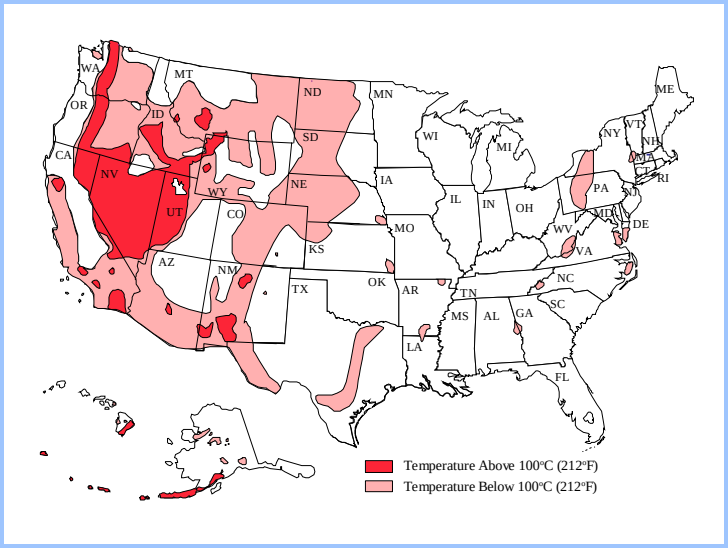
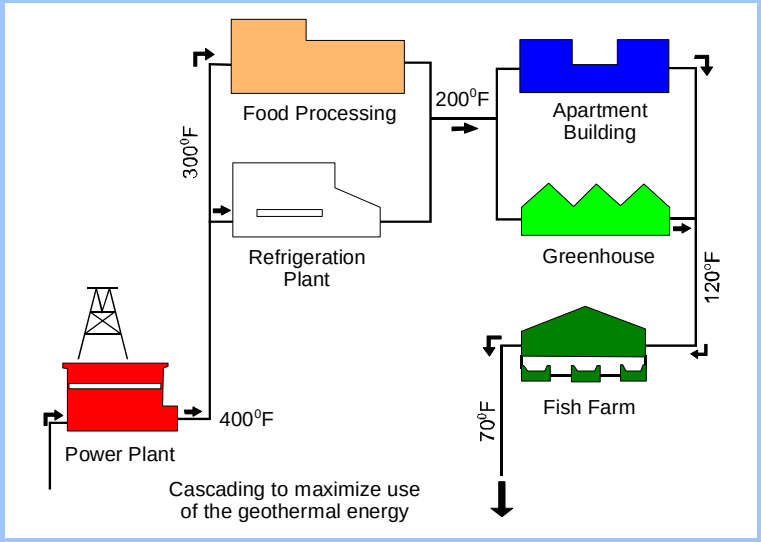
What is Happening in the Klamath Area?

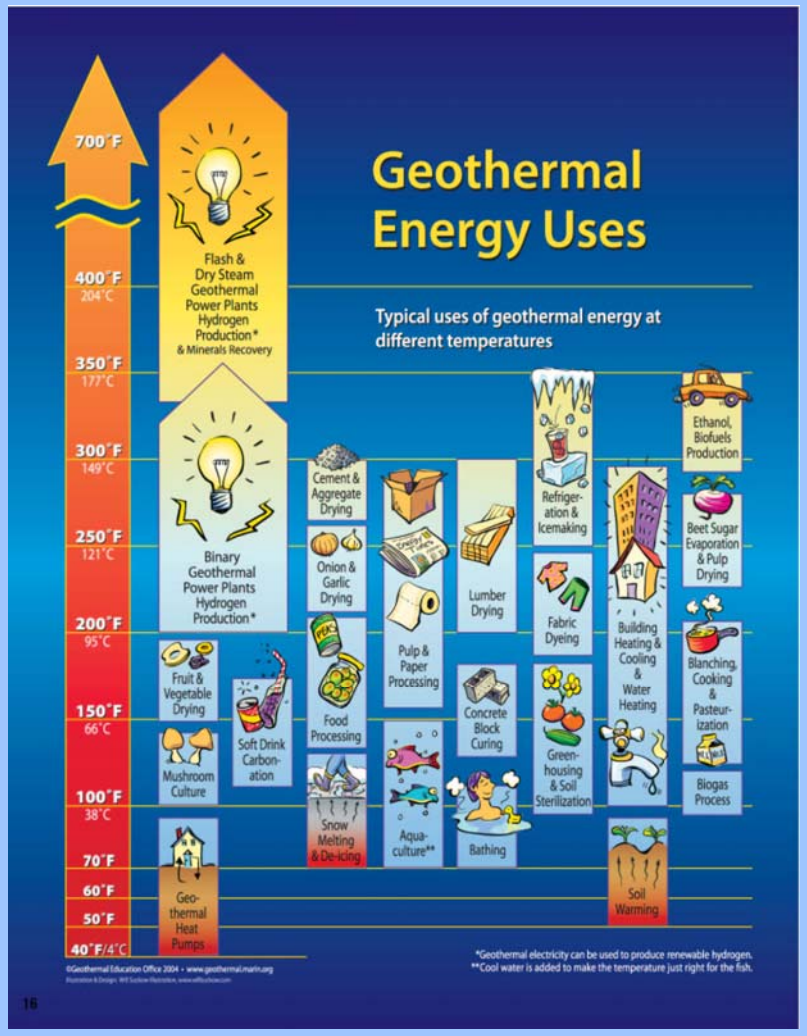
Toni Boyd
Assistant Director
Geo-Heat Center
Oregon Institute of Technology



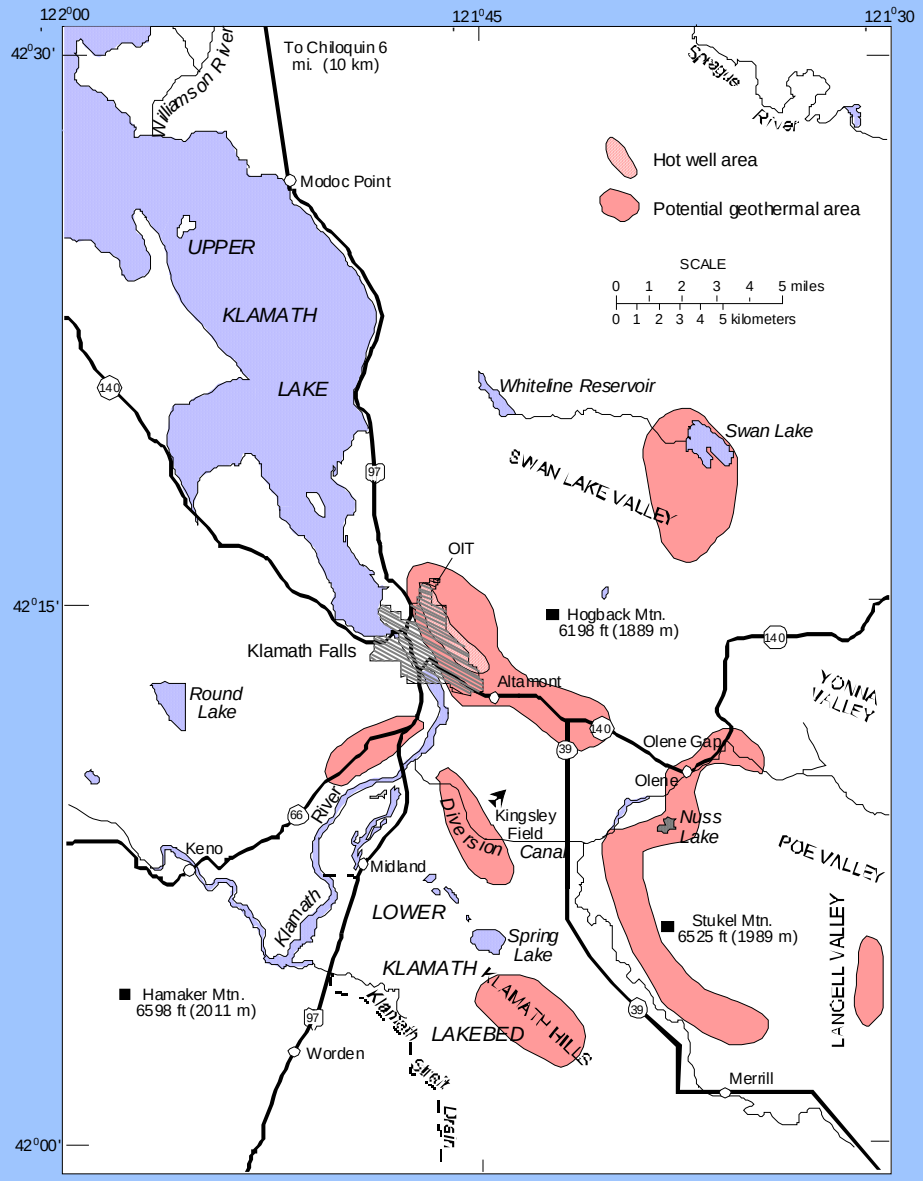
Geothermal Resources of the USA



Cascading geothermal fluids – combined heat & power



- **High temperature: Electric Power**
- **Low temperature: Direct Use**
- **Ambient temperature: Heat Pumps**



Klamath County

District Heating

3 sites

Industrial

2 sites

Greenhouse

2 sites

Aquaculture

1 sites

Space Heating

Over 600 sites

Snow Melting

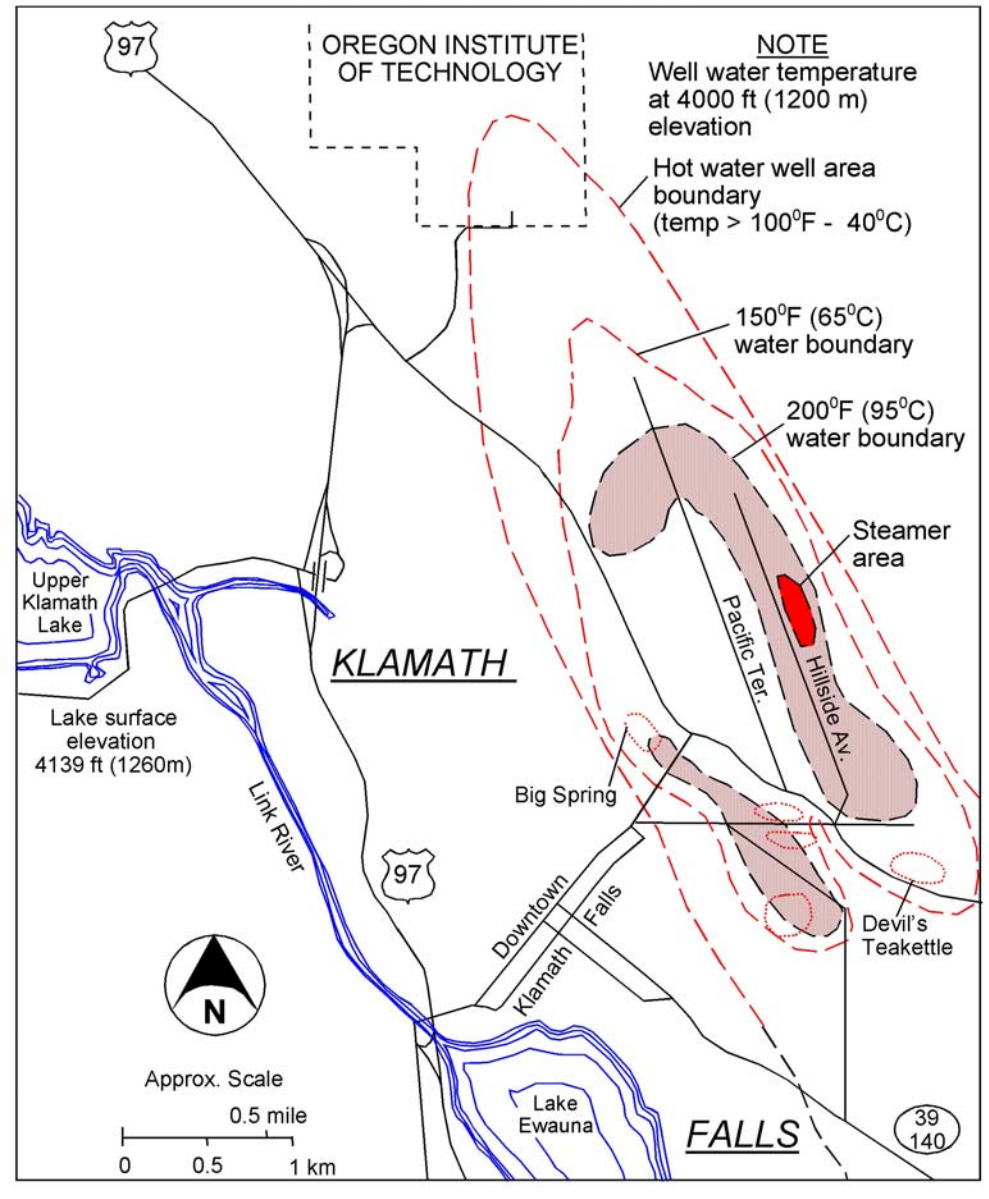
3 main areas

Resort / Spas

4 swimming pools

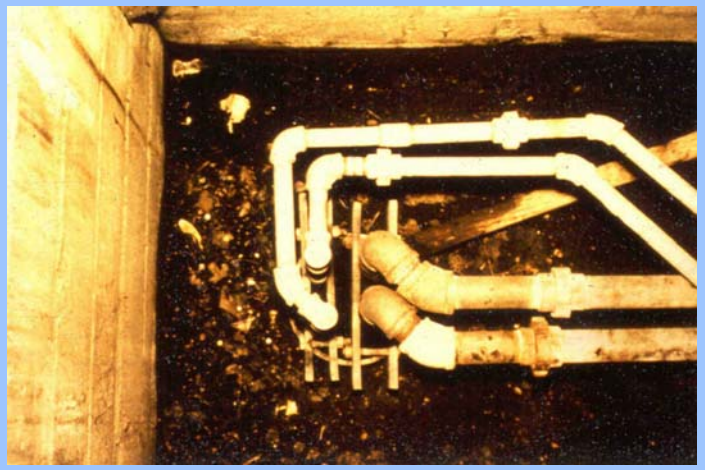
KLAMATH FALLS

- 500+ geothermal wells
- 100 to 2000 feet deep
- 100 to 220°F
- Majority use downhole heat exchangers
- City district heating system – 20 buildings
- Snow melting system
- Oregon Institute of Technology
- 86 MWt capacity, 200 billion Btu/yr
- 50,000 bbl saved per year

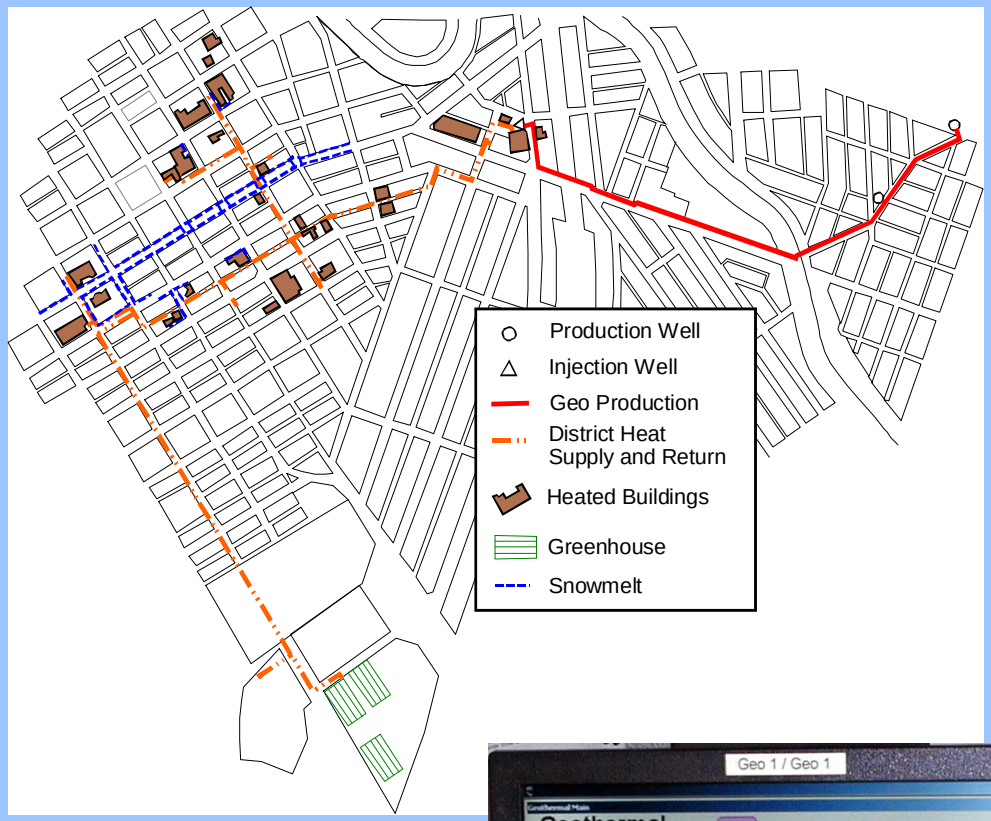


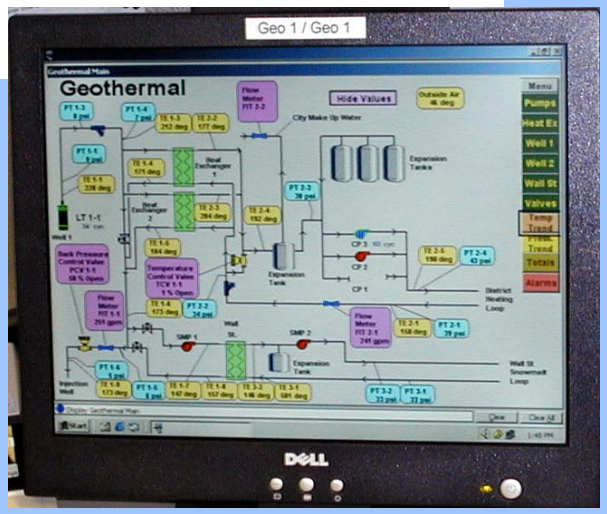
Klamath Falls

DHE

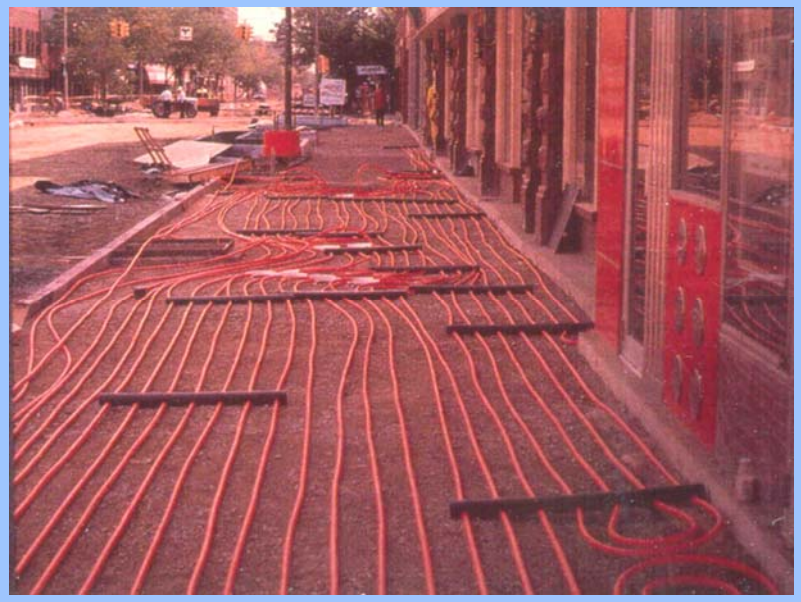


Klamath Falls City District Heating System





Klamath Falls snow melting system



OTHER KLAMATH FALLS DISTRICT HEATING USES

IFA Nursery – 4 acres – trees seedlings

KLAMATH BASIN BREWING COMPANY
Klamath Falls, Oregon

Both using the district heating system

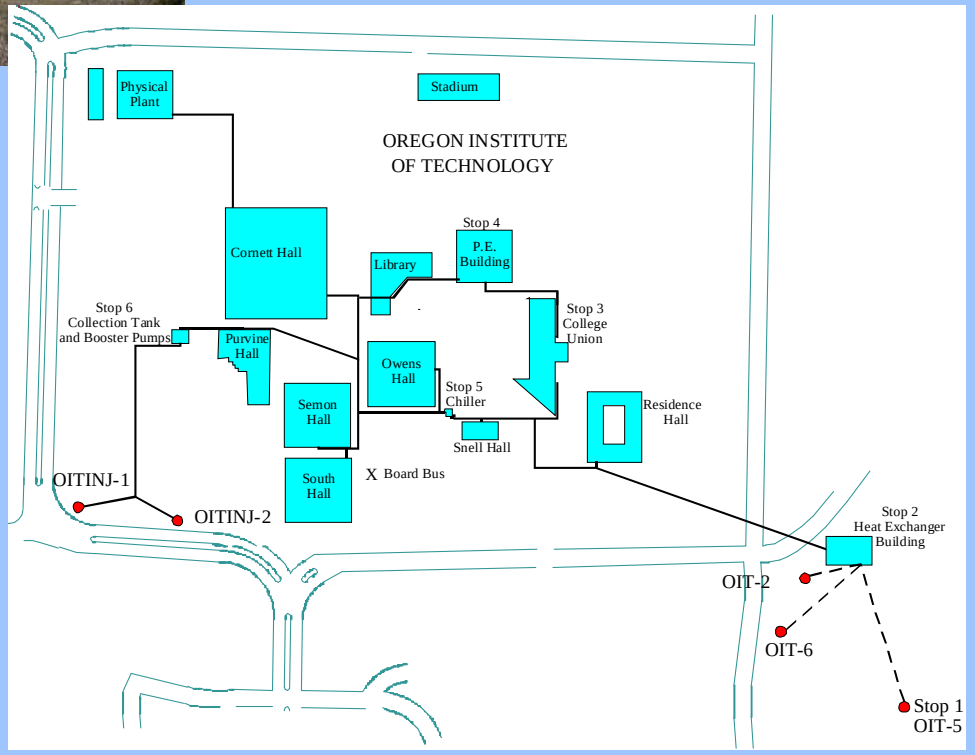
Oregon Institute of Technology

192ºF water

3 wells: 1,200 – 1,800 ft.

6 MWt – 11 mil. Btu/hr

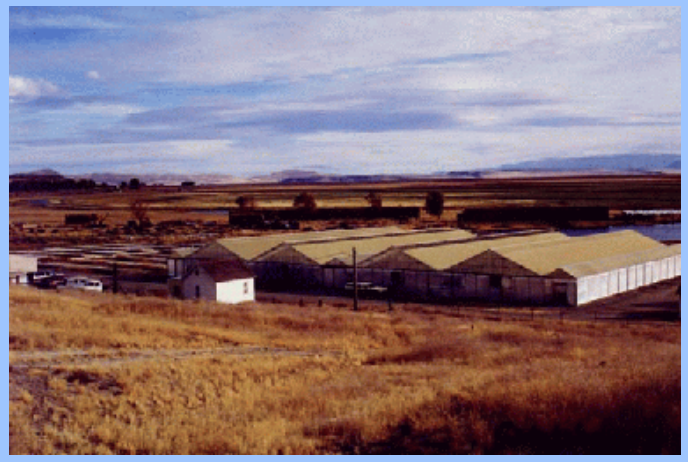
Saving $1mil/yr



“Gone Fishing” –African Cichlids

Ron Barnes

Liskey's Greenhouses



Biodiesel

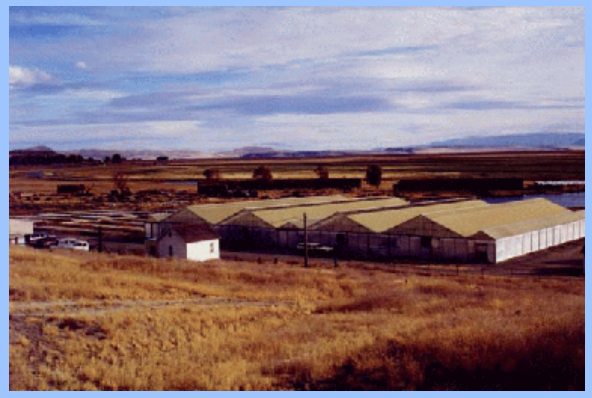
Bio-tactics

Feed stock for predator mites

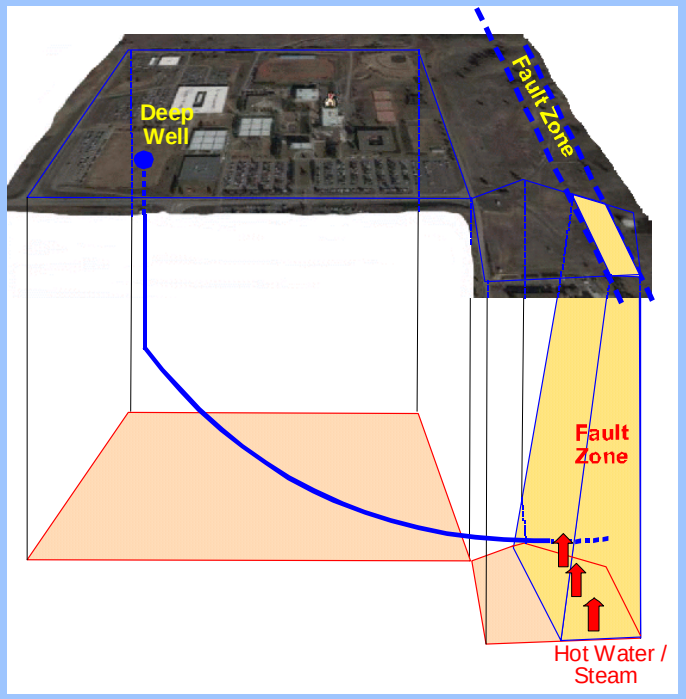
Organic vegetables

New and Future Projects

Liskey's Ranch



Oregon Institute of Technology



Olene Gap

Liskey's Ranch

- Raser Technologies proposing installation of 40 MW power on 6 acres of the ranch
- Everything is progressing
- Klamath County approved conditional use permit
- Working on plant design
- Permits have been submitted
- Cooling water

Olene Gap

- **Several owners have been in contact with us exploring geothermal power possibilities**

OIT Proposed Geothermal Projects

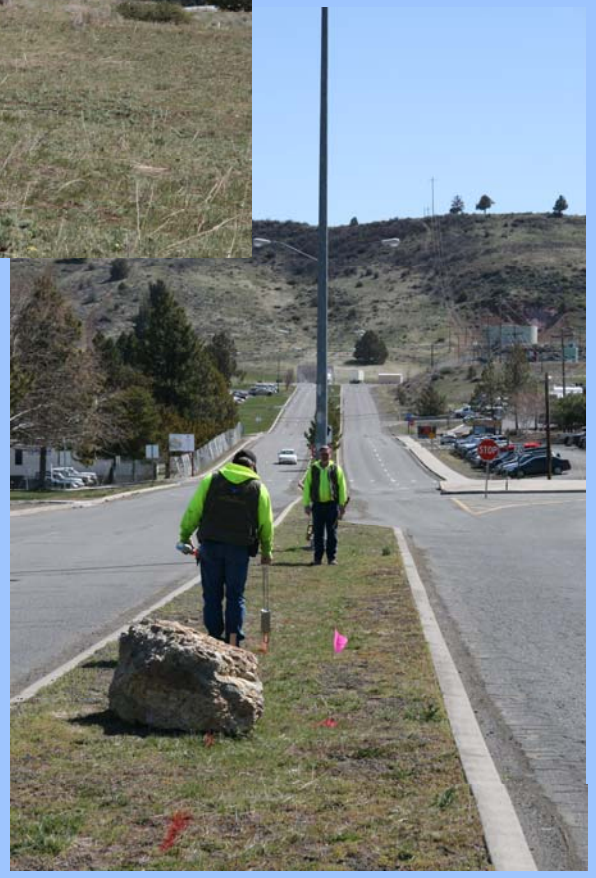
- **Low temperature power plant: 200 kW**
- **High temperature power plant: 1 MW**
- **Incubator greenhouses**
- **Incubator aquaculture ponds**
- **Geothermal heat pump training center**
  OIT - Portland
- **OIT = 100% renewables = “all green”**
  = net zero energy use

High Temperature Power Generation

- Drilling a deep well to 5,000 to 6,000 ft
- Based on geochemistry analysis - >300^{o}F should be encountered
- Single flash steam power plant
- Will provide 100% of campus electrical demand
- Saving $500,000 per year
- Reject water used to supply additional heat to campus and to surrounding buildings - $200,000
- Could also run a binary plant (bottoming cycle) – potential income by net metering
- Used as a demonstration site and student laboratory

Where is OIT at in the process?

- Obtained a $1 million federal earmark
- State is matching the $1 million
- Federal grant requires an EA
- Seismic Survey completed waiting for results
- Hopefully drilling in September



Low Temperature Power Generation

- Use existing wells at approx. 500 gpm
- Take 15ºF off the top (192 - 177ºF)
- Remainder used to heat campus
- Binary (organic Rankine cycle) power plant
- Water cooling though a cooling tower (70ºF)
- Provide 20% of electrical energy use
- Saving $100,000 per year
- Demonstration site and student laboratory

Incubator Site Greenhouses and Aquaculture Facility

- Several 6,000 sq. ft. greenhouses with different heating systems
- Several 3,000 sq. ft. aquaculture ponds with building enclosing fiberglass tanks
- Research and demonstration site for students in cooperation with KCC and OSU Ag. Extension Office
- Incubator site for potential commercial spin-off facilities in the Basin
- Cooperation with Klamath Country Economic Development Association
- Similar to those at New Mexico State University

Geothermal Heat Pumps Training Facility OIT - Portland

- Purchasing a demonstration trailer
- Demonstration heat pump units on campus
- Thermal conductivity test equipment
- Providing training courses on campus and around the state for:
  - Designers
  - Installers
  - Drillers
  - Students

Cost and Time

- **Low temperature power plant: $800,000**
- **High temperature power plant: $5,000,000**
- **Incubator greenhouse: $300,000**
- **Incubator aquaculture facility: $300,000**
- **Geothermal heat pump facility: $100,000**
- **Most will start summer/fall 2008**

THANK YOU