gt;Email: <a href="mailto:ksbdc.wkearns@fhsu.edu">ksbdc.wkearns@fhsu.edu</a>&lt;br&gt;Website: <a href="http://www.fhsu.edu/ksbdc">http://www.fhsu.edu/ksbdc</a></td>
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<td>Montana</td>
<td>Ann Desch, State Director&lt;br/&gt;301 S. Park Avenue, Room 114&lt;br/&gt;Helena, MT 59601&lt;br/&gt;Phone: (406) 841-2747&lt;br/&gt;Fax: (406) 841-2728&lt;br/&gt;Email: <a href="mailto:adesch@state.mt.us">adesch@state.mt.us</a>&lt;br/&gt;Website: <a href="http://commerce.state.mt.us/brd/BRD_SBDC.html">http://commerce.state.mt.us/brd/BRD_SBDC.html</a></td>
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<td>Nebraska</td>
<td>Robert Bernier, State Director&lt;br/&gt;60th &amp; Dodge Street, CBA Room 407&lt;br/&gt;Omaha, NE 68182&lt;br/&gt;Phone: (402) 554-2521&lt;br/&gt;Fax: (402) 554-3473&lt;br/&gt;Email: <a href="mailto:rbernier@unomaha.edu">rbernier@unomaha.edu</a>&lt;br/&gt;Website: <a href="http://nbdc.unomaha.edu/">http://nbdc.unomaha.edu/</a></td>
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<td>Nevada</td>
<td>Sam Males, State Director&lt;br/&gt;Reno College of Business Nazir Ansasri Bldg, 032, rm.411&lt;br/&gt;Reno, NV 89557-0100&lt;br/&gt;Phone: (775) 784-1717&lt;br/&gt;Fax: (775) 784-4337&lt;br/&gt;Email: <a href="mailto:males@unr.edu">males@unr.edu</a>&lt;br/&gt;Website: <a href="http://www.nsbdc.org">http://www.nsbdc.org</a></td>
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<tr>
<td>New Mexico</td>
<td>Roy Miller, State Director&lt;br/&gt;6401 Richards Avenue&lt;br/&gt;Santa Fe, NM 87505&lt;br/&gt;Phone: (505) 428-1362&lt;br/&gt;Fax: (505) 428-1469&lt;br/&gt;Email: <a href="mailto:rmiller@santa-fe.cc.nm.us">rmiller@santa-fe.cc.nm.us</a>&lt;br/&gt;Website: <a href="http://www.nmsbdc.org">http://www.nmsbdc.org</a></td>
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<tr>
<td>North Dakota</td>
<td>Christine Martin, State Director&lt;br/&gt;UND- 118 Gamble Hall, UND, Box 7308&lt;br/&gt;Grand Forks, ND 58202&lt;br/&gt;Phone: (701) 777-3700&lt;br/&gt;Fax: (701) 777-3225&lt;br/&gt;Email: <a href="mailto:christine.martin@und.nodak.edu">christine.martin@und.nodak.edu</a>&lt;br/&gt;Website: <a href="http://www.und.nodak.edu/dept/ndsbdc">http://www.und.nodak.edu/dept/ndsbdc</a></td>
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<td>Oklahoma</td>
<td>Grady Pennington, State Director&lt;br/&gt;517 University, Box 2584, Station A&lt;br/&gt;Durant, OK 74701&lt;br/&gt;Phone : (580) 745-7577&lt;br/&gt;Fax : (580) 745-7471&lt;br/&gt;Email: <a href="mailto:gpennington@sosu.edu">gpennington@sosu.edu</a>&lt;br/&gt;Website: <a href="http://www.osbdc.org">http://www.osbdc.org</a></td>
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<tr>
<td>Oregon</td>
<td>Sandy Cutler, State Director</td>
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<tr>
<td></td>
<td>44 West Broadway, Suite 203</td>
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<td></td>
<td>Eugene, OR 97401-3021</td>
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<tr>
<td></td>
<td>Phone: (541) 726-2250</td>
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<td>Fax: (541) 345-6006</td>
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<td></td>
<td>Email: <a href="mailto:cutlers@lanecc.edu">cutlers@lanecc.edu</a></td>
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<td>South Dakota</td>
<td>Wade Druin, State Director</td>
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<td>414 East Clark Street</td>
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<td></td>
<td>Vermillion, SD 57069</td>
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<td>Phone: (605) 677-5287</td>
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<td>Fax: (605) 677-5427</td>
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<td>Email: <a href="mailto:wdruin@usd.edu">wdruin@usd.edu</a></td>
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<td>Texas</td>
<td>University of Houston SBDC</td>
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<td></td>
<td>Mike Young, State Director</td>
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<tr>
<td></td>
<td>2302 Fannin, Suite 200</td>
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<td></td>
<td>Houston, TX 77002</td>
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<tr>
<td></td>
<td>Phone: (713) 752-8444</td>
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<td></td>
<td>Fax: (713) 756-1500</td>
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<tr>
<td></td>
<td>Email: <a href="mailto:fyoung@uh.edu">fyoung@uh.edu</a></td>
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<tr>
<td></td>
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<tr>
<td>Texas-North SBDC</td>
<td>Liz Klimback, State Director</td>
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<td>Bill J. Priest Institute for Economic Dev.</td>
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<td></td>
<td>1402 Corinth Street</td>
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<td></td>
<td>Dallas, TX 75215</td>
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<td></td>
<td>Phone: (214) 860-5831</td>
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<td>Texas-NW SBDC</td>
<td>Craig Bean, State Director</td>
</tr>
<tr>
<td></td>
<td>2579 South Loop 289, Suite 114</td>
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<tr>
<td></td>
<td>Lubbock, TX 79423</td>
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<td></td>
<td>Phone: (806) 745-3973</td>
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<td>South-West Texas Border Region SBDC</td>
<td>Robert McKinley, State Director</td>
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<tr>
<td></td>
<td>145 Duncan Drive Suite 200</td>
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<td>San Antonio, TX 78226-1816</td>
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</table>
| Utah       | Michael Finnerty, State Director  
1623 South State Street  
Salt Lake City, UT 84115  
Phone: (801) 957-3480  
Fax: (801) 957-3489  
Email: <Finnermi@slcc.edu>  
Website: <http://www.slcc.edu/sbdc/> |
| Washington | Carolyn Clark, State Director  
601 W. First Avenue  
Spokane, WA 99201-3899  
Phone: (509) 358-7765  
Fax: (509) 358-7764  
Email: <clrk@wsu.edu>  
Website: <http://www.wsbdc.org> |
| Wyoming    | Diane Wolverton, State Director  
University of Wyoming  
Wyoming Hall, Room 414  
Laramie, WY 82071-3922  
Phone: (307) 766-3505  
Fax: (307) 766-3406  
Email: <DDW@uwyo.edu>  
Website: <http://www.uwyo.edu/sbdc> |

Service Corps of Retired Executives (SCORE)

The SCORE Association is a national, nonprofit association with 10,500 volunteer members and 389 chapters throughout the United States and its territories. SCORE is a resource partner with the SBA. SCORE Association volunteers—working and retired executives and business owners—donate their time and expertise to provide confidential counseling and mentoring free of charge. In addition to free and confidential email counseling, SCORE offers face-to-face counseling and workshops at 389 chapter locations. **SCORE eNews**, a free e-newsletter, gives tips, ideas, and resources to help you build your business.

SCORE has counseled more than 4.5 million clients since 1964, and provided 440,293 services to the small business community through counseling, educational training workshops, and online assistance in FY2002.95

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The following table lists the SCORE chapter locations in the 19 GeoPowering the West states. For more information on the chapter nearest you, call the SCORE Association office toll free at 1-800-634-0245, or visit the SCORE website.

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The third part of your Marketing Plan should address the Big Market, e.g., who is your competition and how will you deal with them? SCORE provides the following advice on competition:

Very few businesses operate in a vacuum—without competition in a specific market. There also may be indirect competition, which has a significant impact on customer’s buying decisions in your market. Direct and non-direct competitors are trying to convince customers to buy their product rather than yours. It is in your best interest to attempt to know more about the companies that are trying to reduce your take-home pay.\(^9^8\)

In the table below, list your five main competitors and their strengths and weaknesses. Talk with friends, visit your competition, call for information about their products, and analyze how they advertise. Rank each of your major competitors on a scale of 1 to 10.

<table>
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<tr>
<th>MAJOR COMPETITOR</th>
<th>PRODUCT QUALITY</th>
<th>PROCESS</th>
<th>ADVERTISING</th>
<th>CUSTOMER SATISFACTION</th>
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Use the competitive analysis to make decisions in your strategic marketing plan. Knowing your competition enables you to gain a competitive advantage, which always results in more sales and profits. It is impossible to produce a realistic marketing plan and business plan, without knowing your competition.
A business is only as strong as its people—the people who run the show and the people who make the show run. For startups, many potential financing sources look at the company’s management first and foremost. If the management is strong, the company has a much better chance of succeeding.

How is your company managed?

Who will manage the business?
What are the qualifications of the managers?

Will you have a Board of Directors or a Board of Advisors?

☐ Yes
☐ No

If yes, who will be their members?

What are their qualifications?
A qualified Board of Directors or Board of Advisors show potential investors that you have a team of outside experts to call on. Make sure to invite people who may compensate for weaknesses you may have to serve on the board.

Next, you need to determine who will make the show run; what employees do you need? Even if you do not know specifically who you will hire, you need to know what positions you will need to fill, what the job duties for each position will be, the qualifications you will look for in prospective employees, and a salary range. Use the following table to list jobs you will need to fill in the next 12 months.

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<th>POSITION</th>
<th>DUTIES</th>
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</table>
Some jobs you will need to fill now, others you will need to fill as your business grows. Use the following table to list jobs you will need to fill within the next five years.

<table>
<thead>
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<th>DUTIES</th>
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Date needed:

Date needed:

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Date needed:

You need to consider general employment issues as well.
Will your employees be full-time, part-time, or a combination?

- Full-time
- Part-time
- Combination (specify)

Will your employees be salaried, hourly, or a combination?

- Salaried
- Hourly
- Combination (specify)

Will you pay overtime?

- Yes
- No

If yes, how much?
Will you provide benefits?

□ Yes
□ No

If yes, what benefits will you provide?

□ Child care
□ Company car
□ Educational assistance
□ Employee stock purchase plan
□ Employer provided travel
□ Group term life insurance
□ Medical and dental insurance
□ Paid sick leave
□ Paid vacation
□ Retirement plan
□ Other

Will you have to train people?

□ Yes
□ No

If yes, what is your training plan?
5 Show Me the Money

The “money” encompasses two items:

- The **Financial Data** you need to calculate to determine the economic viability of your business, and which potential investors will review to determine whether to invest in your business, and
- The **Financing Plan** you need to develop to determine how much money you need to finance your business.\(^99\)

First let’s look at accounting. Your numbers are only as good as your accounting system and a good accounting system is critical to your business’s success. It is essential that you have a competent accountant set up a system to give you adequate accounting records. If you can’t afford this, you are simply too undercapitalized to be in business. If you don’t understand the need for accounting records, you don’t have enough management experience to be starting a business. This is a common problem area for many small businesses.\(^100\)

There are several good accounting programs on the market for small businesses, e.g., QuickBooks Pro, Peachtree, MYOB Accounting Plus, Simply Accounting Pro, Microsoft Small Business Manager, Cougar Mountain, and Oracle Small Business Suite. Consult your accountant or bookkeeper to pick the one that is right for your business.

---

\(^99\) This section will not discuss specific sources of funding for geothermal entrepreneurs, small companies, and developers, or explain the criteria they use to evaluate the creditworthiness of your business. This will be the subject of the second workbook in the series.

\(^100\) Bangs, Jr., p. 55.
Financial Data

The Financial Data section of your business plan will contain six items:

1. Sources and Applications of Funding
2. Capital Equipment List
3. Balance Sheet
4. Breakeven Analysis
5. Income Projections (also called Profit and Loss)
6. Cash Flow Projections

Check with your bank or financing source to determine what, and how many years of projected financial statements they require. Some banks, for example, require five financial statements: Pre-Funding, Post-Funding, and three years Projected. First year statements are usually broken down by month. Second and third year statements are typically broken down by quarter. For established businesses, banks generally ask for financial statements for the past three years, and projected statements for three years out.

Banks may also ask for your personal tax return and credit history in the belief that the way you manage your personal finances will predict how you will manage your business’s finances. Check with your bank to see what their specific requirements are.

Sources and Applications of Funding

This section is needed for financing proposals but is also useful for the owner. The statement shows how the business will be financed from money coming in (Sources) and how it will be spent (Applications). The Sources and Applications statement is also known as a Financing Plan. See page 107 for a sample statement.
Capital Equipment List

Your business plan should contain a capital equipment list to help maintain control over depreciable assets, for insurance purposes, to insure against letting your reserve for replacement of capital equipment become too low (or be used as a slush fund), and to assist in the creation of a cost budget. A sample capital equipment list is shown.

Balance Sheet

The balance sheet lists the assets, liabilities, and owner’s equity of a business for a specific date. A sample Balance Sheet is shown below.

---

101 Ibid, p. 58.
Balance sheets for all companies, regardless of their size, contain the same categories arranged in the same order. The difference is one of detail. The format is standardized to facilitate analysis and comparison—do not deviate from it. 102

**Current Assets** are assets that are expected to be converted to cash, sold, or used up in a year or less, through normal business operations:

- Cash,
- Government securities,
- Marketable securities,
- Notes receivable (other than from officers or employees),
- Accounts receivable,
- Inventories, and
- Prepaid expenses.

**Fixed Assets** are assets whose useful business life exceeds one year:

- Land,
- Plant,
- Equipment, and
- Leasehold improvements.

**Depreciation** is the decrease in usefulness of fixed assets other than land. It is applied to those fixed assets that will wear out. The value of a depreciable fixed asset is the net cost of that asset minus accumulated depreciation.

**Other Assets** are intangible assets:

- Patents,
- Copyrights,
- Exclusive use contracts, and
- Notes receivable from officers and employees.

**Current Liabilities** are obligations which the business has to pay within one year:

- Accounts payable,
- Notes payable,
- Accrued expenses (wages, salaries, withholding tax, FICA),

---

102 Ibid, p. 61.
- Taxes payable,
- Current portion of long-term debt, and
- Dividends payable.

**Long-Term Liabilities** are obligations which the business has to pay in more than one year:

- Mortgages,
- Trust deeds, and
- Intermediate and long-term bank loans (excluding that portion which is due in the current year).

**Net Worth** or **Owner’s Equity**, equals total assets minus total liabilities:

- Paid-in or invested capital,
- Retained earnings (profit), and
- Other equity.

The Balance Sheet is so called because it shows the balance between Total Liabilities, Net Worth, and Total Assets. They are always in balance.

\[
\text{Total Liabilities} + \text{Net Worth} = \text{Total Assets}
\]

**Breakeven Analysis**

We discussed Breakeven Analysis earlier in the Workbook as a way to help you determine the minimum price and unit sales you need to achieve to cover your costs.

It is essential to remember that increased sales do not necessarily mean increased profits. More than one company has gone broke by ignoring the need for breakeven analysis, especially in those cases where variable costs (those directly related to sales levels) get out of hand as sales volume grows. By doing breakeven analysis, you can better plan ahead to finance your business properly.
**Income Projections**

Income Projections include the Income Statement, also called the Profit and Loss Statement, and are a summary of the revenues and expenses of a business for a specific period of time in the past, now, or in the future. A sample Income Statement is shown on the following page.

**Net Sales** equals Gross Sales less returns, allowances, and discounts. To calculate projected Sales, use a three-tiered approach:

<table>
<thead>
<tr>
<th>SALES PROJECTIONS</th>
<th>WORSE CASE</th>
<th>MOST LIKELY</th>
<th>BEST CASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL SALES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The **Cost of Goods Sold (COGS)** is the cost of the manufactured product sold. It includes the cost of inventories.

**Gross Margin** represents the gross profit on sales without taking indirect costs into account. It is Net Sales minus COGS:

\[
\text{Gross Margin} = \text{Net Sales} - \text{COGS}
\]

As we saw before, Gross Margin is also the profit before expenses expressed as a percentage of sales. The RMA’s *Annual Statement Studies* can tell you how your business’s gross margin compares to that of other companies in your same SIC and NAICS code.
Operating Expenses

Operating Expenses, together with Other Expenses, are those expenses which must be met no matter what Sales are. Be sure to include the owner’s salary as an expense. If you cannot pay yourself and still make a profit, the business is not profitable. How much you pay yourself is entirely up to you. The RMA’s Annual Statement Studies, however, is a good source of information on what others in your same SIC or NAICS code pay themselves and should be used as a guide.

Miscellaneous expenses are those which are too small to be itemized. Some experts suggest to clients that this category be used as a contingency allocation of...
15% of gross revenues for the first year, 10% for the second, and 5% for the third, on the expectation that in a startup there will always be cost overruns.\textsuperscript{104}

**Other Expenses**

These are non-operating expenses. The most common is interest. Breaking out different types of interest, e.g., Mortgage, Term Loan, and Line of Credit, into separate lines will make ratio analysis easier.

**Total Expenses**

This is the sum of all Operating and Other Expenses.

**Profit (or Loss) Pretax**

The Pretax Profit (or Loss) equals:

\[
\text{Pretax Profit (or Loss)} = \text{Gross Margin} - \text{Total Expenses}
\]

This is the amount on which your tax will be calculated.

**Taxes**

Consult your accountant or tax professional.

**Net Profit (or Loss)**

Net Profit (or Loss) is after taxes, and calculated as follows:

\[
\text{Net Profit (or Loss)} = \text{Pretax Profit (or Loss)} - \text{Taxes}
\]
There are three ways to make this number more positive:

1. Increase your Gross Margin,
2. Decrease your Total Expenses, or
3. Both 1 and 2.

**Cash Flow Projections**

In any business, cash comes in and cash goes out. The challenge is ensuring that you have the cash “in” when it is needed to go “out.” It can make the difference between success and failure for a startup, and between growth and stagnation for an established business. Your cash flow analysis will:

- Show you how much cash your business will need;
- When it will be needed;
- Whether you should look for equity, debt, operating profits, or sale of fixed assets;
- Where the cash will come from; and
- Once developed, serve as a budget.\(^{105}\)

The Cash Flow Statement indicates how profitable a business is expected to be, how much cash flow it is expected to generate, the assumptions used, and how that cash flow will be allocated among the various providers of capital. Most banks require Cash Flow projections for three years. If you only do one statement, it should be the Cash Flow Statement. The formula is simple:

\[
\text{Cash Flow} = \text{Cash Receipts} - \text{Cash Disbursements}
\]

The graphic below illustrates how cash flows into and out of a business as receipts and disbursements.\(^{106}\)
An example of a Cash Flow Projection by Quarter is shown on the following page. Your own should be as detailed as needed.

Cash disbursements are actual dollars that you pay out. They do not include future obligations which must be paid off at a later date. Such obligations appear on the Income Statement and Balance Sheet but not on the Cash Flow Statement.

Most banks require Cash Flow statements broken down by month for the first year, and by quarter for the second and third years.
## CASH FLOW PROJECTION
### By Quarter

<table>
<thead>
<tr>
<th>Cash Receipts</th>
<th>1st Quarter</th>
<th>2nd Quarter</th>
<th>3rd Quarter</th>
<th>4th Quarter</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales Receivables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From Sale of Inventory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From Sale of Other Current Assets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From Sale of Capital Assets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From New Capital</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Short-term Loans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Long-term Loans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Other Liabilities (taxes, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Cash Receipts</strong></td>
<td>$ A</td>
<td>$ D</td>
<td>$ E</td>
<td>$ F</td>
<td>$ G</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cash Disbursements</th>
<th>1st Quarter</th>
<th>2nd Quarter</th>
<th>3rd Quarter</th>
<th>4th Quarter</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Goods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Fixed Cash Disbursements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pay Accounts Payable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payroll and Payroll Burden</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash Payments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory Paid in Cash</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principle Payments Short-term Debt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principle Payments Other Liabilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principle Payments Long-term Debt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase of Capital Assets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase of Short-term Assets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payments of Dividends or Draw</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Cash Disbursements</strong></td>
<td>$ B</td>
<td>$ E</td>
<td>$ F</td>
<td>$ G</td>
<td>$ H</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Net Cash Flow</th>
<th>1st Quarter</th>
<th>2nd Quarter</th>
<th>3rd Quarter</th>
<th>4th Quarter</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ A - B = C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>$ F</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cumulative Cash Flow</th>
<th>1st Quarter</th>
<th>2nd Quarter</th>
<th>3rd Quarter</th>
<th>4th Quarter</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>$ C + F</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### * Fixed Cash Disbursements (FCD) Year One

| Utilities          |             |             |             |             |       |
| Salaries and Wages |             |             |             |             |       |
| Payroll Taxes and Benefits |       |             |             |             |       |
| Office Supplies    |             |             |             |             |       |
| Maintenance and Cleaning |       |             |             |             |       |
| Licenses           |             |             |             |             |       |
| Telephone          |             |             |             |             |       |
| Miscellaneous      |             |             |             |             |       |
| **Total FCD/yr**   | $           |             |             |             |       |
| Average FCD per quarter | $     |             |             |             |       |
| Average FCD per month | $    |             |             |             |       |
Financing Plan

Now that you have your financial statements prepared and in order, you need a Financing Plan. A Financing Plan answers three basic questions:

1. How much money do you need for your business?,
2. How will you use the money?, and
3. Where will you get it?

How much money do you need?

A three-tiered approach is often useful to determine how much money you need for your business. It is also useful when the bank comes back to you with a counteroffer, asking you to re-evaluate your needs based on a smaller, or larger, loan size. If you have your three-tiered financing needs already determined, you can get back to the bank quickly. Banks do not want to lend you just enough money to fail.

<table>
<thead>
<tr>
<th>Bare Bones</th>
<th>Reasonable</th>
<th>Optimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is what you can just scrape by with—used, borrowed, makeshift—the bare minimum.</td>
<td>This is what you most likely will get–some new, some used.</td>
<td>This is what you would like if money were no object.</td>
</tr>
</tbody>
</table>
How will you use the money?

Explain how the loan or investment will be spent. Will you buy more equipment? If so, what kind, from whom, and at what cost? Will you hire more people? If so, how many, with what qualifications, and at what salaries? Will you lease more space? If yes, how much, from whom, and at what cost? Do you need the money to cover working capital?

Borrow money to buy fixed assets. Fixed assets are illiquid, e.g., real estate, equipment, vehicles, furniture, computers, etc..
Where will you get the financing you need?

There are two basic types of financing—Debt and Equity. Debt financing is a loan which is secured by the business’ assets. Lenders typically expect sufficiently more collateral than the amount of exposure they face which normally implies that a significant portion (25-50%) of a project or company be financed through equity. Debt is divided into short-term (less than one year), intermediate (1 to 5 years), and long-term (over 5 years). Debt pays interest for a defined period of time. Credit card and banks are a source of debt financing.

<table>
<thead>
<tr>
<th>TYPE OF DEBT</th>
<th>DESCRIPTION</th>
<th>TERM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line of Credit</td>
<td>Revolving or non-revolving; works like a credit card</td>
<td>&lt; 1 year</td>
</tr>
<tr>
<td>Short-term</td>
<td>Seasonal inventory loans, short-run production or construction loans, short-term liquidity problems</td>
<td>&lt; 1 year</td>
</tr>
<tr>
<td>Intermediate-term</td>
<td>Equipment loans, working capital loans</td>
<td>1-5 years</td>
</tr>
<tr>
<td>Long-term</td>
<td>Fixed assets, e.g., real estate, that will be used and paid for over the long run</td>
<td>&gt; 5 years</td>
</tr>
</tbody>
</table>

There are two types of loans: secured and unsecured. A secured loan is backed by collateral that would be tapped to recover the loan in the event of a default. An unsecured loan is not backed by any collateral, and is usually short-term.

Equity investors provide funding in return for an ownership interest in the business being financed. Equity investors expect a return in the form of dividends on their equity shares in relation to their risk. Equity is ownership; it pays profits forever. Venture capitalists are a source of equity investment.

Most startups are self-financed by the owner’s personal assets (savings account, retirement account, etc.) or by various types of debt, e.g., credit cards, a home equity line, or loans from family and friends.\(^{108}\)

If your deal is large enough and the anticipated payoff is sufficiently high (financing needs of over $1 million, with an anticipated payout rate greater than

---

\(^{108}\) Loans from friends and family should be treated formally. Make sure you have a loan agreement stating the terms and interest rate of the loan. If they invest in ownership of a portion of the business, make sure that you both have a legal document that states the terms of the investment and how it may be withdrawn in the future. Consult your lawyer for specific legal advice. (Ibid, 97).
40% annually are two rough measures), your banker and other advisors will steer you to the right people.\textsuperscript{109}

Considering that costs for small geothermal businesses ranges from several thousand dollars for direct use projects to millions for power plants, the bank will be the best place to start for most small geothermal businesses.

Help your banker decide in your favor:

\begin{itemize}
  \item Lower the risk by keeping a low debt-to-worth ratio,
  \item Make sure to have enough working capital to cover current liabilities, and
  \item Match the financing request to your real needs.\textsuperscript{110}
\end{itemize}

Tell your banker what you need the money for, how it will be repaid—and why the deal makes good business sense. Your financing proposal does just that, and if based on your business plan and careful analysis, you should get the right financing.\textsuperscript{111}

A sample financing plan format is shown on the following page.
## Sources and Applications of Funding

### Sources:

<table>
<thead>
<tr>
<th>New Debt:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lines of Credit</td>
</tr>
<tr>
<td>Mortgage</td>
</tr>
<tr>
<td>Term Loans</td>
</tr>
</tbody>
</table>

Available from refinancing or rescheduling old debt

### New Investment:

<table>
<thead>
<tr>
<th>Equity Investments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subordinated Debt</td>
</tr>
</tbody>
</table>

### Applications:

<table>
<thead>
<tr>
<th>Working Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory</td>
</tr>
<tr>
<td>Cash reserve</td>
</tr>
<tr>
<td>Equipment</td>
</tr>
<tr>
<td>Property</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOTAL</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>TOTAL</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>TOTAL</th>
</tr>
</thead>
</table>
Outline of a Business Plan

Cover Sheet

- Name of business
- Names of principals
- Address and phone numbers

Statement of Purpose

Table of Contents

Section 1: The Business

- Description of Business
- Product or Service
- Market
- Location of Business
- Competition
- Management
- Personnel
- Application and Expected Effect of Loan (if needed)
- Summary

Section 2: Financial Data

- Sources and Applications of Funding
- Capital Equipment List
- Balance Sheet
- Break-Even Analysis
- Income Projections (Profit and Loss Statements)
  - Three-year summary
  - Detail by month for first year
  - Detail by quarter for second and third years
  - Notes of explanation
• Cash Flow Projections
  ▪ Detail by month for first year
  ▪ Detail by quarter for second and third years
  ▪ Notes of explanation

• Deviation Analysis

• Historical Financial Reports for Existing Business
  ▪ Balance sheets for past three years
  ▪ Income statements for past three years
  ▪ Tax returns

Section 3: Supporting Documents

• Personal resumes
• Personal balance sheets
• Cost-of-living budget
• Credit reports
• Letters of reference
• Job descriptions
• Letters of intent
• Copies of leases
• Contracts
• Legal documents
• Anything else relevant to the plan
Now that you have your business and financing plans, and are ready to approach a bank or other financing source for money, you need to assemble a Financing Proposal. Check with your banker to see if they have a desired format.

Your financial proposal should answer seven “bankerly” questions:

1. How much do you want?
2. What are you going to do with the money?
3. Why is this loan good for your business?
4. Why do you need our depositors’ money?
5. When will you pay it back?
6. How will you pay it back?
7. What if your plans don’t work out?113

A typical Financing Proposal contains the following items:

- Cover sheet
- Executive summary
- Business plan
- Marketing and Operations Plans
- Detailed financials for 3 to 5 years
- Pertinent supporting data
Cover Page (1 page)

A sample cover page is shown.

If you plan to distribute your plan to several bankers or investors, number each plan prominently on the cover page— to allow you to track the plans and to inhibit recipients from copying or widely passing around the plan.

You may also want to recipients sign a non-disclosure statement. A sample non-disclosure statement is included here. Check with your lawyer for specific legal advice.

Table of Contents (1 page)

The Table of Contents allows the reader to skip to a particular page of interest quickly. It also acts as an outline of your entire business plan.

Executive Summary (1-2 pages)

The Executive Summary is perhaps the most important part of your business plan because it has to grab the reader’s attention. Many potential investors may read only the executive summary and look at the numbers, and then determine whether they will read further. Consequently, your executive summary has to be carefully written. It should be written last, and coalesce in a matter of paragraphs the meat of your business plan.
Business Plan

The body of the business plan is everything between the Executive Summary and the Supporting Documents. There is no specific length for a business plan. Bankers have seen plans ranging from 3 pages (too short) to 500 pages (too long). The number of pages your plan has is not as important as its thoroughness and completeness.

Marketing and Operations Plans

Detailed financials for 3 to 5 years

Pertinent Supporting Documents
Conclusion

“When I’m working on a problem, I never think about beauty. I think only how to solve the problem. But when I have finished, if the solution is not beautiful, I know it is wrong.”

— Richard Buckminster Fuller

Writing is hard work. There is nothing more terrifying than an empty, white piece of paper or a blinking cursor on a blank computer screen. Typing or writing those first few words is a major achievement.

Planning is equally excruciating. Putting a plan down on paper often seems a Herculean task. Yet, there is a direct correlation between success and business planning. Companies that have a business plan have an increased probability of success.

If you have read this Workbook, you have overcome several hurdles. You better understand geothermal energy and its possible business applications. In addition, you have written a business and financing plan for your geothermal business.

Creating and running a successful business is both an art and a science. You have addressed the science, now comes the “art,” making your dream reality.

Good luck and enjoy the journey...
“ACID TEST” RATIO - cash, plus other assets that can be immediately converted to cash, should equal or exceed current liabilities. The formula used to determine the ratio is:

\[
\text{ACID TEST} = \frac{\text{cash} + \text{net receivables} + \text{marketable securities}}{\text{current liabilities}}
\]

AGING RECEIVABLES - a scheduling or accounts receivable according to the length of time they have been outstanding. This shows which accounts are not being paid in a timely manner and may reveal any difficulty in collecting long overdue receivables. This may also be an important indicator of cash flow problems.

AMORTIZATION - the gradual payment of a debt through a schedule of payments or the process of writing off an intangible asset against expenses over the period of its economic useful life.

ASSETS - the valuable resources, or properties and property rights owned by an individual or business enterprise.

BALANCE SHEET - an itemized statement that lists the total assets, liabilities, and net worth of a given business to reflect its financial condition at a given moment.

BELIEF SYSTEM - includes religious, political, nationalistic, and cultural beliefs and values.

BORROWING CAPACITY MODEL - used to estimate the maximum amount of debt a project’s cash flow will support.

CAPITAL - funds that are needed for the base of the business; usually put into the business in a fairly permanent form such as in fixed assets, plant and equipment, or are used in other ways that are not recoverable in the short run unless the entire business is sold.

CAPITAL EQUIPMENT - equipment used to manufacture a product, provide a service, or to sell, store, and deliver merchandise; such equipment will not be sold in the normal course of business but will be used and worn out or consumed over time in the course of business.

CAPITALIZATION - of an asset, when the cost of the asset is allocated to two or more time periods.

CASH FLOW - the difference between the money coming into an investment project and the money going out.

CASH FLOW COVERAGE RATIO - measures the project’s ability to pay for its long-term loan out of its generated free cash flows (see also Debt Service Coverage Ratio).

CASH FLOW PROJECTION - indicates how profitable a project is expected to be, how much cash flow it is expected to generate, the assumptions used, and how that cash flow will be allocated among the various providers of capital.

COLLATERAL - an asset pledged to a lender in order to support a loan.

COMMITMENT FEE - a fee charged by a lender for committing to lend the undisbursed amount of the loan. It normally begins to accrue 30 to 60 days after the signing of the loan agreement. Normal commitment fee is 0.5-1.0 per cent per annum.
CONVENTIONAL DIRECT FINANCING - lenders to the firm look to the firm’s entire asset portfolio to generate the cash flow to service the loans.

CORPORATION - prospective shareholders transfer money, property, or both, for the corporation’s capital stock. A corporation generally takes the same deductions as a sole proprietorship to compute its taxable income. A corporation can also take special deductions.

The profit of a corporation is taxed to both the corporation and to the shareholders when the profit is distributed as dividends. However, shareholders cannot deduct any loss of the corporation.

COST OF CAPITAL - a project’s cost of debt plus its cost of equity.

COST OF GOODS SOLD (COGS) - the cost of the manufactured product sold.

CROSS-DEFAULT CLAUSE - a provision in a loan agreement which provides that a default by the borrower on another loan or loans would constitute a default under the loan agreement. Multilateral development banks require that they retain the option of either declaring their loans immediately due and payable, or of seeking other remedies following what is called the optional cross-default clause.

CUMULATIVE PRESENT WORTH OF REVENUE (CPWRN) - a profitability criteria for geothermal projects based on discounted cash flow analysis; usually calculated on a pre-tax basis.

CURRENT ASSET - cash or other items that will normally be turned into cash, sold, or used up in the operations of a firm within one year.

CURRENT LIABILITIES - amounts owed that will ordinarily be paid by a firm within one year, e.g., accounts payable, wages payable, taxes payable, the current portion of long-term debt, and interest and dividends payable.

CURRENT RATIO - ratio of firm’s current assets to its current liabilities.

DEBENTURES - a type of bond issued to raise funds from the market.

DEBT - borrowed funds from business’s coffers or from other individuals, banks, or institutions. Debt is usually secured with a note which in turn may be secured by a lien against property or other assets. The note states repayment and interest provisions. Convertible debt may be changed into direct ownership of a portion of a business under certain stated conditions.

DEBT SERVICE COVERAGE RATIO - a ratio which measures the project’s ability to pay for its long-term loan out of its generated free cash flows; a ratio below 1.00 indicates that a project cannot service its debt fully out of operating income; decreases in those years when the principal repayment increases (see also Cash Flow Coverage Ratio).

DEMOGRAPHICS - the statistical study of human populations, especially with reference to size and density, distribution, and vital statistics. In marketing, refers to age, sex, income, education, race, marital status, size of household, geographic location, size of city, and profession.

DEPLETION EXPENSE - recognized as natural resource reserves (e.g., a coal deposit or natural gas reserve) are used up.

DEPRECIATION - the recognition of a capital expense as the asset is used over time.
Depreciation is a non-cash expense; it reduces taxable income and provides an annual tax advantage (or tax shield).

**Development Cost per kW Installed Capacity** - a profitability criteria for geothermal projects which includes the costs incurred before the plant goes on line (e.g., lease acquisition, exploration, construction of access roads and drilling pads, drilling, surface facilities, overhead, tax credits).

**Discounted Cash Flow Analysis** - a method used to analyze the economic viability and profitability of a proposed project and the adequacy of the rates of return that investors can expect.

**Distribution** - delivery or conveyance of a good or service to a market.

**Equity** - the owner’s investment in the business. Unlike capital, equity is what remains after the company’s liabilities are subtracted from its assets. Equity investment carries with it a share of ownership and usually a share in profits, as well as some say in how the business is managed.

**Equity Kicker** - an equity incentive (e.g., direct equity participation, royalty payments, or contingent payments) which lenders receive to assume additional risk and induce them to accept less restrictive covenants and less demanding credit support.

**European Commission** - proposes policies and legislation for the European Union, is responsible for administration, and ensures that the provisions of the Treaties and the decisions of the institutions are properly implemented.

**European Union (EU)** - previously known as the European Community, the EU is an institutional framework for the construction of a united Europe. Created after World War II to unite the nations of Europe economically so another war among them would be unthinkable, the EU currently has 15 member-countries.

**Financing Plan** - a description of how a project will be financed; the current and required sources of financing, the types (e.g., debt, equity, etc.) of financing required, and the sources of financing. The financing plan includes arrangements for both construction and permanent financing.

**Fixed Asset** - an item whose useful business life exceeds one year, e.g., land, plant, equipment, and leasehold improvements.

**Fixed Charge Coverage** - a ratio used to measure a project’s ability to repay its debt which includes treating one-third of rental payments as part of the interest component; a ratio below 1.00 indicates that a project cannot service its debt fully out of operating income.

**Forfaiting** - discounting export receivables, e.g., promissory notes, bills of exchange, or letters of credit, without recourse to the exporter. Forfaiting allows exporters to grant credit terms to their overseas buyers without assuming non-payment or currency exchange risks. Once an exporter has received its money from the forfaiter, they are out of the transaction. Forfaiting deals tend to be over $100,000 and take 5-30 days to complete.

**Free Cash Flows** - the cash not required for operations or reinvestment which can be used to service the project’s debt or pay dividends to equity investors.

**Front-End Fee** - a commission charged by the Financier for arranging a loan facility payable at signing of the loan.
GROSS MARGIN - the profit before expenses expressed as a percentage of sales.

GROSS PROFIT MARGIN - measures the difference between what it costs to produce a product and what you’re selling it for. It tells you how much of each sales dollar you can expect to use to cover your operating expenses and profit.

GROSS PROFIT - net sales (sales minus returned merchandise, discounts, or other allowances) minus the cost of goods sold.

GUARANTEE - a written undertaking by the guarantor to pay a beneficiary a stated amount if the borrower fails to meet certain commitments such as loan repayment. If a guarantee covers part of debt servicing and covers all events of nonpayment, it is commonly called partial credit guarantee. If it covers a specific risk guarantee, e.g., sovereign risk, it is called partial risk guarantee. A partial risk guarantee is callable only if the default on debt servicing is due to the specific risk covered.

ILLIQUID - a firm is said to be illiquid if its current assets cannot be converted into cash to meet current liabilities.

INCOME STATEMENT - statement of income and expenses for a specific period of time.

INCREMENTAL CASH FLOW - the difference between the cash flow with and without the project; does not include sunk costs.

INTERNAL RATE OF RETURN (IRR) - the capital investment projects expected rate of return; if the required rate of return (cost of capital) equals the IRR (the expected rate of return), the projects NPV is zero. The project should be undertaken if the IRR exceeds the projects cost of capital.

INTEREST COVERAGE RATIO - the ratio of earnings before interest and taxes (EBIT) divided by interest charges which measures a projects ability to cover interest charges; a ratio below 1.00 indicates that a project cannot service its debt fully out of operating income.

INVENTORY - materials owned and held by a business, e.g., new materials, intermediate products and parts, work-in-process, and finished goods, intended either for internal consumption or for sale.

JOINT FINANCING - when loans from the primary financier and the co-financiers are used to finance, in some agreed proportions, the same set or package of goods and services required for an operation.

LIFE STAGE - the chronological benchmarking of people’s lives at different ages (e.g., pre-teens, teenagers, empty-nesters, etc.).

LIFESTYLE - the collective choice of hobbies, recreational pursuits, entertainment, vacations, and other non-work time pursuits.

LIMITED LIABILITY CORPORATION (LLC) - a condition in which owners of stock are not held liable for the debts of the corporation beyond the extent of their stockholdings.

An LLC may be a sole proprietorship, a corporation, or a partnership. (A minimum of two members is required for federal tax purposes to operate an LLC as a partnership.) Consequently, the applicable tax forms, estimated tax payment requirements, and related tax publications depend upon whether the LLC operates as a sole proprietorship, corporation, or partnership. The default entity for federal tax treatment of an LLC with two or more members is a partnership.
LIMITED LIABILITY PARTNERSHIP (LLP) - a condition in which owners of stock are not held liable for the debts of the corporation beyond the extent of their stockholdings.

The default entity of an LLP is a partnership and the partnership tax forms, estimated tax payment requirements, and partnership publications apply.

LIMITED RECOURSE, - when project sponsors are obligated to supplement the projects cash flow under certain (limited) circumstances.

LIQUIDITY - describes the solvency of a business; refers to the degree of readiness in which assets can be converted into cash without a loss; also called cash position.

LONG-TERM LIABILITIES - liabilities or expenses that will not mature within the next year.

MILL - one-thousandth of the U.S. dollar.

NEGATIVE CASH FLOW - more money going out than coming in over a period of time.

NET INCOME, OR ACCOUNTING PROFIT - the remaining revenue after paying all explicit costs.

NET PRESENT VALUE (NPV) - the difference between what a project costs and what it is worth; the present value of all of the after-tax cash flows, all its costs now and in the future. Undertake a capital investment project when its NPV is positive.

NET WORTH - owner’s equity in a given business represented by total assets minus total amounts owed to outside creditors (total liabilities) at a given moment in time.

NON-RECURSIVE FINANCING - when securities and other borrowings are serviced entirely out of a projects cash flow.

NOTE - represents a loan that will be repaid, or substantially reduced 30, 60, or 90 days later at a stated interest rate. Notes are short-term and, unless they are made under a line of credit, each loan and each renewal requires a separate loan application.

ORDINARY SHARES - a class of share that does not benefit from any preference in the payment of dividends or in the repayment of capital.

OVERALL STEAM SUPPLY COST - a profitability criteria of a geothermal project which represents the “fuel cost” of the power plant; cost of steam of hot water supply to the power plant in unit cost per kilowatt hour; allows comparison of a 166 geothermal power plant with other types of electrical power projects.

OWNER’S EQUITY - the owner’s right to the assets of the business after the total liabilities are deducted. See also Net Worth.

PARALLEL FINANCING - when loans from the primary financier and the co-financiers are used to finance separate packages of goods and services.

PARI PASSU - Latin meaning “all equal.”

PARTNERSHIP - the relationship existing between two or more persons who join to carry on a trade or business. Each person contributes money, property, labor, or skill, and expects to share in the profits and losses of the business.

A partnership is not a taxable entity. Each partner includes his or her share of the partnership’s income or loss on his or her tax return.

PASSIVE INVESTOR - an investor that does not actively manage or would not contribute
to the improvement of the efficiency of the company.

**PAYOUT TIME** - the number of years when CPWNR is zero for the first time in plant life; capital investment divided by free cash flow (the amount available to pay back the original capital investment).

**POSITIONING** - a marketing method based on determining what market niche the business should fill and how it should promote its products or services in light of competitive and other forces.

**POSITIVE CASH FLOW** - more money coming in than going out over a period of time.

**PREFERENCE SHARES** - a class of share that benefits from preference in the payment of dividends or the repayment of capital.

**PRESENT VALUE (PV)** - the total amount that a series of future payments is worth today. Stated another way, PV is the value of the free cash flow stream that is available to service project debt, and is calculated from the projects cash flow projections.

**PROFIT-TO-INVESTMENT RATIO** - the ratio of total undiscounted net profit to investment; the amount of new money generated from an investment project per dollar invested.

**PROFITABILITY CRITERIA** - methods used by project developers and potential investors to assess a project's profitability and ability to cover debt service with free cash flows; see **Cumulative Present Worth of Net Revenue, Development Cost per kW Installed Capacity, Discount Cash Flow Analysis, Internal Rate of Return, Net Present Value, Overall Steam Supply Cost, Payout Time, Profit-to-Investment Ratio**.

**PRO FORMA** - a projection or estimate of what may result in the future from actions in the present. A pro forma financial statement shows how the actual operations of a business will turn out if certain assumptions are realized.


**PROFIT** - the selling price minus all costs and expenses incurred in making a sale. Also, the reward to the entrepreneur for the risks assumed by him or her in the establishment, operations, and management of a given enterprise or undertaking.

**PROJECT FINANCING** - the raising of funds to finance an economically separable capital investment project in which the providers of the funds look primarily to the cash flow from the project as the source of funds to service their loans and provide the return of and a return on their equity invested in the project. Cofinancing and guarantees can form a part of the financing package for such projects.

**PSYCHOGRAPHICS** - personality and emotionally based behavior linked to purchase choices, e.g., whether customers are risk-takers or risk-avoiders, impulsive buyers, etc.

**QUASI-EQUITY** - in addition to the contribution of cash as capital, there are other forms of capital investment such as subordinated loans and redeemable preference shares; such forms do not usually have the same rights as ordinary shares.

**RETURN ON EQUITY** - profit on the total equity in the company.

**RETURN ON INVESTMENT (ROI)** - profit on the invested capital.
RULE 144A - adopted by the Securities and Exchange Commission (SEC) in 1933, Rule 144A liberalized the restrictions that existed on trading unregistered debt and equity securities. As a result of Rule 144A, qualified institutional buyers can trade unregistered debt and equity securities with each other without regard to the private placement restrictions that otherwise apply to unregistered securities. Rule 144A issues can generally be arranged more quickly than public offerings because the securities do not have to be registered with the SEC. The principal buyers of Rule 144A debt are large life insurance companies which are receptive to Rule 144A debt offerings that are rated investment grade (e.g., Moodys Baa 3 or better or Standard & Poors BBB- or better).

S CORPORATION - An eligible domestic corporation can avoid double taxation (once to the shareholders and again to the corporation) by electing to be treated as an S corporation. An S corporation generally is exempt from federal income tax. Its shareholders include on their tax returns their share of the corporation’s separately stated items of income, deduction, loss, and credit, and their share of non-separately stated income or loss. Also called Subchapter S Corporation or Tax Option Corporation.

SENSITIVITY ANALYSIS - evaluation of any chosen profitability criterion to changes in project variables (e.g., plant capacity factor, inflation rate, etc.); main purpose is to identify the variables that will have the most impact on profitability.

SOLE PROPRIETORSHIP - an unincorporated business that is owned by one individual. It is the simplest form of business organization to start and maintain. The business has no existence apart from the owner. Its liabilities are the owner’s personal liabilities; the owner must undertake the risks of the business for all assets owned, whether used in the business or personally owned.

SUNK COSTS - money that has already been spent.

SYNDICATION LOAN - a loan that will be lent by a number of banks.

SYNDICATED PARTICIPATION - when the primary financier commits to fund the entire loan and, at or subsequent to loan closing, sells a participation in its loan to another bank or banks. In these cases, the primary financier remains committed for the entire amount but funds a portion of its commitment through the purchaser(s) of the participation(s).

SYNDICATION - the process whereby the primary financier identifies other financial institutions that will commit to lend under its documentation on terms reasonably similar to those under which it is prepared to lend.

TAKEOVER - the acquisition of one company by another company.

TARGET MARKET - specific individuals, distinguished by socioeconomic, demographic, and interest characteristics, who are the most likely potential customers for a business’s goods and services.

TERM LOANS - secured or unsecured loans, usually for periods of more than a year to as many as ten years. Term loans are paid off like a mortgage: so many dollars per month for so many years. Term loans are most commonly used for equipment and other fixed assets, working capital, and real estate.

USEFUL LIFE - the lifetime of a piece of equipment or machinery as defined by the government for tax purposes (or by the manufacturer).
VALUE SYSTEM - includes religious, political, nationalistic, and cultural beliefs and values.

VENTURE CAPITAL (VC) - the process by which investors fund early stage, more risk-oriented business endeavors. A venture capital funding arrangement will typically entail relinquishing some level of ownership and control of the business to offset the high risk the investor takes in the promise of high return on the investment.

The investment is usually in the form of stock or an instrument which can be converted into stock at some future date. Typical investments range from between $500,000 and $5 million with a VC expecting a 20-50% annual return on their investment at the time they are bought out.

WORKING CAPITAL - the difference between current assets and current liabilities. Working capital cycles through the business in a variety of ways, e.g., inventories, accounts and notes receivable, and cash and securities.

YIELD - the rate of return from an investment relative to the actual dollars paid.
References


Appendix

Note: Because state and federal legislated regulations change over time, those contained in this guidebook may not be up-to-date. Please check with the appropriate state and federal agencies in order to verify the information contained herein before initiating any project.

For leasing lands in cities and counties, contact the appropriate local officials in the jurisdiction of interest.
DEFINITION OF GEOTHERMAL: Statute and No.: Geothermal Steam Act of 1970 (Public Law 91-581)

"Geothermal steam and associated resources" means (i) all products of geothermal processes, embracing indigenous steam, hot water, and hot brines; (ii) steam and other gases, hot water, and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formation; (iii) heat or other associated energy found in geothermal formation; and (iv) by-products derived from them.

GEOTHERMAL IS CHARACTERIZED AS: Mineral

OWNERSHIP: Statute and No.: U.S. Court of Appeals for the Ninth Circuit, Ottobonic vs the United States of America, 549 F. 2d 1271 (9th Cir.) The federal government claims ownership of all geothermal resources underlying federal lands or where mineral rights have been maintained.

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: Geothermal Steam Act of 1970 (Public Law 91-581) Bureau of Land Management, State Office Indian Lands 25 C.F.R Parts 131, 171, 172, 173. For information concerning the leasing of Indian Lands, contact the Bureau of Indian Affairs or the governing body of the Indian Nation.

LEASING: Competitive leases are available on known Geothermal Resource Areas (KORA) lands. Non-Competitive leases are available on all other lands. Exploration permits are also available on all lands including those under lease. For leasing state, county, or municipal lands, contact the appropriate officials in the jurisdiction of interest.

LEASE TERMS: Bureau of Land Management, State Office
Primary: 10 years, 5-year extension available if drilling or have power purchase agreement.
Renewable: For as long as producing in commercial quantities, 40 year maximum.
Rentals: $2/acre KGRA lands, $1/acre non-KGRA lands but increasing in year 6-10 and $12/acre in years 10-15.
Royalties: (% of gross sales): 10 to 15% plus up to 5% of by-products.

DILIGENCE REQUIREMENTS: Bureau of Land Management, State Office

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: Groundwater regulation is the responsibility of the surface management agency or, in most instances, the state agency responsible for groundwater regulation.

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: Geothermal Steam Act of 1970 (Public Law 91-581) Bureau of Land Management, State Office

INJECTION REQUIREMENTS: Statute and No.: Geothermal Steam Act of 1970 (Public Law 91-581) Bureau of Land Management, State Office


AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Environmental Protection Agency, Bureau of Land Management, State Office

ADDITIONAL INFORMATION: For the regulation of geothermal leasing, exploration, and development contact the appropriate state office of the Bureau of Land Management or see 30 U.S.C., 1001 et. seq., 43 C.F.R., Part 3200, and 30 C.F.R., Part 270.


* Legislation passed and signed into law in 1988 (Pl 100.443) provides for three 5-year extension of the primary lease term if special circumstances exist. Pl 100.443 also extended protection for units of the National Park System.
ALASKA

DEFINITION OF GEOTHERMAL: Statute and No.: Alaska Administrative Code (AAC) Title 41, Chapter 06, Section 060. "Geothermal resources" means the natural heat of the earth at temperatures greater than 120°C (212°F?), measured at the point where the highest temperature encountered enter or contact a well or other resource extraction device and includes:
   a. The energy including pressure, in whatever form present in, resulting from, created by, or that may be extracted from the natural heat;
   b. The material medium, including the geothermal fluid naturally present, as well as substances artificially introduced to serve as a heat transfer medium; and
   c. All dissolved or entrained minerals and gases that may be obtained from the material medium, but excluding hydrocarbon substances and helium.

"Geothermal Fluid" means liquids and steam at temperatures greater than 120°C (212°F?) naturally present in a geothermal system. All waters below 120°C (212°F) are available for appropriation as groundwater.

GEOTHERMAL IS CHARACTERIZED AS: Water

OWNERSHIP: Statute and No.: Public Lands, Alaska Lands Act, Title 8, Chapter 5, Section 135. All geothermal resources are owned by the state of Alaska. However, the owner of the surface has a priority right to a lease.

AGENCY RESPONSIBLE FOR LEASING: Department of Natural Resources, Division of Oil & Gas, 3601 C Street, Anchorage, AK 99503-5948; Phone: (907) 269-8808

LEASING: Leasing is by competitive bid in areas designated by the Commissioner of the Department of Natural Resources. Non-competitive prospecting permits are available in non-designated areas and may be converted to a lease upon discovery.

LEASE TERMS: Department of Natural Resources
   Primary: 10 years.
   Renewable: 5 years if engaged in drilling and thereafter for duration of commercial production.
   Rentals: $3/acre.
   Royalties: (% of sales): 10 to 15% of gross revenues derived from production, sale, or use.

DILIGENCE REQUIREMENTS: N/A

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: For water rights and quantities of water: Department of Natural Resources, Division of Mining & Water:

   Anchorage Office
   3601 C Street, Suite 800
   Anchorage, AK 99503-5935
   907-762-2165

   Northern Office
   3700 Airport Way
   Fairbanks, AK 99707-4699
   907-451-2790

   Mat-Su Office
   PO Box 949
   Palmer, AK 99645-0949
   907-745-7200

   For water quality: Department of Environmental Conservation:

   Anchorage Office
   3601 C Street, Suite 1334
   Anchorage, AK 99503-5935
   907-563-6529
   907-349-7755

   Northern Office
   610 University Avenue
   Fairbanks, AK 99709-3643
   907-451-2172
   907-451-2360

   Juneau Office
   410 Willoughby, Suite 105
   Juneau, AK 99801
   907-465-5350

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: Title 41, Chapter 06, Section 040 and 11AAC 87.070, 11AAC 87.180. Department of Natural Resources, Division of Oil & Gas, 3601 C Street, Anchorage, AK 99503-5948, Phone: (907) 762-2547

INJECTION REQUIREMENTS: Statute and No.: AS 41.06.010. Department of Natural Resources

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: Statute and No.: AS 46.15.010, AS 46.03, and AS 16. Department of Environmental Conservation, Permitting Office, and/or Commissioner's Office.

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Department of Environmental Conservation, Permitting Office

ARIZONA

DEFINITION OF GEOTHERMAL. Statute and No.: Arizona Revised Statutes (ARS) 27-651
a. "Geothermal resource" means all products of geothermal processes embracing indigenous steam, hot water, and hot brines;
b. Steam and other gases, hot water, and hot brines resulting from water, other fluids, or gas artificially introduced into geothermal formations;
c. Heat or other associated energy found in geothermal formations including any artificial stimulation or induction thereof; and
d. Any mineral or minerals, exclusive of fossil fuels and helium gas, which may be present in solution or in association with geothermal steam, water, or brines.

GEOTHERMAL IS CHARACTERIZED FOR LEASING AS: Steam, hot water, heat, or mineral

OWNERSHIP: The geothermal resource is included in the ownership of the land.

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: ARS 27-668. State Lands Department. For Public Lands: Bureau of Land Management

LEASING: ARS 27-670 Leasing is on a competitive basis.

LEASE TERMS: ARS 27-671 State Land Department
Primary: 10 years
Renewable: As long as production is maintained.
Rentals: $1.00/acre/year
Royalties: (% of sales): Not less than 12.5% of gross value at the wellhead.

DILIGENCE REQUIREMENTS: None

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: See ARS 27-667. Department of Water Resources

AGENCY RESPONSIBLE FOR DRILLING/REGULATING: Statute and No.: ARS 27-656. Arizona Geological Survey

INJECTION REQUIREMENTS: Arizona Administrative Code Rule Title 12 Chapter 7-175

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: ARS 27-632

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Department of Environmental Quality

ADDITIONAL INFORMATION REGARDING PERMITTING, REGULATING, OR MONITORING:

Arizona Geological Survey
(Lead Agency)
416 W. Congress #100
Tucson, AZ 85701
(520) 770-3500

State Land Department
1615 W. Adams, Room 329
Phoenix, AZ 85007
(602) 542-4631

Department of Environmental Quality
3033 N. Central
Phoenix, AZ 85012
(602) 207-2300

Department of Water Resources
500 N. 3rd
Phoenix, AZ 85004
(602) 417-2400
CALIFORNIA

DEFINITION OF GEOTHERMAL: Statute and No.: Public Resources Code (PRC), Section 6903.
For purposes of this chapter, "geothermal resources" shall mean the natural heat of the earth, the energy in whatever form below the surface of the earth present in, resulting from, or created by, or which may be extracted from, such as natural heat, and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas or other hydrocarbon substances.

"Low-temperature geothermal well" means a well drilled for the purpose of providing geothermal resources as defined in Section 6903 from which fluids can be produced which have value by virtue of the heat contained therein and have a temperature that is not more than the boiling point of water at the altitude of the occurrence.

GEOTHERMAL IS CHARACTERIZED AS: Mineral

OWNERSHIP: Statute and No.: PRC, Paragraph 6904. Also see Pariani vs California (CA Court of Appeals, 1981). The state claims ownership whenever it owns the mineral estate, otherwise the resource is the property of the owner of the mineral estate.

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: PRC, Paragraph 6904, 6911, and 6916. California State Lands Commission

LEASING: Leasing in a Geothermal Resource Areas (GRA) is by competitive bid. Exploration permits are available in non-GRA areas.

LEASE TERMS: State Lands Commission
Primary: 10 years and so long as geothermal resources are being produced or utilized or are capable of being produced or utilized in commercial quantities but not to exceed 99 years.
Renewable: Yes
Rentals: Not less than $1/acre on up
Royalties: (% of sales): Minimum of 10% of gross revenue and not higher than 16-2/3%.

DILIGENCE REQUIREMENTS: California State Lands Commission

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATING: Division of Oil, Gas and Geothermal Resources

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: PRC, Paragraph 6911. Division of Oil, Gas and Geothermal Resources

INJECTION REQUIREMENTS: Statute and No.: PRC, Paragraph 6921, Chapter 4, commencing with Section 3700 of Division 3. Division of Oil, Gas and Geothermal Resources

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: Statute and No.: PRC, Section 3715.5. Division of Oil, Gas and Geothermal Resources

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Division of Oil, Gas and Geothermal Resources

ADDITIONAL INFORMATION:

California State Lands Commission
Mineral Resources Mgmt. Division
200 Oceangate, 12th Floor
Long Beach, CA 90802
(562) 590-5201

Division of Oil, Gas and Geothermal Resources
801 K Street, MS 20-20
Sacramento, CA 95814-3530
(916) 323-1788

California Energy Commission
1516 9th Street
Sacramento, CA 95814
(916) 654-4287

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COLORADO

DEFINITION OF GEOTHERMAL. Statute and No.: Colorado Geothermal Resources Act, Colorado Revised Statutes CRS 37-90.5-103
"Geothermal resource" means the natural heat of the earth and includes:
   a. The energy that may be extracted from the natural heat;
   b. The material medium used to extract the energy from a geothermal resource; and
   c. Geothermal by-products.

"Geothermal fluid" means naturally occurring groundwater, brines, vapor, and steam associated with a geothermal resource.
"Geothermal by-products" means dissolved or entrained minerals and gases that may be obtained from the material medium, excluding hydrocarbon substances and carbon dioxide.

GEOTHERMAL IS CHARACTERIZED AS: Water

OWNERSHIP: Statute and No.: Colorado Revised Statutes 37-90.5-104
Where a geothermal resource is found in association with geothermal fluid which is tributary groundwater, such geothermal resource is declared to be a public resource to which usufructuary rights only may be established according to the procedures of this article. No correlative property right to such a geothermal resource in place is recognized as an incidence of ownership of an estate in land. The property rights to a hot dry rock resource is an incident of the ownership of the overlying surfaces unless severed, reserved, or transferred with the subsurface estate expressly. Nothing in this section shall be deemed to derogate valid, existing property rights to geothermal resource which has vested prior to July 1, 1983. However, such property rights shall not be deemed vested absent the award of a decree for an application filed prior to the effective date of this article pursuant to existing water law or the entering into a geothermal lease prior to the effective date of this article or unless utilizing facilities are actually in existence prior to July 1, 1983. A facility for utilization of geothermal resources shall be considered to be in existence if it is in actual operation or is undergoing significant construction activities prior to operation. Nothing in this section shall be deemed to derogate the rights of a landowner to non-tributary groundwater.

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: "Special Rules and Regulation Relating to Geothermal Resource Leases," (Form 248-1)1972, Lease Form (Form 248-2)1972. State Board of Land Commissioners

LEASING. Leases may be awarded by the State Board of Land Commissioners for lands under its jurisdiction through negotiation or by competitive bidding.

LEASE TERMS: State Board of Land Commissioners
   Primary: Set in the lease.
   Renewable: As long as production continues; if no production, State Board of Land Commissioner decides.
   Rentals: Set in the lease.
   Royalties: (% of sales): Set in the lease.

DILIGENCE REQUIREMENTS: Water Quality Control Commission and the State Board of Land Commissioners - To continue injection and/or discharge and maintain lease

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: Department of Natural Resources, Division of Water Resources

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: Colorado Revised Statutes 37-90-138, 37-90.5-105, 37-91. Department of Natural Resources, Division of Water Resources

INJECTION REQUIREMENTS: Statute and No.: Colorado Geothermal Resources Act 37-90.5-106. Department of Natural Resources, Oil & Gas Conservation Commission and/or Division of Water Resources

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: Title 37, Colorado Revised Statutes, Article 90.5

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: U. S. Environmental Protection Agency

ADDITIONAL INFORMATION:

Department of Natural Resources
Oil & Gas Conservation Commission
1580 Logan Street
Denver, CO 80203
(303) 894-2100

Department of Natural Resources
Division of Water Resources
818 Centennial Building
1313 Sherman Street
Denver, CO 80203
(303) 866-3581
Info Desk: 866-3587

Water Quality Control Commission
Department of Health
4210 E. 11th Avenue
Denver, CO 80220
(303) 692-3500
DEFINITION OF GEOTHERMAL: Statute and No.: Rules on Leasing and Drilling of Geothermal Resources, Title 13, Sub-Title 7, Chapter 183-3.  
"Geothermal resources" means the natural heat of the earth, the energy, in whatever form, below the surface of the earth present in, resulting from, or created by, or which may be extracted from the natural heat, and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas or other hydrocarbon substances.

GEOTHERMAL IS CHARACTERIZED AS: Mineral

OWNERSHIP: Statute and No.: Rules on Leasing and Drilling of Geothermal Resources, Title 13, Sub-Title 7, Chapter 183, Paragraph 13-183-19. State claims ownership on all state and reserved lands.

"Reserved lands" means those lands owned or leased by any person in which the state or its predecessors in interest has reserved to itself, expressly or by implication the minerals or right to mine minerals, or both.  
"State lands" includes all public and other lands owned by or in possession, use and control of the state of Hawaii or any of its agencies.

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: HRS, Paragraph 182-14 and Sub-Paragraph 13-183, Department of Land and Natural Resources

LEASING: Leases on state lands are granted on a competitive bid basis. Leases on reserved lands may be granted on a competitive bid basis by public auction or without public auction to the occupier or to his assignee of the rights to obtain a mining lease.

LEASE TERMS: Department of Land and Natural Resources  
Primary: 10 years.  
Renewable: Not to exceed 65 years.  
Rentals: $1/acre per year.  
Royalties: (% of sales): 10% for steam, 5% for by-products.

DILIGENCE REQUIREMENTS: Statute and No.: HRS, Paragraph 182-14 and 13-183-61. Department of Land and Natural Resources

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: Department of Land & Natural Resources, Water Resources Management Division (808) 587-0222; Department of Health, Clean Water Branch (808) 586-4309

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: HRS, Paragraph 182-14 and Paragraph 13-183-57 to 75, Department of Land & Natural Resources

GEOTHERMAL RESOURCE PERMITS: HRS, Paragraph 205-5-7. Geothermal development activities, whether for research or commercial purposes, means exploration, development - waste disposal. Production of electrical energy from geothermal resource is governed by the Planning Commission of the County of Hawaii, on privately held, non-conservation district lands. On conservation land and state-owned lands, Department of Land and Natural Resources must approve use and must issue a conservation district use permit.

INJECTION REQUIREMENTS: Statute and No.: HRS, Paragraph 13-183-77-79 and HRS, Paragraph 182-14, Department of Land & Natural Resources

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: Statute and No.: HRS 343, HRS 205-5.1, and § 13-183-87

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Department of Health, Environmental Management, Clean Air Branch, Clean Water Branch (808) 586-4909

ADDITIONAL INFORMATION:

Department of Land & Natural Resources  
Chairperson  
P.O. Box 373  
Honolulu, HI 96809  
(808) 587-0404

Department of Business & Economic Development  
State Permit Counter  
P.O. Box 2359  
Honolulu, HI 96801  
(808) 586-2423

Department of Health & Environmental Mgmt. Div.  
PO Box 3378  
Honolulu, HI 96801  
(808) 586-4364

Planning Department  
County of Hawaii  
25 Anapuni Street  
Hilo, HI 96720  
(808) 961-8288
IDaho


"The natural heat energy of the earth, the energy, in whatever form, which may be found in any position and at any depth below the surface of the earth present in, resulting from, or created by, or which may be extracted from, such natural heat, and all minerals in solution or other products obtained from the material medium of any geothermal resource. Ground water having a temperature of two hundred twelve (212) degrees Fahrenheit or more in the bottom of a well shall be classified as a geothermal resource. Geothermal resources are found and hereby declared to be sui generis, being neither a mineral resource nor a water resource, but they are also found and hereby declared to be closely related to and possibly affecting and affected by water and mineral resources in many instances" (IC § 42-4002).

Section 42-230 Idaho Code

(a) "ground water" is all water under the surface of the ground what ever may be the geological structure in which it is standing or moving.

(1) All ground water having a temperature of greater than eighty-five (85) degrees Fahrenheit and less than two hundred twelve (212) degrees Fahrenheit in the bottom of a well shall be classified and administered as a low temperature geothermal resource pursuant to section 42-233, Idaho Code.

(2) All ground water having a temperature of two hundred twelve (212) degrees Fahrenheit or more in the bottom of a well shall be classified as a geothermal resource pursuant to section 42-4002, Idaho Code, and shall be administered as a geothermal resource pursuant to chapter 40, title 42, Idaho Code.

Section 42-233 Idaho Code

Low temperature geothermal resource. The right to the use of low temperature geothermal resources of the state shall be acquired by appropriation. The appropriation may be perfected by means of the application, permit and license procedure as provided for in chapter 4.

Geothermal is characterized as: Sui generis

Ownership: Statute and No.: Idaho Code, Chapter 16, Section 47-1602. State claims ownership of all geothermal resources underlying state and school lands.

Agency Responsible for Leasing: Statute and No.: Idaho Code, Chapter 16, Section 47-1603. Idaho State Board of Land Commissioners

Leasing: Leasing is by competitive bid in areas designated by Director of the Department of State Lands or where competitive interest. Other areas are available for a lease upon submittal of application to the Department of State Lands.

Lease Terms: Idaho State Department of Lands

Primary: 10 years.
Renewable: So long as commercial production or drilling continues to minimum of 1,000 ft, maximum 40 years with preferential right to renew.
Rental: $1/acre first 5 years, $2/acre second 5 years, $3/acre thereafter.
Royalties: (% of sales): 10%

Diligence Requirements: N/A

Agency Responsible for Groundwater Regulations: Idaho Department of Water Resources

Agency Responsible for Regulating Drilling: Statute and No.: Idaho Code, Chapter 40, Sec. 42-238 and Sec. 42-4001 through 42-4015. See Drilling for Geothermal Resources Rules & Regulations and Minimum Well Construction Standards, and/or contact the Idaho Department of Water Resources.

Injection Requirements: Statute and No.: Idaho Code, Title 42, Chapter 39 and Chapter 40, Section 42. See A Guide to the Idaho Well Program and Rules and Regulations. Drilling for Geothermal Resources, and/or contact the Idaho Department of Water Resources.

State Environmental Statute Pertaining to Exploration, Development, and Injection: Statute and No.: Idaho Code, Chapter 40, Section 42-4003 through 42-4009

Agency Responsible for Environmental Protection: Idaho Department of Health & Welfare, Environmental Division, and/or Idaho Department of Water Resources

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<tr>
<td>(208) 334-0200</td>
<td>(208) 327-7900</td>
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</table>
MONTANA

DEFINITION OF GEOHERMAL: Statute and No.: Leasing Statute 77-4-102(1) Montana Code Annotated (M.C.A.).

"Geothermal resource" means the natural heat energy of the earth, including the energy, in whatever form, which may be found in any position and at any depth below the surface of the earth, either present in, resulting from, created by, or which may be extracted from, such natural heat, and all minerals in solution or other products obtained from the material medium of any geothermal resource.

GEOTHERMAL IS CHARACTERIZED AS: Sui generis but governed by law as to groundwater.

OWNERSHIP: Statute and No.: Leasing Statute 7-4-102(1) M.C.A.

On state lands geothermal resources are owned by the state as part of their mineral reservation. However, state water laws also apply to all geothermal development involving production and diversion of geothermal fluids.

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: Administrative Rules of Montana (ARM) 26-26(2)-S60120, State Board of Land Commissioners

LEASING: All leasing is by competitive bid. However, if only one bid is received, the applicant may negotiate a lease with the Department of Natural Resources and Conservation

LEASE TERMS: State Board of Land Commissioners

Primary: 10 years.

Renewable: As long as resources are produced in paying quantity.

Rental: Minimum of $1/acre; $2/acre after discovery.

Royalties: (a/o sales): 10% of gross revenue from the sale of heat energy, steam, brine, or associated gas on the fair market value of such heat energy or steam.

DILIGENCE REQUIREMENTS: Department of Environmental Quality

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: Department of Natural Resources & Conservation, Water Resources Division

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: 37-43-101 et seq., ARM 40.3.106(6)-S10620

Department of Natural Resources and Conservation

INJECTION REQUIREMENTS: Department of Environmental Quality

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION:

a. Air Pollution Discharge Permit 75-2-101 et seq. M.C.A. Regulation at 16-2.14(1)-S1400.;

b. Water Pollution Discharge Permit/pretreatment standards for waste water discharged into municipal sewer system: 40 C.F.R. Parts 122, 403;

c. Permit requirements for discharge into state water: 75-5-101 et. seq. M.C.A. Regulation at ARM 16-2.14(10)-S14460;


AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Department of Natural Resources & Conservation, Water Resources, Environmental Quality and/or Fish, Wildlife, and Parks


Dept. of Natural Resources & Conservation
Water Management Bureau
48 N. Last Chance Gulch
P O Box 201601
Helena, MT 59620
Ph: (406) 444-6637
Fax: (406) 444-5918

Dept. of Natural Resources & Conservation
Water Operations Bureau
48 N. Last Chance Gulch
PO Box 201601
Helena, MT 59620
Ph: (406) 444-6610
Fax: (406) 444-5918

Dept. of Environmental Quality
Permitting & Compliance Div.
1520 E. Sixth Street
Helena, MT 59620
Ph: (406) 444-4323
Fax: (406) 444-5275

State-Owned Lands
Dept. of Natural Resources & Conservation
Truistland Mgmt. Div.
1625 11th Avenue
Helena, MT 59620
Ph: (406) 444-2074
Fax: (406) 444-2684

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DEFINITION OF GEOTHERMAL: Statute and No.: Nevada Revised Statute (NRS) 534A.010
Geothermal resources are defined as the natural heat of the earth and the energy associated with that natural heat, but excluding hydrocarbons and helium. In addition, geothermal resources are divided into classes for purposes of regulation as follows:

Domestic Class: This type of geothermal resource is developed for dwellings with common ownership on a single parcel of land, and uses not more than an annual average of 1800 gallons per day. A geothermal resource developed for a community's usage that does not produce geothermal heat for sale or for the generation of power is also considered as a domestic well.

Commercial Class: A commercial well is primarily used to provide geothermal resources on a commercial basis for purposes other than generation of power.

Industrial Class: This type of geothermal resource is used primarily to generate power.

GEOTHERMAL IS CHARACTERIZED AS: Mineral if use is only for heat content. For low temperature uses and where there is consumptive use, the resource would be characterized as both water and mineral and would fall under the jurisdiction of the State Engineer, Division of Water Resources (water) and the State Division of Minerals (heat).

OWNERSHIP: Statute and No.: NRS 534A.050 Geothermal resources in Nevada belong to the owner of the surface estate, unless they have been reserved by or conveyed to another person.

AGENCY RESPONSIBLE FOR LEASING: Contact Office of State Lands. For federal lands, contact the Bureau of Land Management.

LEASING: Leases are negotiated.

LEASE TERMS: Office of State Lands
Primary: N/A
Renewable: N/A
Rentals: N/A
Royalties: (% of sales): N/A

DILIGENCE REQUIREMENTS: Nevada Administrative Code (NAC) 534A.210

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATING: Department of Conservation and Natural Resources, Division of Environmental Protection

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: NRS 534A. Department of Minerals

INJECTION REQUIREMENTS: Statute and No.: NAC 534A.410 and Chapter 445 Nevada Administrative Code, Section 2596 inclusive. State Department of Conservation and Natural Resources, Division of Environmental Protection and Division of Minerals

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: NRS 534A, Department of Minerals

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: State Department of Conservation and Natural Resources, Division of Environmental Protection, and Division of Minerals.

ADDITIONAL INFORMATION:

State Lands Division
333 West Nye Lane
Carson City, NV 89710
(702) 687-4363
Pamela Wilcox

Department of Conservation
123 West Nye Lane
Carson City, NV 89710
(702) 687-4670, ext. 3150
Russ Land

Division of Minerals
400 West King Street, #106
Carson City, NV 89703
(702) 687-5050
Fax: (702) 687-3957
John Snow
Ndom@govmail.state.nv.us
Http://www.state.nv.us/b&i/minerals
NEW MEXICO

DEFINITION OF GEOTHERMAL: Statute and No.: New Mexico Statutes Annotated (NMSA) 1978, 71-5-3 and NMSA 1978, 72-2-17.

"Geothermal resource" means the natural heat of the earth, or the energy, in whatever form, below the surface of the earth present in, resulting from, creating by or which may be extracted from, this natural heat, and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas and other hydrocarbon substances.

"Geothermal fluid" means naturally occurring steam or hot water which is at a temperature of at least 95°F in the natural state of free-flowing springs or pumped from wells.

GEOTHERMAL IS CHARACTERIZED AS: Mineral

OWNERSHIP: Statute and No.: NMSA 1978, 19-13-3 and NMSA 1978, 71-5-2. The state claims ownership of geothermal resources whenever it holds the mineral rights.

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: NMSA 1978, 19-13-5. State Land Office

LEASING: Leasing is competitive in geothermal resource fields and non-competitive in all other areas.

Primary: 5 years.
Renewable: 5 years and for as long as resources are produced.
Rentals: $1/acre for first 5 years or when in production. $5/acre second 5 years and no production.
Royalties: (% of sales): 10% of gross revenues minus transportation costs or royalty of 8% of the net revenue received from the operation of an energy producing plant.

DILIGENCE REQUIREMENTS: N/A

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: Office of the State Engineer

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: NMSA 1978, 71-5-6, 71-6-8, 72-12-3, 72-12-26. Oil Conservation Division and/or Office of the State Engineer

INJECTION REQUIREMENTS: Statute and No.: NMSA 1978, 71-5-6. Oil Conservation Division, Office of the State Engineer; and New Mexico Environment Department

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: NMSA 1978, 71-5-6 and 74-6-1 through 12. —Note: All NMSA numbers are being revised.

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: New Mexico Environment Department

ADDITIONAL INFORMATION: Southwest Technology Development Institute, NMSU, Las Cruces, NM (505) 646-1846.

Leasing/Land Entry/Archaeology
New Mexico State Land Office
Oil, Gas and Mineral Division
310 Old Santa Fe Trail
PO Box 1148
Santa Fe, NM 87504-1148
Sam Taylor
(505) 827-5750

Drilling, Injection, Production
Oil Conservation Division (OCD)
New Mexico, Mineral, and Natural Resources Dept.
2040 South Pacheco
PO Box 6429
Santa Fe, NM 87505-5472
Roy Johnson
(505) 827-8198
Rjohnson@emnrasf.state.nm.us

Water Rights, Drilling, Production, Injection
New Mexico State Engineer Office (SEO)
Water Rights Division
Bataan Memorial Building
PO Box 25102
Santa Fe, NM 87504-5102
(505) 827-6120
(800) 928-3766

Environmental, Discharge, Injection
New Mexico Environment Dept. (NMED)
Water and Waste Management Div.
Ground Water Bureau
Harold S. Runnels Building
1190 St. Francis Drive
Santa Fe, NM 87505-4182
(505) 827-2855
(800) 879-3421

Geothermal Resources, Development and Uses
Southwest Technology Development Institute
New Mexico State University
Box 30001, Dept. 3SOL
Las Cruces, NM 88003-0001
Jim Witcher
(505) 646-3949
jwitcher@nmsu.edu

Geologic Reports and Maps
New Mexico Bureau of Mines and Mineral Resources
New Mexico Institute of Mining and Technology
801 Leroy Place
Socorro, NM 87801-4796
(505) 835-5410
"Geothermal resource" means the recoverable stored heat of the earth. "Geothermal energy" means the internal energy of the earth, available to man as heat from rocks or liquids.

GEOTHERMAL IS CHARACTERIZED AS: Heat

OWNERSHIP: Unless facility is located on state land, the surface owner maintains ownership of the geothermal facility. If the facility is sold, ownership of the geothermal facility is transferred to the new owner. A notice of ownership change must be filed with the Office of the State Geologist by using the "Geothermal Energy Sundry Notices and Reports" form, available from the North Dakota Geological Survey.

AGENCY RESPONSIBLE FOR LEASING: North Dakota Geological Survey

LEASING: Leases are negotiated.

LEASE TERMS: North Dakota Geological Survey

DILIGENCE REQUIREMENTS: N/A

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: Office of the State Geologist, State Department of Health, and State Water Commission

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: NDCC Chapter 38-19-03, Industrial Commission, Office of the State Geologist

INJECTION REQUIREMENTS: Statute and No.: NDCC 38-19-03 and Chapter 43-02-07-14, Industrial Commission, Office of the State Geologist

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: NDCC Chapter 38-19-03

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Industrial Commission, Office of the State Geologist

ADDITIONAL INFORMATION: For additional information regarding geothermal resource development, please contact the Office of the State Geologist and the North Dakota Geological Survey.

Mailing Address: Office Location: Mailing Address: Office Location:
Industrial Commission 1600 E. Interstate Avenue Industrial Commission 1600 E. Interstate Avenue
Office of the State Geologist Bismarck, ND Office of the State Geologist Bismarck, ND
* 600 E. Boulevard Avenue State Geologist, John Bluemle e-mail: bluemle@rival.ndgs.state.nd.us Ph: (701) 328-8000 Fax: (701) 328-8010
Bismarck, ND 58505-0840

Geothermal Regulatory Program Administrator
North Dakota Geological Survey
600 E. Boulevard
Bismarck, ND 58505-0840
Ann Fritz
e-mail: afritz@rival.ndgs.state.nd.us

Note: Wells developed for geothermal resource development must not only comply with NDCC Ch. 38-19, but also comply with Water Well Construction Code, NDCC Ch. 33-18. Contact the North Dakota State Health Department for more information regarding the water well code.

North Dakota State Department of Health
Environmental Health Section
PO Box 5520
Bismarck, ND 58506-5520
Ph: (701) 328-5150
General Information No. (ND Department of Health) (701) 328-2372

For regulations and permitting for geothermal (ground-source) heat pumps, contact the North Dakota Geological Survey, Bismarck, ND (701) 328-8000.
DEFINITION OF GEOTHERMAL: Statute and No.: Oregon Revised Statute (ORS) 522.005(11); ORS 577.090
Subsection (11): "Geothermal resources" means the natural heat of the earth, the energy in whatever form, below the surface of the earth present in, resulting from, or created by, or which may be extracted from the natural heat, and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases, and steam, in whatever form, found below the surface of the earth, exclusive of helium or of oil, hydrocarbon gas or other hydrocarbon substances, but including, specifically:
   a. All products of geothermal process, embracing indigenous steam, hot water, and hot brines;
   b. Steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formation;
   c. Heat or other associated energy found in geothermal formations; and
   d. Any by-product derived from them.
Subsection (12): "Geothermal well" includes any excavation made for producing geothermal resources and any geothermal reinjection well as defined in subsection (10) of this subsection.
Subsection (13): "Geothermal reinjection well" means any well or converted well constructed to dispose of geothermal fluids derived from geothermal resources into an underground reservoir.

GEOTHERMAL IS CHARACTERIZED AS: Water if the temperature is less than 250°F, and under the jurisdiction of the Department of Water Resources. If it is above 250°F, it is considered mineral and under the jurisdiction of the Department of Geology and Mineral Resources. Also, if exploration for geothermal resources of any temperature at depth greater than 2000 feet, it is under the jurisdiction of the Department of Geology and Mineral Resources.

OWNERSHIP: Statute and No.: ORS 522.035, ORS 537.090. Owner of the surface estate, unless otherwise reserved or conveyed.

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: ORS 273.551; Oregon Administrative Rules, Chapter 141 75-010 through 141-75-575. Division of State Lands

LEASING: Leases are available on a non-competitive as well as competitive basis.

LEASE TERMS: Division of State Lands
   Primary: 10 years.
   Renewable: 5 years if discovery has been made or is imminent. Leases are renewable every 10 years. No lease shall exceed 50 years except the lessee shall have a right of first refusal if the Division decides to continue leasing.
   Rentals: $1/acre (1st, 2nd, & 3rd year), $3/acre (4th year), $5/acre all subsequent years.
   Royalties: (% of sales): 10% of production value of resource produced.

DILIGENCE REQUIREMENTS: Division of State Lands

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: ORS 537, Department of Water Resources (<250°F) and/or ORS 522, Department of Geology & Mineral Industries (>=250°F)

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Same as above.

INJECTION REQUIREMENTS: Same as above, plus Oregon Administrative Rules, Chapter 690, Division 65-055-Water Resources Department/Low Temperature Geothermal Effluent Disposal.

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: Statute and No.: ORS 522 and Oregon Administrative Rules, Chapter 141-75-265. Department of Geology and Mineral Industries; Department of Water Resources and/or Department of Environmental Quality

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Department of Environmental Quality

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<th>Department of Geology and Mineral Industries</th>
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<tr>
<td>775 Summer Street NE</td>
<td>158 12th Street NE</td>
<td>800 N.E. Oregon Street, #28</td>
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<tr>
<td>Salem, OR 97310-1337</td>
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<td>Portland, OR 97232</td>
</tr>
<tr>
<td>(503) 378-3805</td>
<td>(503) 378-8455</td>
<td>(503) 731-4100</td>
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<tr>
<td>811 S.W. 6th Street</td>
<td>625 Marion Street NE</td>
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<tr>
<td>Portland, OR 97204</td>
<td>Salem, OR 97310</td>
</tr>
<tr>
<td>(503) 229-5696</td>
<td>(503) 378-4040</td>
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<tr>
<td>1-800-452-4011</td>
<td>1-800-221-8035</td>
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SOUTH DAKOTA

DEFINITION OF GEOTHERMAL: Statute and No.: South Dakota Compiled Laws (SDCL) 5-1-2
"An act to define geothermal resources and to provide for leasing of geothermal resources on state lands."

"Geothermal resources" the use of the natural heat of the earth or the energy, in whatever form, below the surface of the earth for commercial or industrial heating or electrical generating purposes.

GEOTHERMAL IS CHARACTERIZED AS: Water resource and subject to all the provisions of SDCL, Chapter 46-5 and 46-6 inclusive. "Geothermal use" is classified as "beneficial use" by both the Secretary of the Department of Environment and Natural Resources and the Board of Water Management.

OWNERSHIP: Statute and No.: SDCL Chapter 46-5. Appropriated as water.

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: SDCL Chapter 5-7. Office of Schools and Public Lands

LEASING: Leasing is on a competitive basis by public auction.

LEASE TERMS: Statute and No.: SDCL Chapter 5-7. Office of Schools and Public Lands.
Primary: 10 years.
Renewable: So long as resources are produced from the leased lands.
Rentals: Minimum of $1/acre.
Royalties: (% of sales): Not less than 10% of the gross revenue, exclusive of school and public lands that were made or incurred with respect to transmission of their services or process, received from the sale of steam, brine, and gases at the point of delivery to the purchaser.

DILIGENCE REQUIREMENTS: Office of Schools and Public Lands

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: Department of Environment & Natural Resources, Division of Environmental Services

AGENCY RESPONSIBLE FOR INJECTION REQUIREMENTS, DILIGENCE REQUIREMENTS, AND ENVIRONMENTAL PROTECTION: Department of Environment & Natural Resources, Division of Environmental Services

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION:
Department of Environment & Natural Resources, Division of Environmental Services

ADDITIONAL INFORMATION: Department of Environment & Natural Resources, Division of Environmental Services
Office of Schools & Public Lands
500 E. Capital Avenue
Pierre, SD 57501
(605) 773-3303
Comissioner Curt Johnson
custj@apls.state.us

South Dakota Public Utilities Commission
500 E. Capitol Avenue
Pierre, SD 57501
(605) 773-3201
TEXAS

DEFINITION OF GEOTHERMAL: Statute and No.: Geothermal Resources Chapter, Texas Natural Resources Code (TNRC), Title 5, Chapter 141.003. Geothermal Resources Act of 1975:
"Geothermal energy and associated resources" means:
a. Products of geothermal processes, embracing indigenous steam, hot water, and hot brines, and geopressured water;
b. Steam and other gases, hot water and hot brines resulting from water, gas or other fluids artificially introduced into geothermal formations;
c. Heat or other associated energy found in geothermal formations; and
d. Any by-product derive from them.

GEOTHERMAL IS CHARACTERIZED AS: Mineral

OWNERSHIP Statute and No.: Texas Natural Resources Code (TNRC), Title 5, Chapter 141

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: TNRC 141.003. General Land Office, Mineral Division

LEASING: N/A

LEASE TERMS: Railroad Commission

DILIGENCE REQUIREMENTS: N/A

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: Texas Natural Resources Conservation Commission, Texas Department of Licensing & Regulation

AGENCY RESPONSIBLE FOR DRILLING/REGULATIONS: Texas Railroad Commission, Oil and Gas Division

INJECTION REQUIREMENTS: Statute and No.: Texas Administrative Code (TAC), Section 16, § 3.9 and TAC, Section 16, § 3.46

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: TNRC 141.003

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Texas Natural Resources Conservation Commission

ADDITIONAL INFORMATION: Texas Bureau of Economic Geology

General Land Office
Department of Energy Resources
Mineral Division
Steven Austin Building
1700 N. Congress
Austin, TX 78711
(512) 463-5042

Texas Natural Resources Conservation Commission
PO Box 13087
Austin, TX 78711-3087
(512) 239-1000

Texas Bureau of Economic Geology
University of Texas
University Station
PO Box X
Austin, TX 78731-8924
(512) 471-1534

Texas Railroad Commission
Permits Division and Oil & Gas Division
William B. Travis Building
1701 N. Congress
Austin, TX 78711
(512) 463-7257

Texas Department of Licensing & Regulation
Water Well Driller Program
PO Box 12157
Austin, TX 78711

* Licensing of geothermal heat loop (AC) drillers and well construction.
(312) 463-6599
1-800-803-9202 (ext. 37880)
UTAH


"Geothermal resources" means:
   a. The natural heat of the earth at temperatures greater than 120°C; and
   b. The energy, in whatever form, including pressure, present in, resulting from, created by, or which may be extracted from the natural heat, directly or through a material medium. Geothermal resource does not include geothermal fluids.

"Geothermal fluid" means water and steam at temperatures greater than 120°C naturally present in a geothermal system.

GEOTHERMAL IS CHARACTERIZED AS: Water

OWNERSHIP: Statute and No.: Geothermal Resource Conservation Act, UCA, Section 73-21-4.

Ownership of a geothermal resource derives from an interest in land and not from an appropriated right to geothermal fluids. This chapter shall apply to all lands in the state of Utah, including federal and Indian lands to the extent allowed by law. In effect, the right to geothermal resource is based on ownership of the mineral rights or surface rights, which are usually obtained by direct ownership or by leasing. Because of the potential relationship between geothermal fluids and groundwater resource, however, an approved application to appropriate geothermal fluids is required prior to the production of geothermal fluids from a well (UCA, Section 73-21-8). The appropriations process for geothermal fluids is similar to that of water appropriations, and includes provisions for advertisement of the application and the filing of protests. Utah Division of Water Rights

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: UCA, Section 65-1-18. Utah School and Institutional Trust Lands Administration (SITLA)

Hydrothermal resources at low and moderate temperatures (<120°C) are regulated by the Department of Natural Resources, Division of Water Rights under Utah Water Law.

LEASING: Competitive leasing involves lands which have newly become available for lease because of new purchase, relinquished leases, or any other reason and are leased under the simultaneous filing procedures. Applications for non-competitive leases are filed with the Board of State Lands, Division of State Lands.

LEASE TERMS: Board of State Lands

   Primary: 10 years.
   Renewable: For as long as land is in production.
   Rentals: $1/acre per year.
   Royalties: (% of sales): 10% of gross proceeds received from sale of those products, or 10% of the fair market value when the products are utilized but not directly sold.

DILIGENCE REQUIREMENTS: Currently a drilling requirement by the end of the first 5 years. SITLA is considering dropping the 5-year drilling requirement.

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: Utah Division of Water Rights

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: UCA, Section 73-21-5. Utah Division of Water Rights

INJECTION REQUIREMENTS: Statute and No.: UCA, Section 73-21-5. Utah Division of Water Rights and/or Division of Water Quality; injection may be required in order to maintain water levels in heavily used aquifers.

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: Statute and No.: UCA, Section 73-21-2 and UCA 26-11, Section 1-20

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Department of Environmental Quality, Division of Water Quality

Department of Natural Resources
Division of Water Rights
PO Box 146300
Salt Lake City, UT 84116-6300
(801) 538-7240
www.nr.state.ut.us

Department of Environmental Quality
Division of Water Quality
PO Box 144870
Salt Lake City, UT 84114-4870
(801) 538-6146
(801) 538-6016 (fax)
www.eq.state.ut.us

Utah School and Institutional Trust
Lands Administration
675 E. 500 S, Suite 500
Salt Lake City, UT 84102
(801) 538-5100
(801) 355-0922 (fax)
www.tl.state.ut.us

Department of Natural Resources
Utah Geological Survey
1594 W. North Temple, Suite 3110
Box 146100
Salt Lake City, UT 84114-6100
(801) 537-3300
(801) 537-3400 (fax)
www.ugs.state.ut.us
DEFINITION OF GEOTHERMAL: Statute and No.: Geothermal Resources Act, Revised Code Washington (RCW), Chapter 79.76(3).
"Geothermal resource" means only that natural heat energy of the earth from which it is technologically practical to produce electricity commercially and the medium by which such heat energy is extracted from the earth, including liquids or gases, as well as any mineral contained in any natural or injected fluids, brines, and associated gas, but excluding oil, hydrocarbon gas, and other hydrocarbon substances. All direct-use geothermal resources are considered to be groundwater and regulated accordingly. (Emphasis added)

GEOTHERMAL IS CHARACTERIZED AS: Sui generis. Direct use resources are characterized as groundwater.

OWNERSHIP: Statute and No.: Geothermal Resource Act, RCW, Chapter 79.76. Geothermal resources are the property of the surface owner. Water Rights: Chapters 18.104, 43.27A, 90.14, 90.16, 90.22, 90.44 and 90.54 RCW, Chapters 173-100, 173-136, 173-50, 173-154, 173-166, 173-500, and 173-590 WAC.

AGENCY RESPONSIBLE FOR LEASING: Statute and No.: Geothermal Resources Act, RCW, Chapter 79.76. Department of Natural Resources, Division of Lands.

LEASING: All leases are negotiated.

LEASE TERMS: All terms are negotiated.

DILIGENCE REQUIREMENTS: All terms are negotiated.

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: Department of Ecology. Groundwater Management Areas: Chapter 90.44 RCW, Chapter 173-100 WAC.

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Department of Ecology, RCW 18.104, Chapter 173-160 WAC, Chapter 173-162 WAC.

INJECTION REQUIREMENTS: Statute and No.: Geothermal Resources Act, RCW, Chapter 79.76. Department of Natural Resources, Division of Geology & Earth Resources. Department of Ecology, Chapter 90.48 RCW, Chapter 173-218 WAC. Underground Injection control program.

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: State Environmental Policy Act 1971 and Geothermal Resources Act, RCW, Chapter 79.76.

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Department of Ecology, RCW 43.21A.040


Department of Natural Resources
Division of Lands
1111 Washington Street SE
PO Box 47001
Olympia, WA 98504-7001
(360) 902-1000

Department of Ecology
300 Desmond Drive
PO Box 47600
Lacey, WA 98504-7600
(360) 407-6000

Department of Natural Resources
Division of Geology & Earth Resources
1111 Washington Street NE
PO Box 47001
Olympia, WA 98504-7001
(360) 902-1450
(360) 902-1785 (fax)

Washington State University
Energy Program
925 Plum Street, Bldg. 4
PO Box 43165
Olympia, WA 98504-3165
(360) 956-2016
(360) 956-2030 (fax)
DEFINITION OF GEOTHERMAL: Statute and No.: Wyoming Statutes (WS) Chapter XI Rules and Regulations Governing the Issuance of Geothermal Permits and Leases. "Geothermal resources" shall mean the natural heat in the subsurface of the earth, its energy, in whatever form, resulting from, or created by, or which may be extracted from, such natural heat and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases, and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas, other hydrocarbon substances or miscellaneous minerals.

GEOTHERMAL IS CHARACTERIZED AS: Water

OWNERSHIP: Statute and No.: Nature of Water Rights and Beneficial Use, Article 1, §41-3-101 Wyoming Statutes (WS). Geothermal is a public resource available for appropriation.


LEASING: Leasing in Known Geothermal Resource Areas (KGRA) is by competitive bid. Other lands are available through a non-competitive permit which may be converted to a lease within 50 days should the area be classified as a KGRA.

LEASE TERMS: Wyoming State Lands Office
- Primary: 10 years.
- Renewable: As long as geothermal resources are being produced or utilized, or are capable of being produced or utilized in commercial quantities.
- Rentals: $2/year.
- Royalties: (% of sales): 10% of gross revenue as determined by a reasonable value received from the sale of steam, brine, from which no minerals have been extracted, and associated gases at the point of delivery to purchaser thereof. In such a case where the resource is used by the lessee and not sold, the gross revenue therefrom to be determined as those said geothermal resources had been sold to a third person and then primarily market price in the same market area and under the same market conditions.

DILIGENCE REQUIREMENTS: Drilling must commence within two (2) years. State Board of Land Commissioners

AGENCY RESPONSIBLE FOR GROUNDWATER REGULATIONS: State Engineer - a permit must be obtained from the State Engineer's Office prior to drilling any water well (Wyoming Statute 41-3-930)

AGENCY RESPONSIBLE FOR REGULATING DRILLING: Statute and No.: Rules and Regulations Governing the Issuance of Geothermal Resource Permits and Leases. State Board of Land Commissioners and State Engineer

INJECTION REQUIREMENTS: Surface disposal may be approved by the Wyoming Game and Fish Department, State Engineer or Department of Environmental Quality.

STATE ENVIRONMENTAL STATUTE PERTAINING TO EXPLORATION, DEVELOPMENT, AND INJECTION: State Engineer or Department of Environmental Quality, Section 12, Board of Land Commissioners Permit to Prospect for Geothermal Resources

AGENCY RESPONSIBLE FOR ENVIRONMENTAL PROTECTION: Department of Environmental Quality

ADDITIONAL INFORMATION: State Engineer's Office and/or University of Wyoming and Rules and Regulations governing the Issuance of Geothermal Resource Permits and Leases, November 1, 1975 and Permit to Prospect for Geothermal Resources.

Wyoming State Lands Office
and/or State Board of Land
Commissioners
3rd Floor West
Herschler Building
Cheyenne, WY 82002
(307) 777-6638

Dept. of Environmental Quality
4th Floor West
Herschler Building
Cheyenne, WY 82002
(307) 777-7781

University of Wyoming
Department of Geology
and Geophysics
16th & Gibbon Street
PO Box 3006
Laramie, WY 82071
(307) 766-3389

State Engineer's Office
4th Floor East
Herschler Building
Cheyenne, WY 82002
(307) 777-6159

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