

Small Scale Geothermal Resources for Public Power

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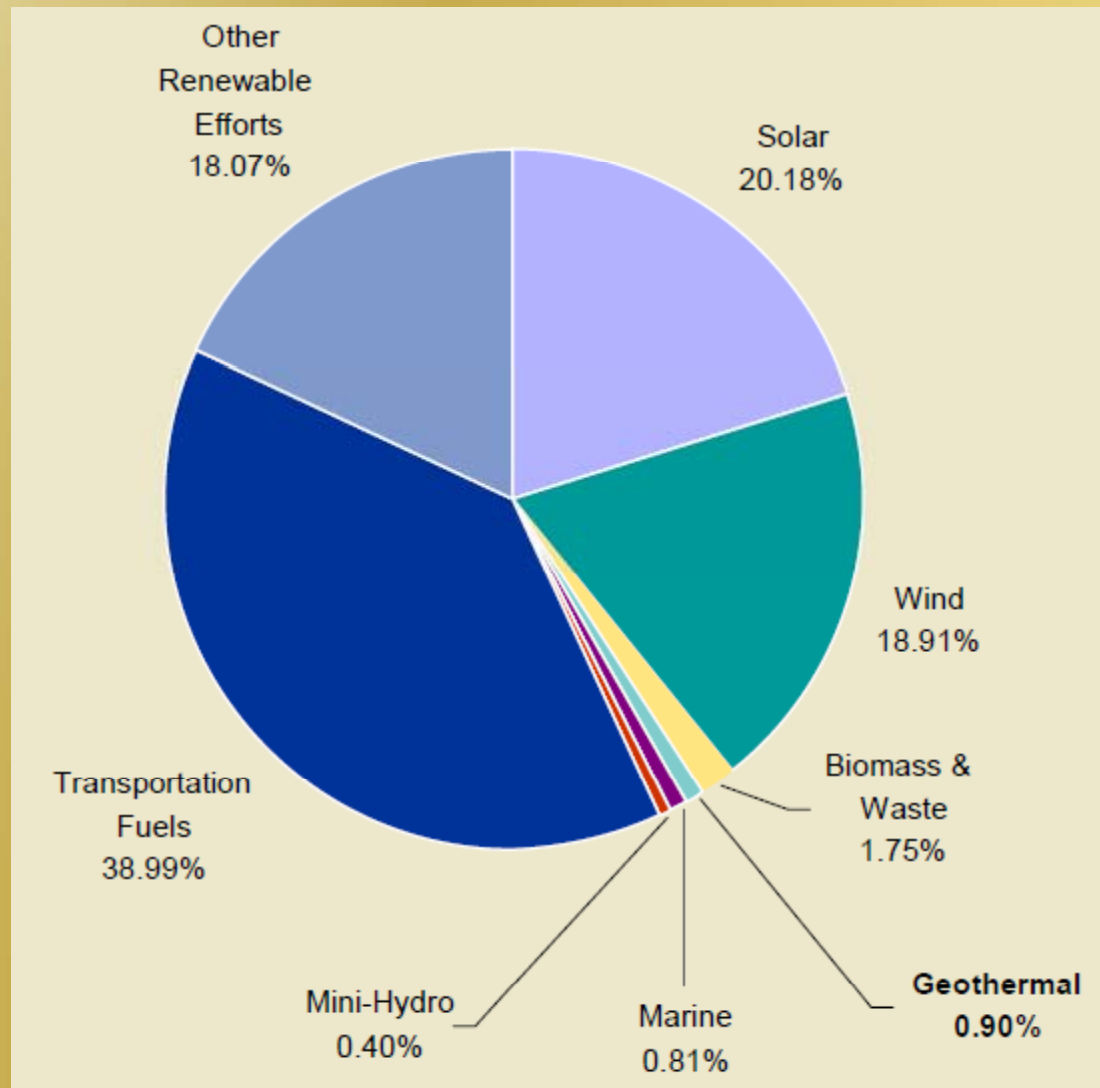
Capacity Factor

Technology	Expected Capacity Factor (%)
Coal	71
Nuclear	90
Geothermal	86-95
Wind	25-40
Solar	24-33
Natural Gas Combustion Turbine	30-35
Hydropower	30-35
Biomass	83

Source: DOE Office of Energy Efficiency and Renewable Energy Geothermal Program, Geothermal Risk Mitigation Strategies Report, February 15, 2008

- Geothermal resources have very high capacity factors and therefore low shaping costs, making them attractive resources when combined with no fuel costs and renewable energy credits (RECs) that can be marketed.

Share of Renewable Energy Investment in 2006



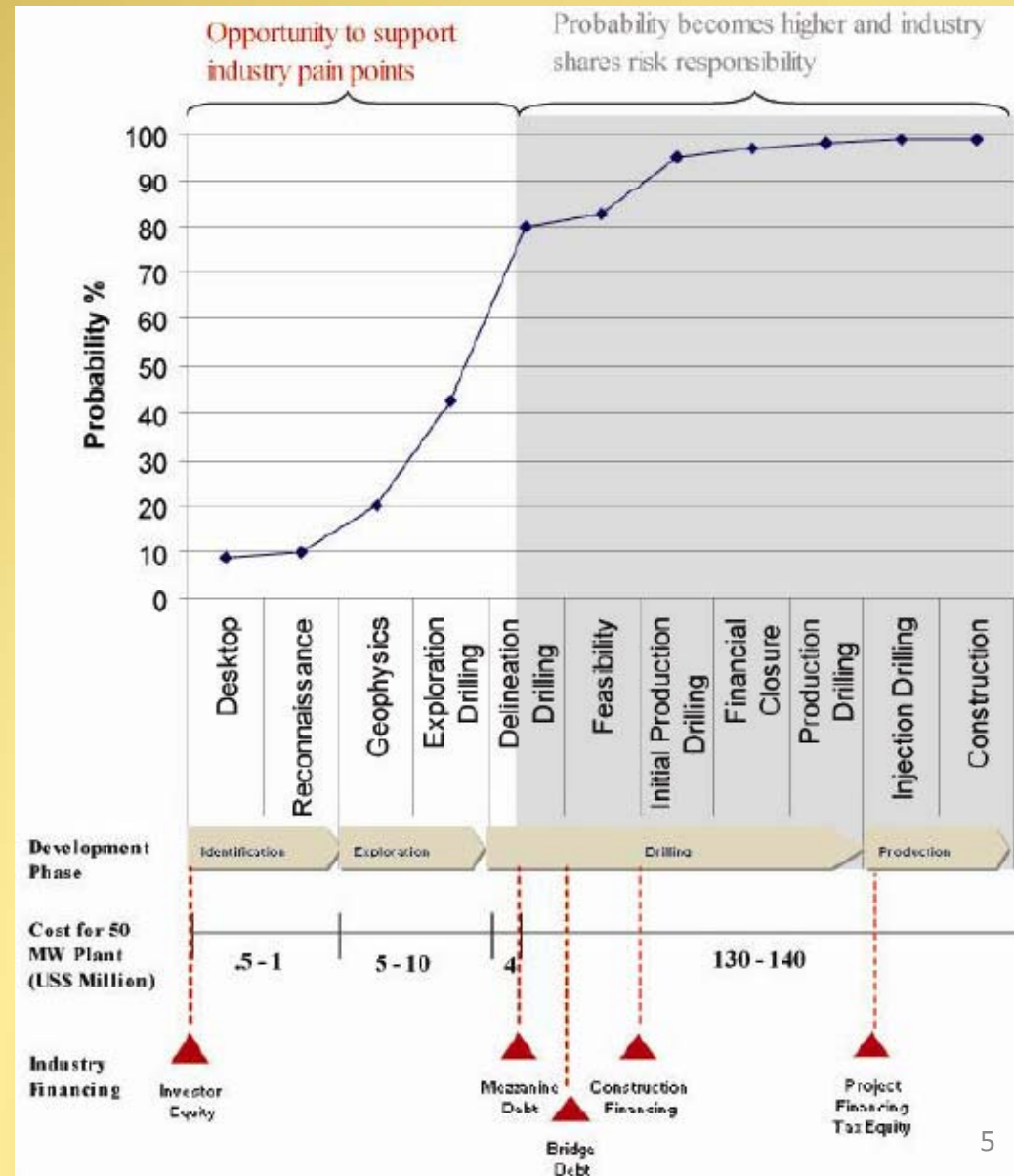
- Despite their favorable characteristics, geothermal represented less than 1% of the renewable energy investments in 2006. Why?

Investing in Geothermal

- Investments in geothermal have significant upfront costs that must be spent prior to determining the viability of the resource basin.
- Due to the high cost of exploration, banks have not funded development with loans until late in the development process, which means the developer needs front end equity.
- In the private sector Production Tax Credits in conjunction with accelerated depreciation have been worth more than 60% of the capital costs of projects. There are new incentives in the Stimulus package.

Success Probability at Each Phase of Development

- In a 2008 study prepared for the U.S. Department of Energy, for a relatively large geothermal facility of 50 aMW, the risk factors involved in early identification, exploration and partial drilling require that roughly \$12 - \$15 million be invested from equity before financing is secured. The money comes from third parties once the site has a high probability of success.
- In this same study, the average industry cost for exploratory drilling for slim holes is about \$1.5 million per well drilled.



Source: DOE Office of Energy Efficiency and Renewable Energy Geothermal Program, Geothermal Risk Mitigation Strategies Report, February 15, 2008

Geothermal Production Costs

- Large Projects greater than 20 aMW tend to come in at \$0.06 to \$0.075/kWh.
- Smaller Projects less than 20 aMW have been developed for about \$0.07 to \$0.10/kWh.
- The cost on these projects is before any incentives, such as grants, RECs, tax credits and no- and low-interest loans have been included.
- Smaller scale projects may be more expensive due to the higher percentage of cost associated with exploration and drilling compared to the generation produced from the facility.

The Paisley Project – Financial Overview

- Cost of Production is expected to be about \$.08/kWh before any incentives.
- The existing well has been logged and tested.
- A feasibility study as well as geophysics and geochemistry has been completed.

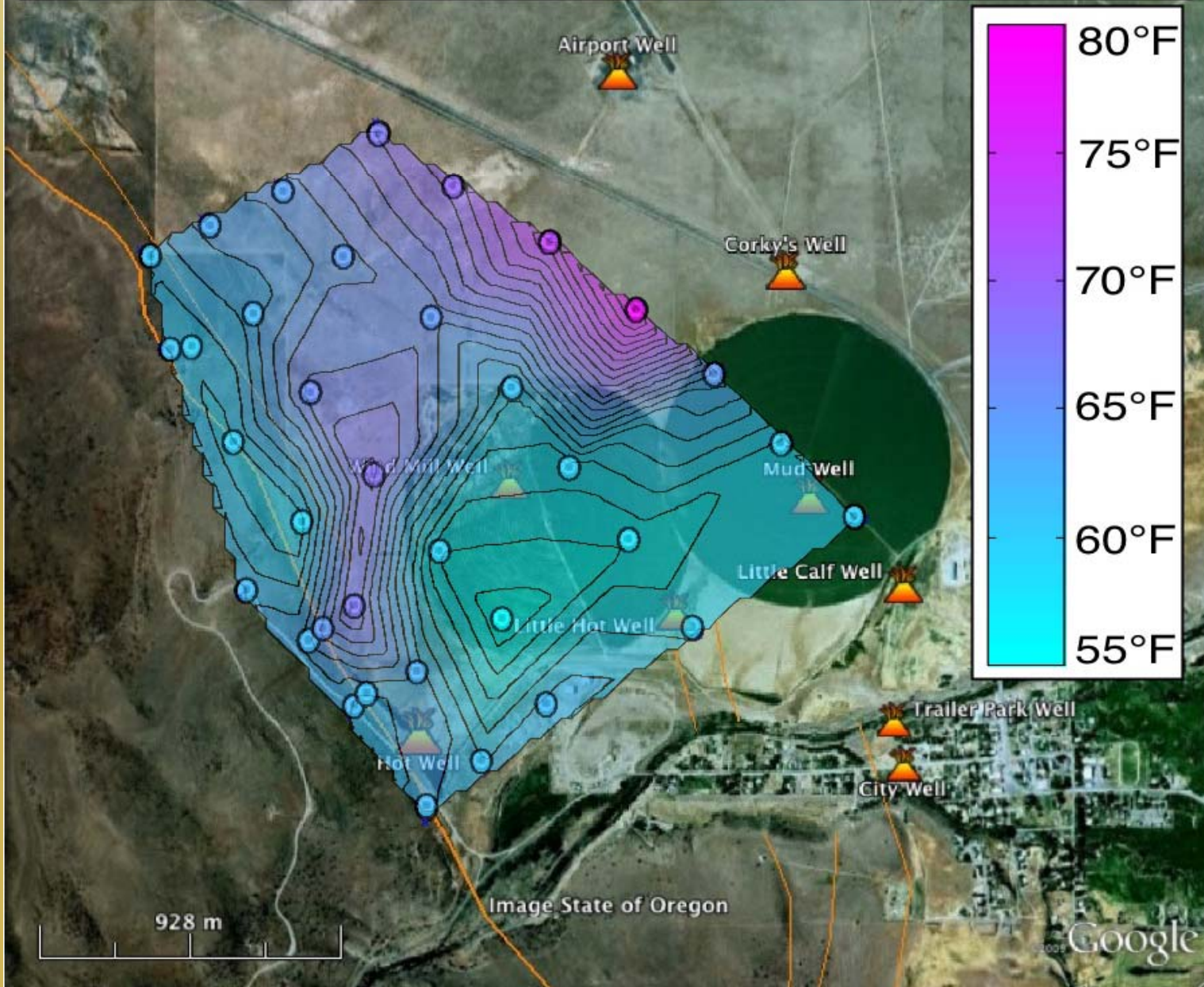


Dan Hand and Lynn Culp installing 2 meter pipes for soil temperature measurement

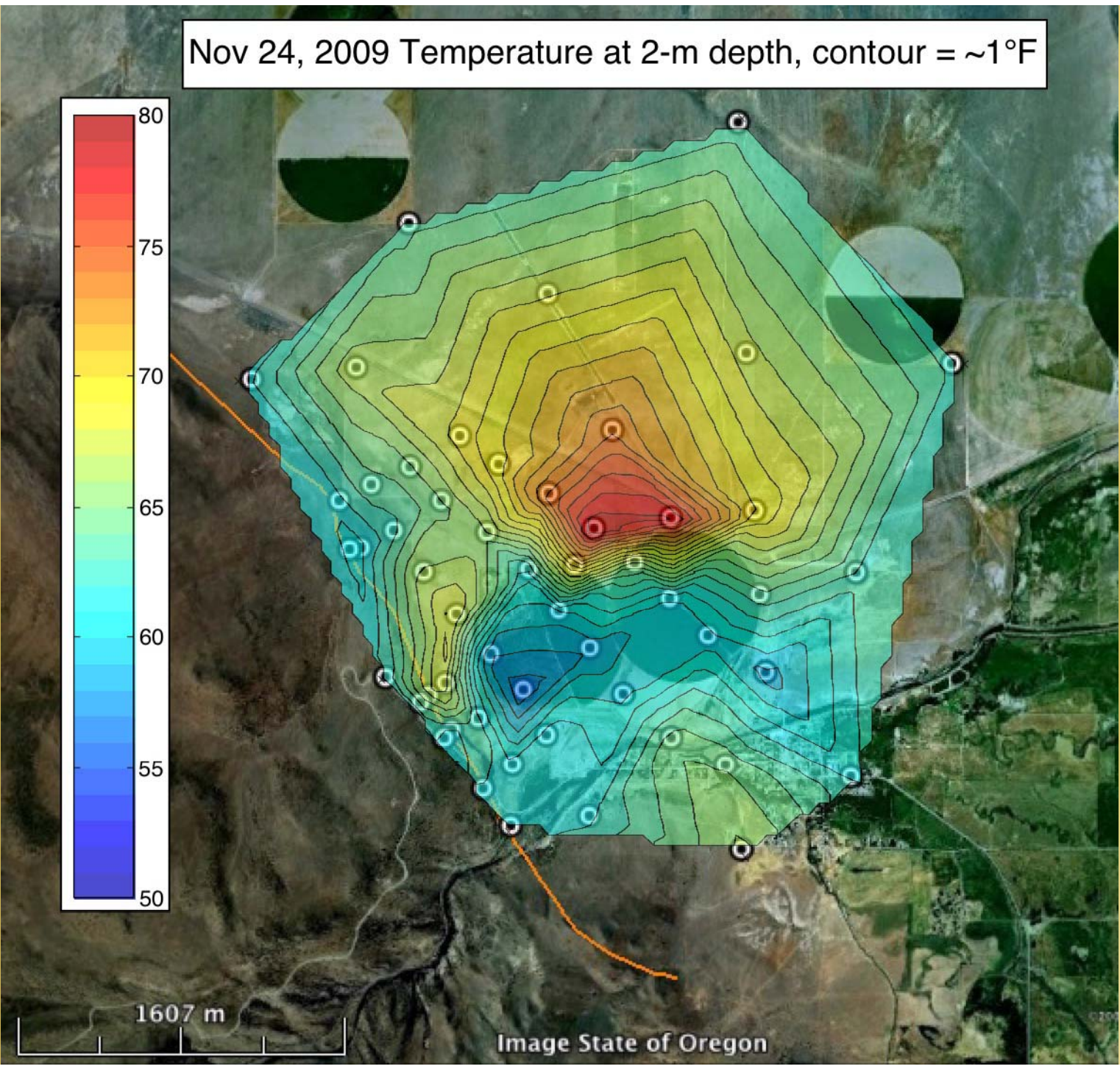
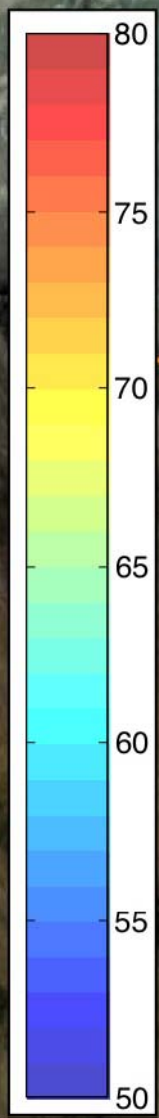


Temperature at 2-m depth, RAW Data, 4 Nov 2009

contour interval = 1°F



Nov 24, 2009 Temperature at 2-m depth, contour = $\sim 1^\circ\text{F}$



1607 m

Image State of Oregon

The Paisley Project – Financial Overview (Continued)

- The project is now past the identification and exploration stage and entering the production drilling stage.
- If the project can capture some of the available incentives, production cost could drop to as low as \$.055/kWh.
- The project is now at 70% probability of success.

Issues for Public Power to Consider

- Ownership rights to output of geothermal facilities are more attractive than purchasing power from resource developers.
- Partial mitigation of front end risk in exploration costs through Stimulus funding or other forms of federal or state assistance.
- Partnership with a private entity to take advantage of Production Tax Credits or other financial tools not available to public power.
- Joint Ventures with the private sector in developing smaller scale geothermal resources.

Incentives for Renewable Energy

Oregon:

Oregon's Business Energy Tax Credit (BETC)

Small Scale Energy Loan Program (SELP)

Federal:

Modified Accelerated Cost-Recovery System (MACRS)

Federal Business Investment Tax Credit (ITC)

Renewable Energy Production Incentive
(REPI)/Production Tax Credit (PTC)

USDA Rural Energy for America Program (REAP)

Clean Renewable Energy Bonds (CREBs)

DOE Innovative Technology Loan Guarantee Program

American Recovery and Reinvestment Act-Stimulus
Funds



Partnerships

- Partnering with existing geothermal developers is possible, especially on large projects.
- U.S. Geothermal, Nevada Geothermal, as well as ENEL have expressed interest.
- Resources:
 - www.grants.gov
 - www.dsireusa.org



Flat Resources to Serve Above HWM Load

- New BPA Power contracts require customers to serve above High Water Mark (HWM) loads on a forecast basis with flat blocks of power.
- In considering the value of a generation resource to serve above High Water Mark loads, a utility has to examine both (1) the cost of developing and operating the resource, and (2) the cost of shaping the output into a flat block of power.
- BPA's cost of shaping services will be determined in the FY 2012 rate case, but we know it will reflect the market price of power. Shaping costs could add another 30% or more to the cost of a low capacity factor resource.

Renewable Energy Credit (REC)

- A REC is a tradable certificate of the non-power environmental attributes associated with one MWh of generation from a qualified resource.
- Current Renewable Energy Credit Market Developing
 - Range of Prices \$0.005 to \$0.025/kWh
- As new regulations are adopted and implemented, RECs will become more valuable.
- Under Washington State's Renewable Portfolio Standard (RPS), a geothermal resource with a generating capacity of not more than 5 MW earns 2 RECs for every one MWh produced.

Oregon's Business Energy Tax Credit (BETC)

- Under the pass-through option, project owner may transfer tax credit to pass-through partner in return for lump-sum cash payment. This option allows non-profits without tax liability to use BETC by transferring tax credit for eligible project to partner with tax liability. Requires a tax paying partner.
- Benefits:
 - 50% of Renewable Projects Paid as a Tax Credit
 - 33.5% available as a Pass Through Credit to Non tax paying entities for Projects. Tax credit is taken over 5 years, 10% each year.
 - Cost to apply \$35,000.

Clean Renewable Energy Bonds (CREBs)

- Financing for Renewable Energy Projects owned by Rural Electric Cooperatives.
- This is an IRS program, which provides interest free loans to Electric Cooperatives.
- Funding Allocation-Participation in the program is limited by volume of bonds allocated by Congress. Participants must first apply to the IRS for CREBs allocation, then issues the bonds within specified time period. The new CREBs allocation of \$2.4 billion does not have a defined expiration date.
- The Lending Institution gets a tax credit from the IRS instead of an interest payment from the Co-op. Maximum current term is 14 years. CFC can help and has done many CREBs bonds.

Stimulus Funds

The American Recovery and Reinvestment Act of 2009

- State of Oregon has received Federal funds for projects as well as the U.S. Dept. of Energy. It is unclear how and when the funds will be released.
- State funds seem to favor government entities, such as State facilities, Counties, Cities and institutions of education.