

Overview of Direct Use in the US

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Introduction

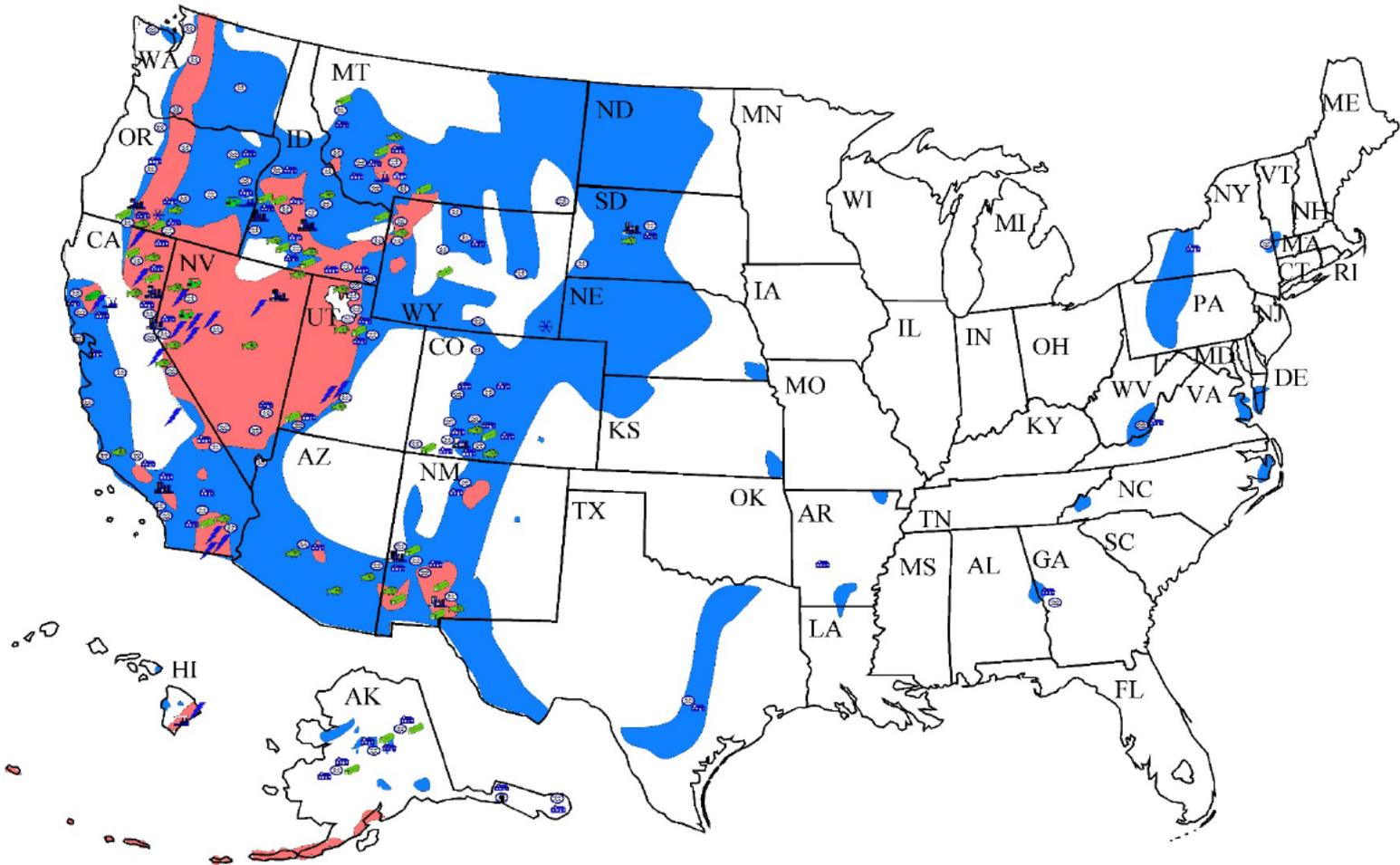
- ▶ Use of heat rather than converting to electricity
- ▶ Use of low- to moderate temperature fluids 38°C to 150°C (100°F to 300°F)
- ▶ 85% of identified resources are below 93°C (200°F)
- ▶ More likely to be located near potential user
- ▶ Uses conventional water-well drilling equipment
- ▶ Uses conventional, off-the-shelf equipment (allow for temperature and chemistry of fluid)
- ▶ Minimum start-up-time

Types of Applications

- ▶ Industrial Applications
- ▶ Agricultural Drying
- ▶ District Heating
- ▶ Space Heating
- ▶ Greenhouses
- ▶ Aquaculture
- ▶ Resorts and Spas
- ▶ Snow Melting / Cooling



U.S. GEOTHERMAL PROJECTS AND RESOURCE AREAS



- | | | | |
|--|--|---|---|
|  Space Heating |  Greenhouses |  Agricultural Drying |  Temperature above 100°C (212°F) |
|  District Heating |  Aquaculture |  Snowmelting |  Temperature below 100°C (212°F) |
|  Industrial |  Spas and Pools |  Power Plant |  Area Suitable for Geothermal Heat Pumps (Entire U.S.) |

Source: ESRI, 1995
GHC, 1996

State Summaries

State	#	Type	Capacity (MWt)	Annual Energy (TJ/yr)
Alaska	22	H,G,B,C	7.8	156.2
Arizona	13	H,F,B	23.5	317.4
California	103	D,H,G,F,B	105.1	2,183.6
Colorado	41	D,H,G,F,B	29.5	627.6
Idaho	74	D,H,G,F,B	94.2	1,479.1
Montana	34	H,G,F,B	15.8	297.8
New Mexico	29	D,H,G,F,B	38.7	335.7
Nevada	30	D,H,A,F,B	74.8	1,153.6
Oregon	688	D,H,G,F,I,A,S,B	77.8	802.8
South Dakota	1008	D,H,F,B	66.3	577.6
Utah	26	H,G,F,B	45.8	449.9
Washington	7	H	1.9	45.5
Wyoming	21	H,G,F,S,B	28.3	701.0
All Others	7	H,B	6.4	64.4

Direct Use Applications

- ▶ 19 + District heating systems
- ▶ Over 2,000 individually heated buildings
- ▶ 7 Industrial and agricultural drying applications
- ▶ 45 Greenhouse complexes
- ▶ 51 Aquaculture operations
- ▶ 242 Resorts and spas
- ▶ 6 Snow melting projects

District Heating



- ▶ Located in 7 states (CA, CO, ID, NM, NV, OR, SD)
- ▶ 81.6 MWt, 839.6 TJ/yr
- ▶ Temperature ranges from 59°C to 103°C (38°F to 218°F)
- ▶ 4 systems in Boise, Idaho
- ▶ 2 systems in Klamath Falls, Oregon
- ▶ 2 systems in Reno, Nevada
- ▶ Smallest system located in Midland, SD - 10 buildings (0.6 MWt)
- ▶ Largest system located in Boise, ID - 81 buildings (22.2 MWt)

Space Heating



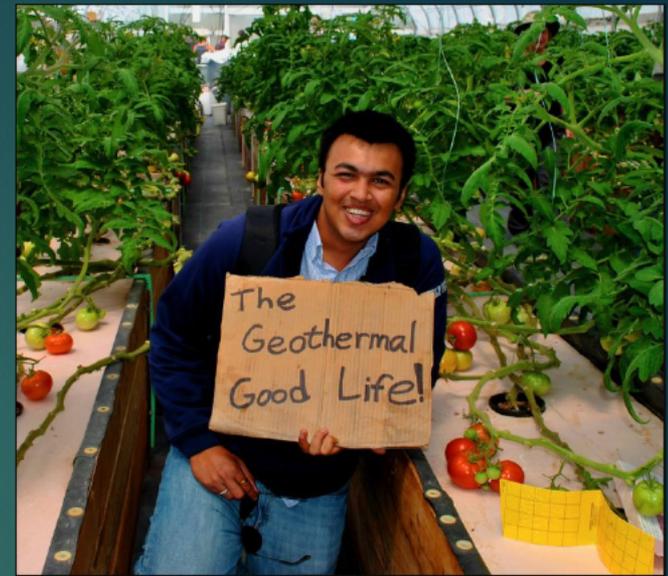
- ▶ Located in 17 states (AK, AR, AZ, CA, CO, GA, ID, MT, NM, NV, NY, OR, SD, TX, UT, VA, WY)
- ▶ 139.9 MWt, 1,360.6 TJ/yr
- ▶ 600 individual wells in Klamath Falls, Oregon
- ▶ 300 individual wells in Reno, Nevada
- ▶ Peppermill Hotel Casino
 - ▶ Saving \$2.2 million in natural gas bills
 - ▶ reduces 12,000 metric tons of CO₂ emissions per year

Industrial and Agricultural Drying

- ▶ Located in 3 states (CA, NV, OR)
- ▶ 37.8 MWt, 493.1 TJ/yr
- ▶ Usually requires higher temperatures
- ▶ Biodiesel
- ▶ Onion Dehydration
- ▶ Brewery
- ▶ Laundry Facility



Greenhouses



- ▶ Located in 9 states (AK, CA, CO, ID, MT, NM, OR, UT, WY)
- ▶ 96.9 MWt, 799.8 TJ/yr
- ▶ Low to high temperatures (37°C to 110°C) (98°F to 230°F)
- ▶ Variety sizes of operations 0.04 to 13 hectares (0.1 to 32 acres)
- ▶ Potted plants, tree seedlings, vegetables, roses, cut flowers, spider mites

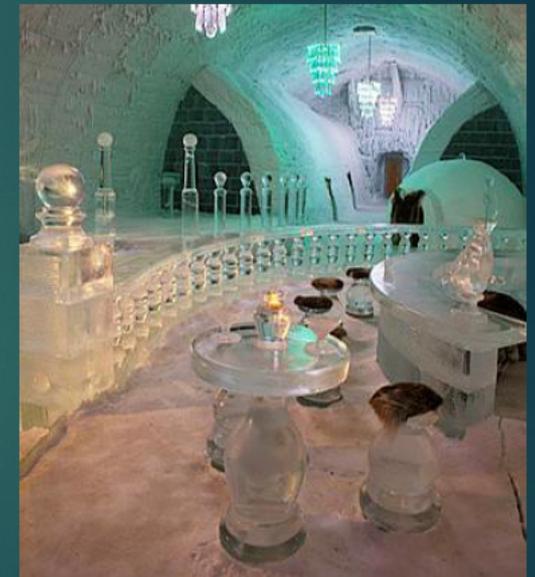
Aquaculture



- ▶ Located in 11 states (AZ, CA, CO, ID, MT, NM, NV, OR, SD, UT and WY)
- ▶ 142 MWt, 3,074 TJ/yr
- ▶ Ponds, raceways or tanks used
- ▶ Tilapia, trout, catfish, tropical fish, alligators, prawns, bass
- ▶ Water quality and disease control important
- ▶ Largest tilapia farm located in Canby CA

Snow Melting Cooling

- ▶ Snow melting located in 2 states (OR, WY)
- ▶ 2.5 MWt, 20 TJ/yr
 - ▶ Most are cascaded from other systems
 - ▶ Largest systems are at OIT and City of Klamath Falls
- ▶ Cooling
- ▶ 2.3 MWt, 47.6 TJ/yr
 - ▶ Chena Ice Museum

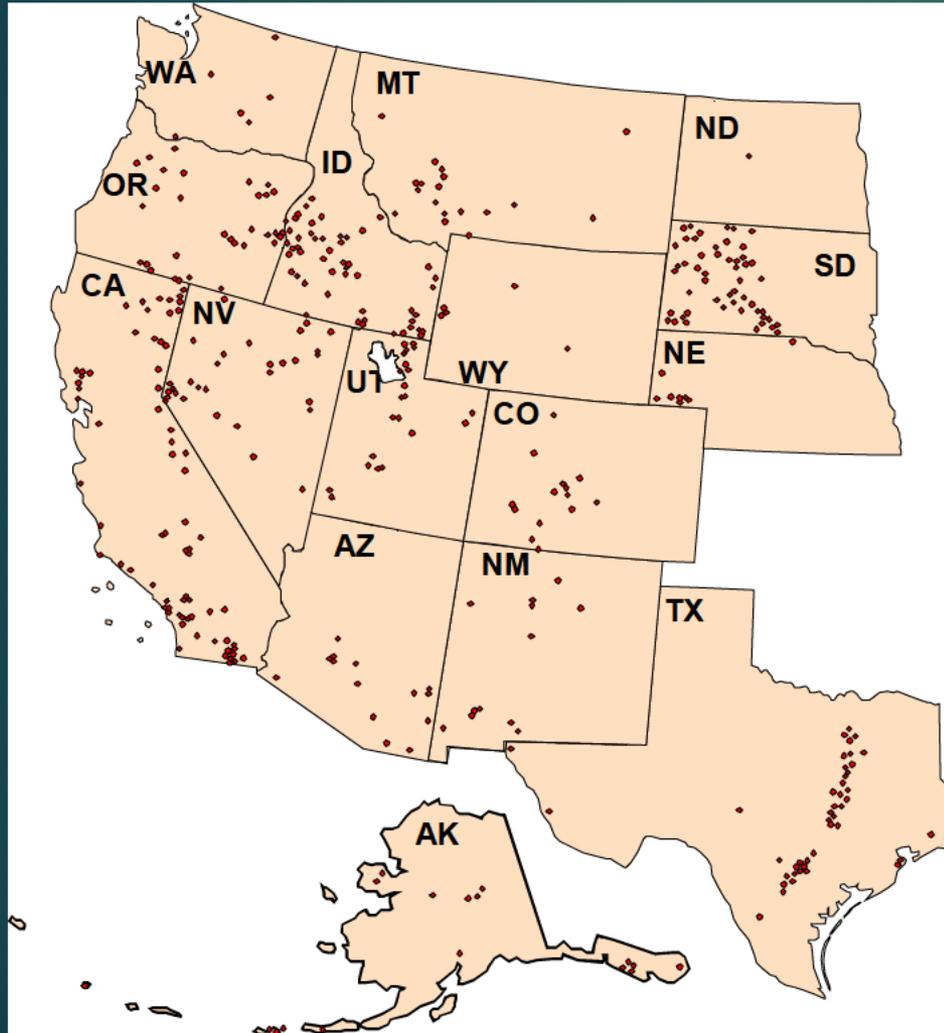


Resorts and Spas

- ▶ Located in 17 states (AK, AZ, CA, CO, GA, ID, MT, NM, NV, NY, OR, SD, TX, UT, WA, WV, WY)
- ▶ 122.9 MWt, 2,557.5 TJ/yr
- ▶ Large concentration of pools and spas in Calistoga, CA and Truth or Consequences, NM
- ▶ Can use low temperature resource – desired swimming temperature 27°C (81°F)
- ▶ Numbers are hard to quantify



Collocated Resources



Resource with a temperature of 122°F and above

Located within 5 miles of a community

404 communities identified in the 16 western states

Some communities have experienced some development of the resource



Thank you for your time