



Financing Geothermal Energy Development: *Opportunities & Challenges*

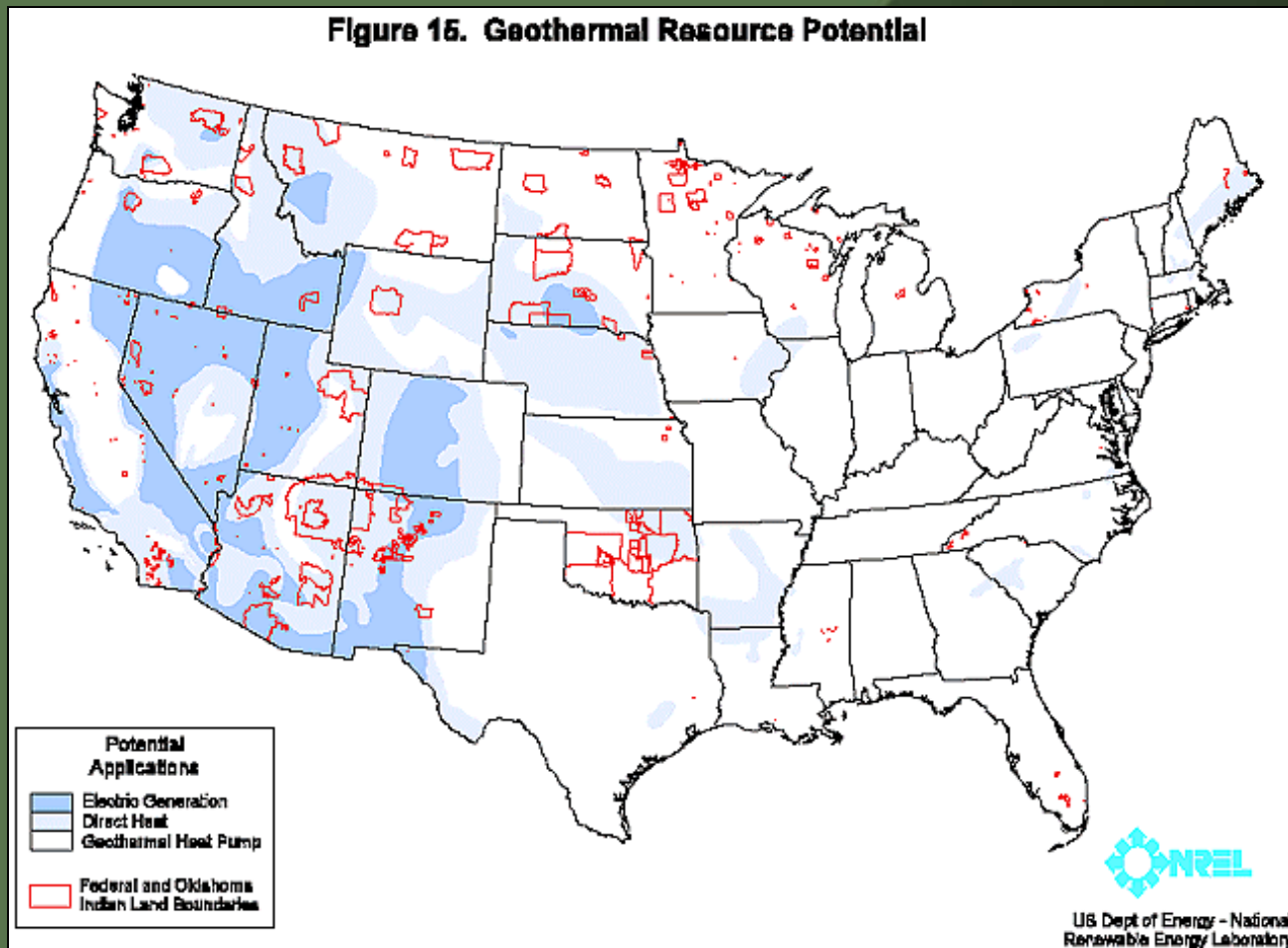
**National Conference on Sustainable Energy
Council of Energy Resource Tribes**

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Outline

- Geothermal resources on Tribal lands
- Types of geothermal projects
 - Direct use
 - Electricity generation
- Financing challenges
- Sources of financing
- Non-financial assistance
- Conclusion

Geothermal Resources on Tribal Lands



Types of Geothermal Projects

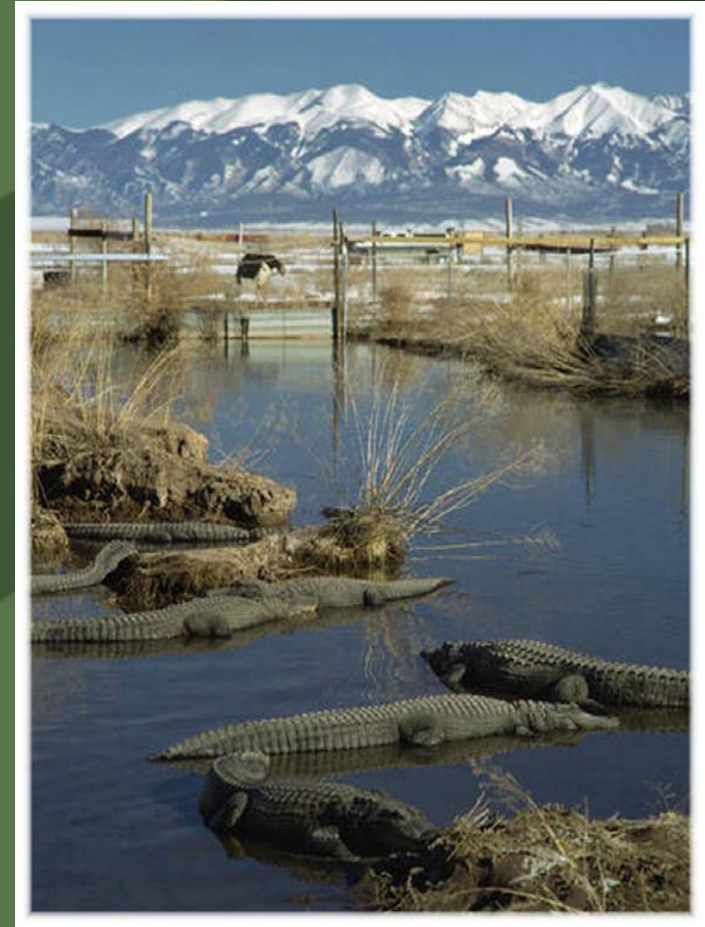
- Direct use – uses heat from water directly
 - Aquaculture
 - Greenhouses
 - Industrial or agricultural processes
 - Resorts and spas
 - Space and district heating
- Electricity generation – converts heat from water into steam to drive turbine
 - Requires hotter resource ($> 212^{\circ}\text{F}$)
 - From 100 kWe to 1 MWe

Well Costs

- Well depths and drilling costs vary widely.
- 90% of direct use wells are < 1800 ft.
- Well drilling costs range from \$30-200/ft.
- Most likely well drilling costs are \$50-100/ft.

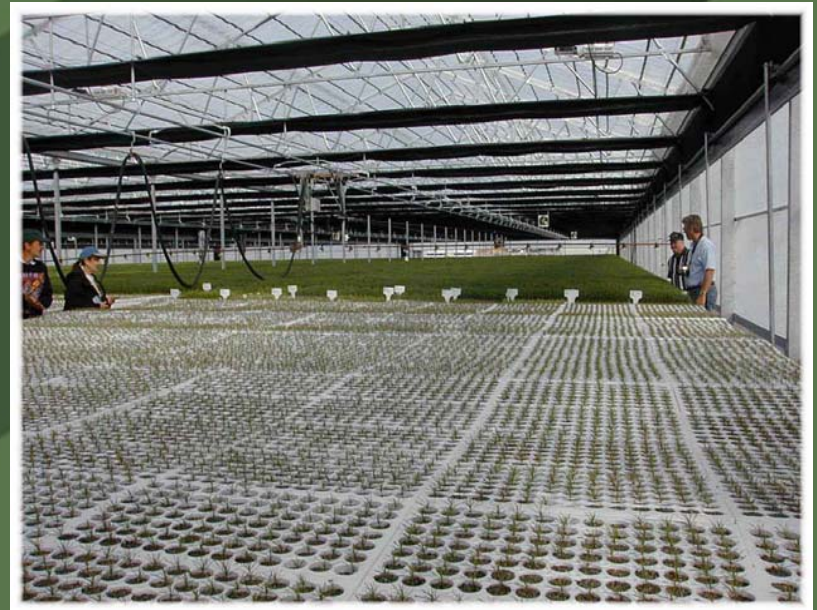
Aquaculture

- Optimum growth temperature requirements:
 - Depends on species.
 - 59-90°F
- Cost of establishing business depends on:
 - Size of project,
 - Species raised, and
 - Whether a well already exists.
- Average aquaculture business has 6 employees and annual sales of \$400,000.

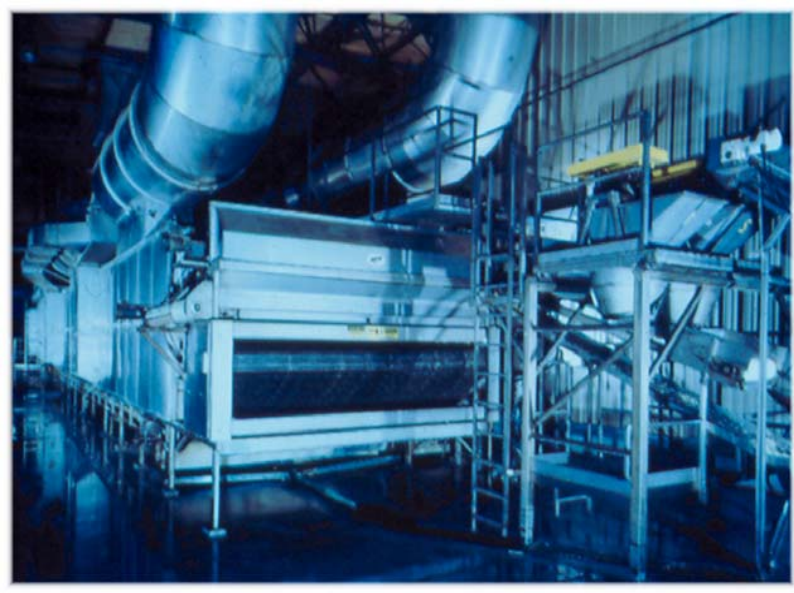


Greenhouses

- Capital costs vary by project size, location, material used, and whether a well currently exists.
- Total greenhouse costs (includes greenhouse and operating equipment) are \$12.84-16.12/ft² of greenhouse, with an average cost of \$14.32/ft².
 - A “backyard” 1,000ft² greenhouse would cost approximately \$14,320.
 - 1-acre greenhouse would cost about \$624,000 (excludes economies of scale).



Industrial or 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.
- Temperatures range from 86-356°F.

Resorts and Spas

- Every major hot spring has record of use by Native Americans.
- Earliest commercial use of geothermal energy.
- Spa design depends on the local culture, character of the location, and what the developer is trying to achieve in terms of atmosphere, service, and clientele.
- 206 geothermal resorts and spas in 14 Western states.



Space and District Heating

- More than 120 operations in U.S. use geothermal energy for district and space heating.
- Well depths vary: 275 ft at Pagosa Springs, 3,030 ft in Boise.
- Temperatures vary: 138°F to 218°F.
- Retrofit costs depend on existing system.



Retrofit Costs

- Generally small buildings ($< 10,000 \text{ ft}^2$) use heating systems which are not hot water-based and must be retrofitted.
- An automotive repair shop with 3 unit heaters would have a retrofit cost of \$12,600-\$14,390 to retrofit.
- A small office with two roof top heat pumps would incur a retrofit cost of approximately \$9,013.

Small-scale Power Generation

- Currently only one plant in the U.S. has an installed capacity of 1 MWe or less.
- All geothermal plants have high upfront costs due to risks of proving the resource.
- Smaller plants cost more per installed kWe than larger plants.
- Need to build market and establish economies of scale for producing small modular plants.



Small-scale Power Generation (Cont'd)

- *250 kWe plant*

- Not a free standing business
- Could be profitable if linked to another project, e.g., fish farming, greenhouse, dehydration, etc., that has a constant cash flow
- Approx. cost is \$350,000-450,000

- *1 MWe plant*

- Look at potential for commercial sale
- Assume can sell power at 5¢/kWh and 90% capacity
- Annual revenues are approx. \$450,000
- Approx. cost is \$3-4 million

Capital and O&M Costs for Small Binary Geothermal Plants

Net Power (kW)	Resource Temperature, °F			Total O&M Cost (\$/year)
	212	248	284	
	Capital Cost, \$/kW			
100	2,786	2,429	2,215	21,010
200	2,572	2,242	2,044	27,115
500	2,357	2,055	1,874	33,446
1,000	2,143	1,868	1,704	48,400

Source: DiPippo, 1999 (adjusted to 2003 \$)

Financing Challenges

- Financing challenges common to any small business:
 - Getting outside funding is difficult during the early years of a business.
 - Banks demand tangible assets or evidence of significant revenue to secure a loan.
 - Banks are unlikely to grant an unsecured loan to a startup business.

Financing Challenges (Cont'd)

- For a startup business, financing sources may look at other items:
 - Feasible business plan with realistic projections
 - Management expertise and commitment to make the business succeed
 - Capital injection (generally a minimum of 30%) by the owner
 - Owner's personal financial strength
 - Collateral

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?

Sources of Financing

- Sources depend on size of project and amount of financing needed
 - Ranges from several thousand dollars for direct use projects to millions for power plants
- Personal assets, credit cards, home equity line
- “Insider” financing, e.g., friends, family
- Bank credit line
- Indian Loan Guaranty and Insurance Fund
- Department of Energy solicitations

Indian Loan Guaranty and Insurance Fund

- 20% owner equity and 51% Indian ownership required
- Maximum loan that can be guaranteed is \$500,000 for individuals, \$5.5 million for Tribes
- Up to 90% of loan can be guaranteed
- Term determined by lender - up to 30 years
- Interest rates range from New York prime plus 1½% or 2¾%, depending on percentage of loan guaranteed
- Interest subsidy may be available for up to 5 years
- One-time 2% payment charged to lender may be charged to borrower
- Fund guarantees \$75 million in loans annually

“First Steps Toward Developing Renewable Energy and Energy Efficiency on Tribal Lands”

- DOE seeks applications from federally-recognized tribes or Alaskan Native Corporations for strategic energy planning, energy options analysis, energy organization development, and human capacity building.
- Total DOE funding of \$500,000 to \$1 million
- DOE anticipates selecting 5-20 applications for negotiation
- 1-year grants; no cost share required
- Proposals due 18 April, 8:00 PM EST
- Solicitation No. DE-PS36-03GO93003

“Renewable Energy Development on Tribal Lands”

- DOE seeks applications from federally-recognized tribes or Alaskan Native Corporations to:
 - Conduct feasibility studies for renewable energy installations on tribal lands (no cost share required), or
 - Develop economically sustainable renewable energy projects (20% cost share required).
- Total DOE funding available is \$2 million to \$3 million
- DOE anticipates selecting 5-10 feasibility studies and 3-5 projects for negotiation
- 1 to 3-year project terms
- Proposals due 30 April, 8:00 PM EST
- Solicitation No. DE-PS36-03GO93002
- Pueblo of Jemez received \$179,056 for FY02 program to do a feasibility study of geothermal resources.

Non-financial Assistance

- Geo-Heat Center
- Other Sources of Geothermal Information
- Native American Business Resources
- *Geothermal Business & Financing Plan Workbook*

Geo-Heat Center

- One-stop shop for data and information on all types of direct use projects.
- Experienced staff provides first-hand technical assistance to companies and individuals.
- Library of over 5,000 volumes.
- Supported by DOE.
- www.geoheat.oit.edu

Other Sources of Geothermal Information

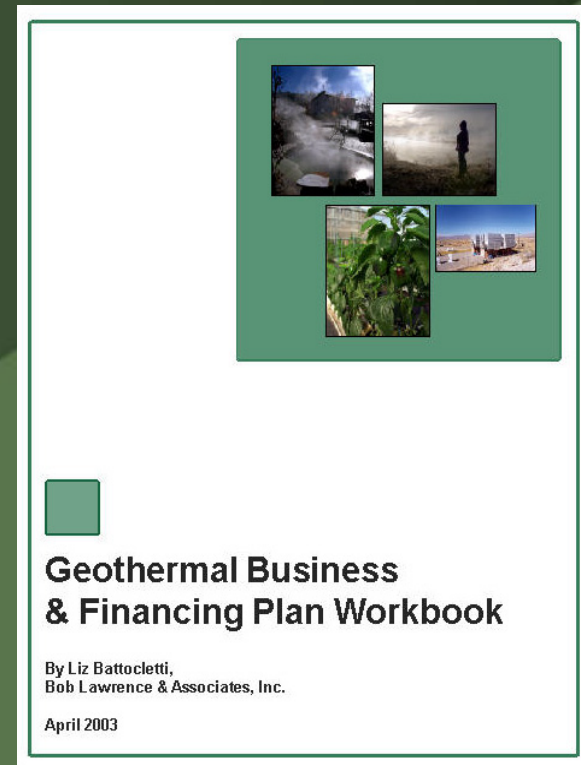
- **GeoPowering the West**
www.eere.energy.gov/geopoweringthewest
- **Geothermal Education Office**
<http://geothermal.marin.org>
- **Geothermal Energy Association**
www.geo-energy.org
- **Geothermal Resources Council**
www.geothermal.org
- **National Renewable Energy Laboratory (NREL)**
www.nrel.gov/geothermal
- **DOE, Energy Efficiency & Renewable Energy Network: Geothermal Energy**
www.eere.energy.gov/RE/geothermal.html
- **DOE Geothermal Energy Program**
www.eere.energy.gov/geothermal/
- **DOE, Geothermal Technical Site**
geothermal.id.doe.gov/

Native American Business Resources

- National Center for American Indian Enterprise Development
- Native American Business Consultant
- Arizona Native American Business Development Center
- California Native American Business Development Center
- Northwest Native American Business Development Center
- UIDA Business Services
- Organizations provide management and technical assistance from startup to expansion, in various areas, including:
 - Financial and Loan Packaging
 - Business Plan Preparation
 - Procurement Assistance
 - Minority Certification and 8(a) Assistance
 - Internal Computerized Accounting
 - Tax Advice

Geothermal Business & Financing Plan Workbook

- Helps geothermal entrepreneur, small company, or project developer:
 - Understand different types of geothermal projects, and
 - Structure a business and financing plan for a small geothermal project.
- Will be available in PDF format on Geothermal- biz.com website
- Written by BL&A
- Supported by DOE Geothermal Technologies Program



Conclusion

- Opportunities exist to develop geothermal resources into thriving businesses.
- Challenges exist to financing geothermal development, as for any small business.
- Financing challenges differ based on size of project and amount of financing needed.
- Smaller direct use projects could be self-financed.
- Issue still remains source of cash flow.
- Cascaded projects easier to finance.



Thank You

*This presentation will be posted on
the Geothermal-biz.com website.*

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