Renewable Energy & Sustainable Development Projects at Chena Hot Springs, Alaska

presented by:

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Chena Hot Springs Resort

2006 SMU Conference

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CHENA HOT SPRINGS RESORT Alaska

VISION:

To become a self-sustaining community in terms of energy, food, and fuel to the greatest possible extent

Chena Hot Springs

- Discovered in 1905
- Privatized in 1907
- Purchased by the Karls in 1998
- 13,000+ overnight guests in 2005
- 60,000 additional day visitors
- Largest wintertime destination in Fairbanks North Star borough

District Heating

- First geothermal well drilled in November 1998

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- All buildings on property are heated geothermally using ~300gpm of 165°F water
- Estimated yearly savings of $183,000 in heating fuel coats

Moose Lodge, 20,000ft² heated solely with geothermal district heating system

Greenhouse & Gardens

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- Producing crops for onsite use on a year-round basis

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- First greenhouse established in 2004 as a joint project between Chena Hot Springs and UAF
- Producing crops for onsite use on a year-round basis
- New 5000ft greenhouse recently completed for 2006 season
- Heated from geothermal wells but could operate off any waste heat source

Greenhouse & Gardens

Geothermally Heated Greenhouse #2
at Chena Hot Springs Resort

Greenhouse & Gardens

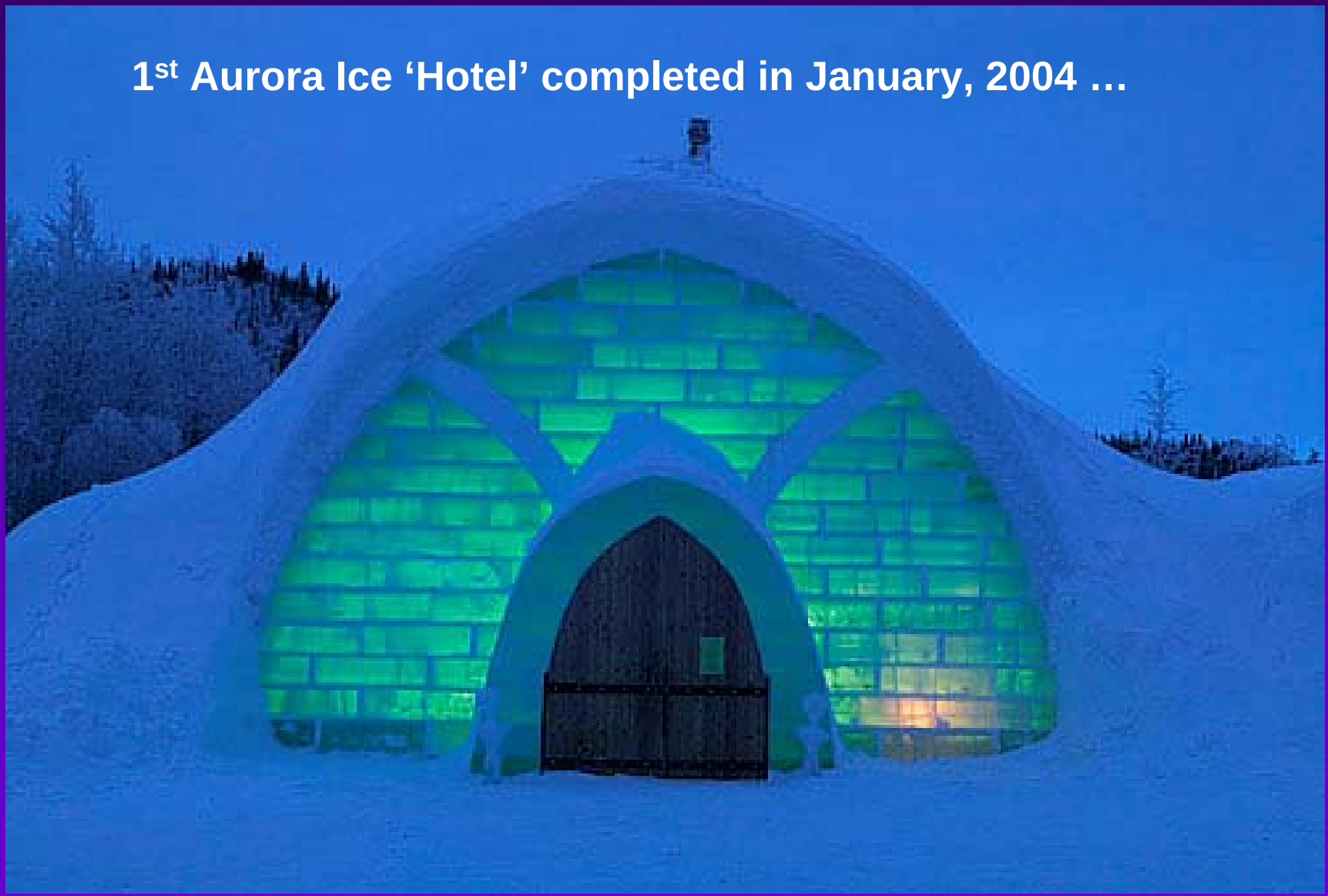
Chena Hot Springs Resort Alaska

Absorption Chiller

Chena Hot Springs Absorption Chiller: designed to keep the Aurora Ice Museum 'on ice' year-round

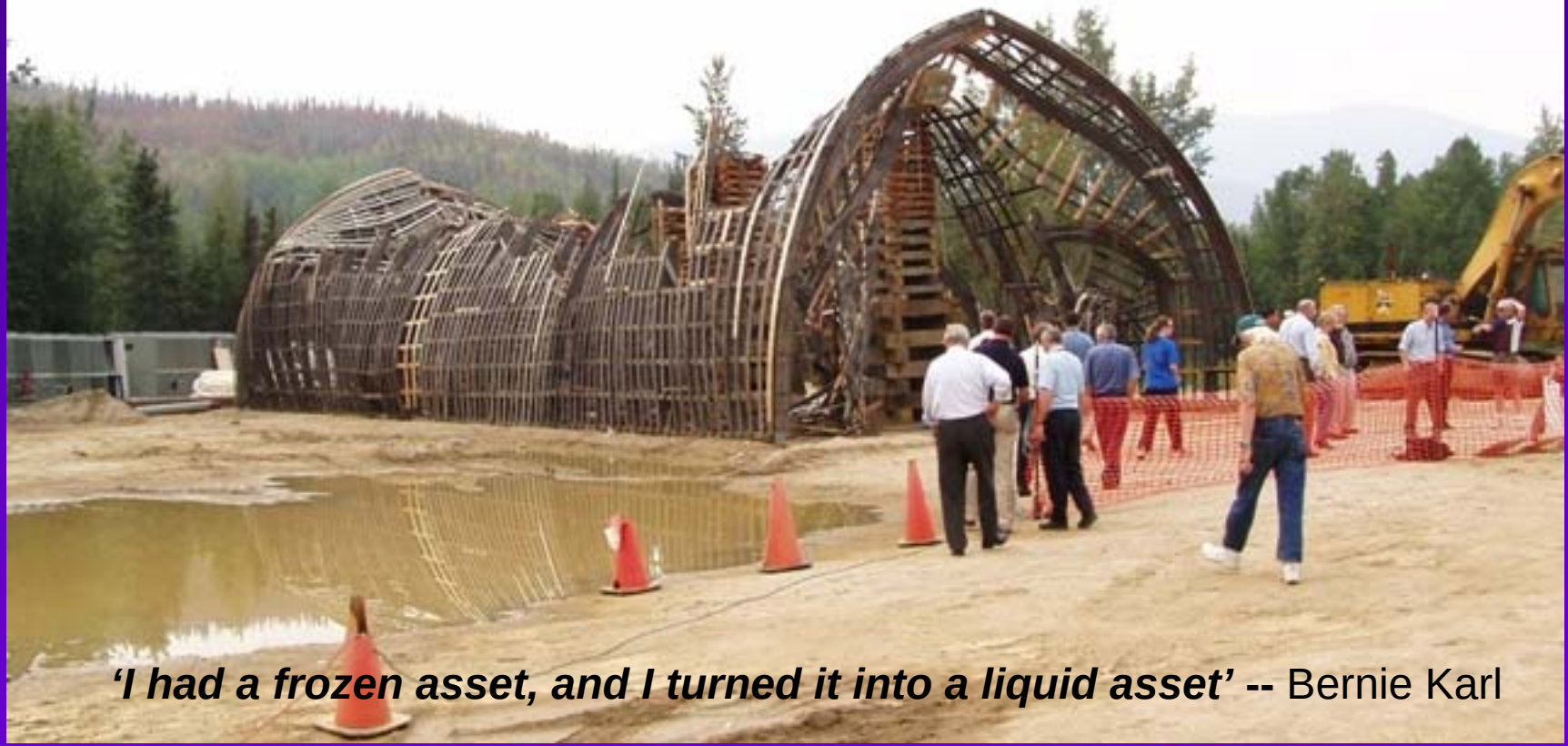
AURORA ICE MUSEUM

1st Aurora Ice 'Hotel' completed in January, 2004 …



AURORA ICE MUSEUM

Voted 1st Aurora Ice Hotel in North America in 2004 by Forbes Magazine



'I had a frozen asset, and I turned it into a liquid asset' **--** Bernie Karl

AURORA ICE MUSEUM

AURORA ICE MUSEUM

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CHENA HOT SPRINGS ABSORPTION CHILLER

Monument Creek Provides Cooling Water (~40F)

Geothermal Wells Provide Hot Water (~165F)

Approximately 15 tons of Refrigeration Required for Ice Museum (180,000 BTU per hour)

Renewable Energy

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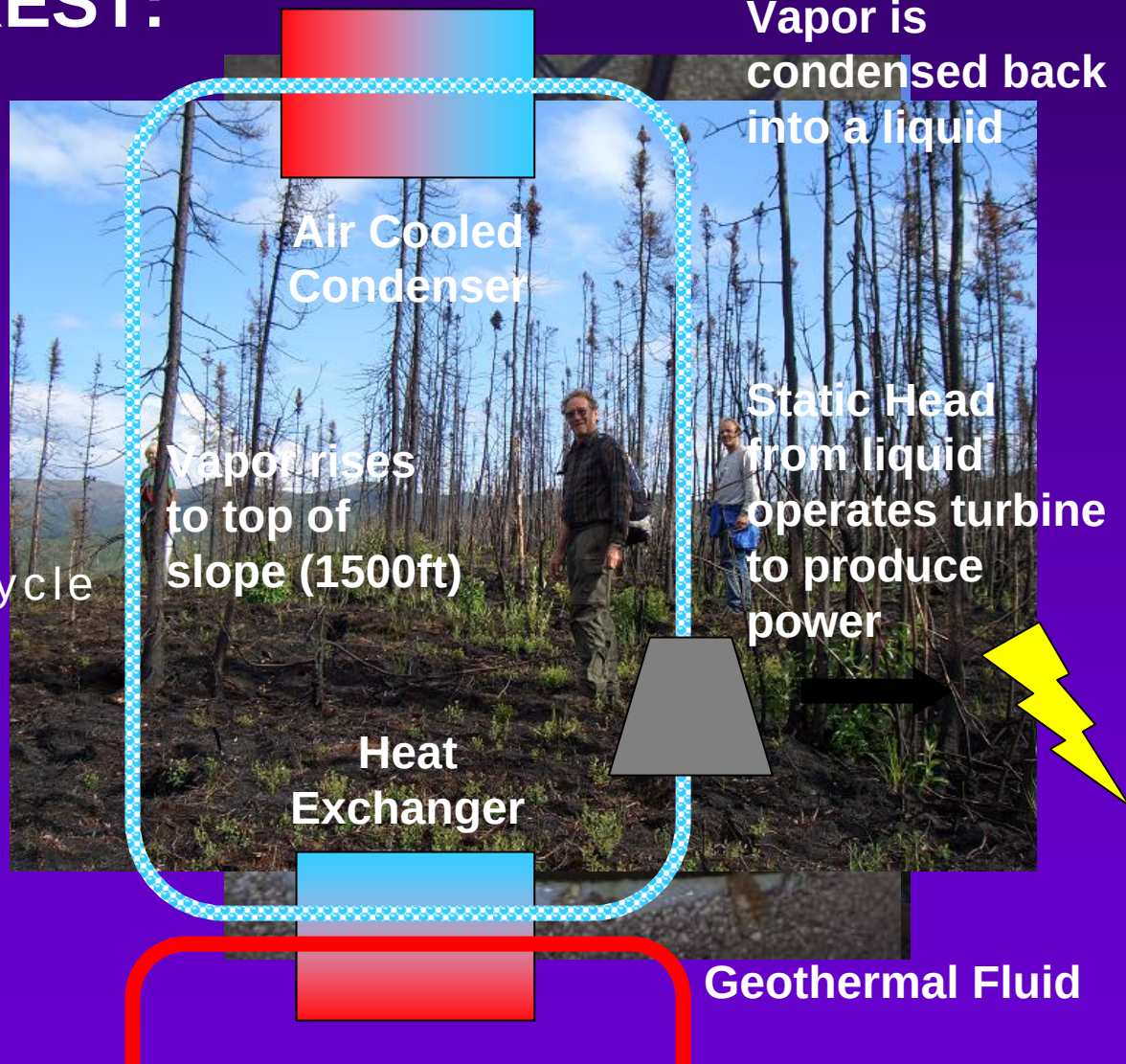
Renewable Energy

AREAS OF INTEREST:

- Geothermal
- Hydropower
- Solar Power
- Wind Power
- Biomass Project
- Artificial Hydrologic Cycle
- Hydrogen



ORC Geothermal Power Plant

for

Chena Hot Springs

Project Participants:

- ***Chena Hot Springs Resort***
- ***Chena Power***
- ***Alaska Energy Authority***
- ***United Technologies Corporation***

Renewable Energy

WHY IS CHENA HOT SPRINGS IDEAL FOR DEMONSTRATION PROJECTS?

Semi-remote and off grid location replicates many challenges of remote installations, *including lack of on-site specialized technical knowledge*

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WHY IS CHENA HOT SPRINGS IDEAL FOR DEMONSTRATION PROJECTS?

Installation and O&M costs are reasonable due to location, yet can be extrapolated to other more remote sites

Renewable Energy

WHY IS CHENA HOT SPRINGS IDEAL FOR DEMONSTRATION PROJECTS?

Has numerous natural resources opportunities

WHY IS CHENA HOT SPRINGS IDEAL FOR DEMONSTRATION PROJECTS?

- Has accommodations to host conferences and workshops

WHY IS CHENA HOT SPRINGS IDEAL FOR DEMONSTRATION PROJECTS?

- Personal motivation of owners

Modified Chiller

Given:

Market for low-temperature heat driven ORC systems is limited because inherently low thermal efficiency results in high equipment cost.

Air-conditioning equipment has 3 to 4 times lower capital cost than equally sized power generating equipment (including existing ORC systems)

Idea:

Use existing air-conditioning equipment with minimum hardware modifications.

PureCycle 200 Product

- Put on the Market in 2003 by UTC Power
- Operates off waste heat >500°F
- Uses R245 Refrigerant

PureCycle 200 Operating off Landfill Flare in Austin, TX

PureCycle 200 Product

Partnership formed between Chena Hot Springs and UTC in 2004 to adapt PureCycle 200 for use in low temperature geothermal systems

Chena Power Plant

FIRST 200kW UNIT FOR CHENA HOT SPRINGS:

- **First 200kW has been built and commissioned**
- **Has been operating in bypass mode for 2 weeks**
- **Began operation in full power production mode on February 15th**
- **Is currently putting out net 230kW**
- **Anticipated shipping date is April 15th**

Chena Power Plant

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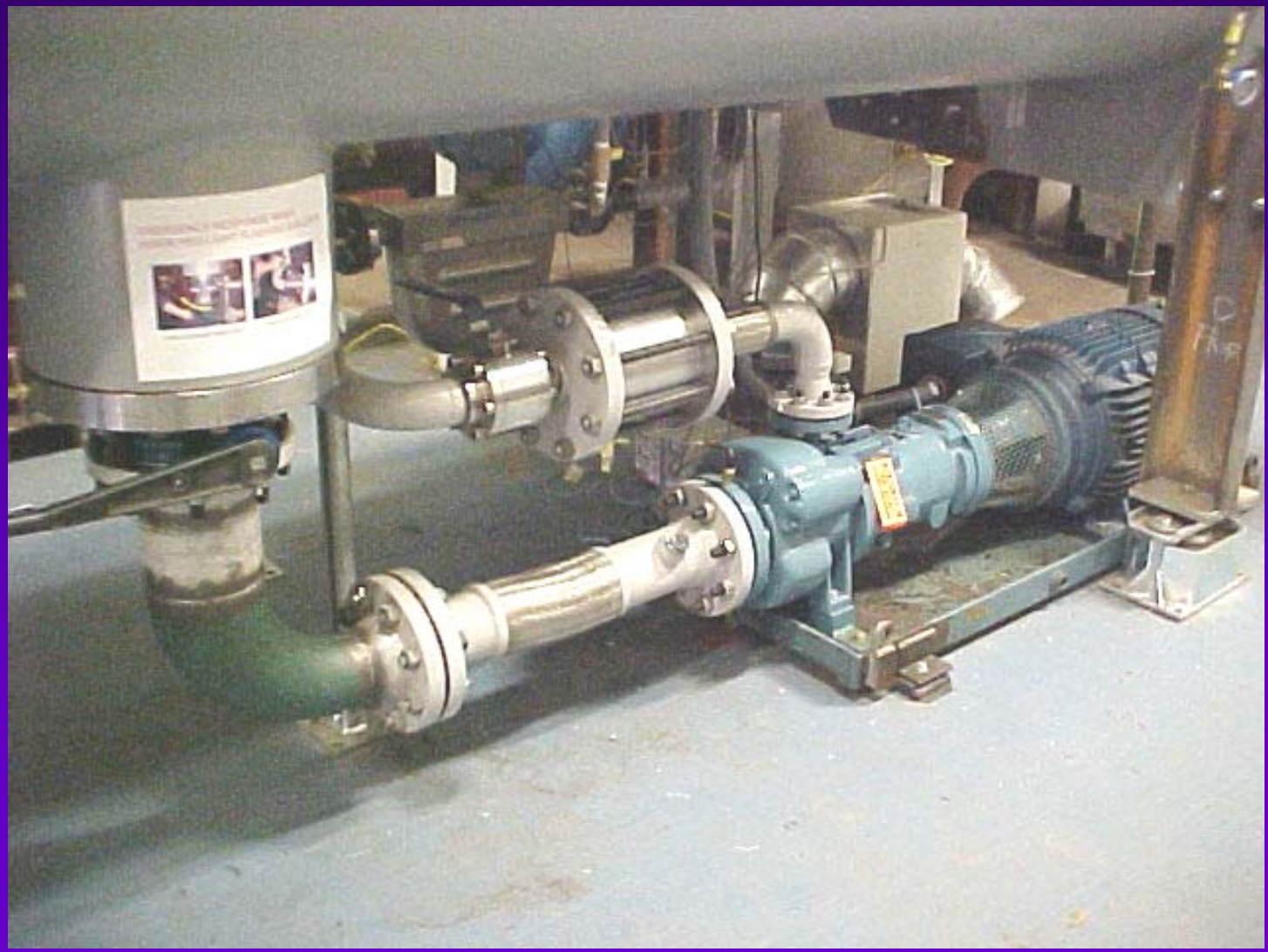

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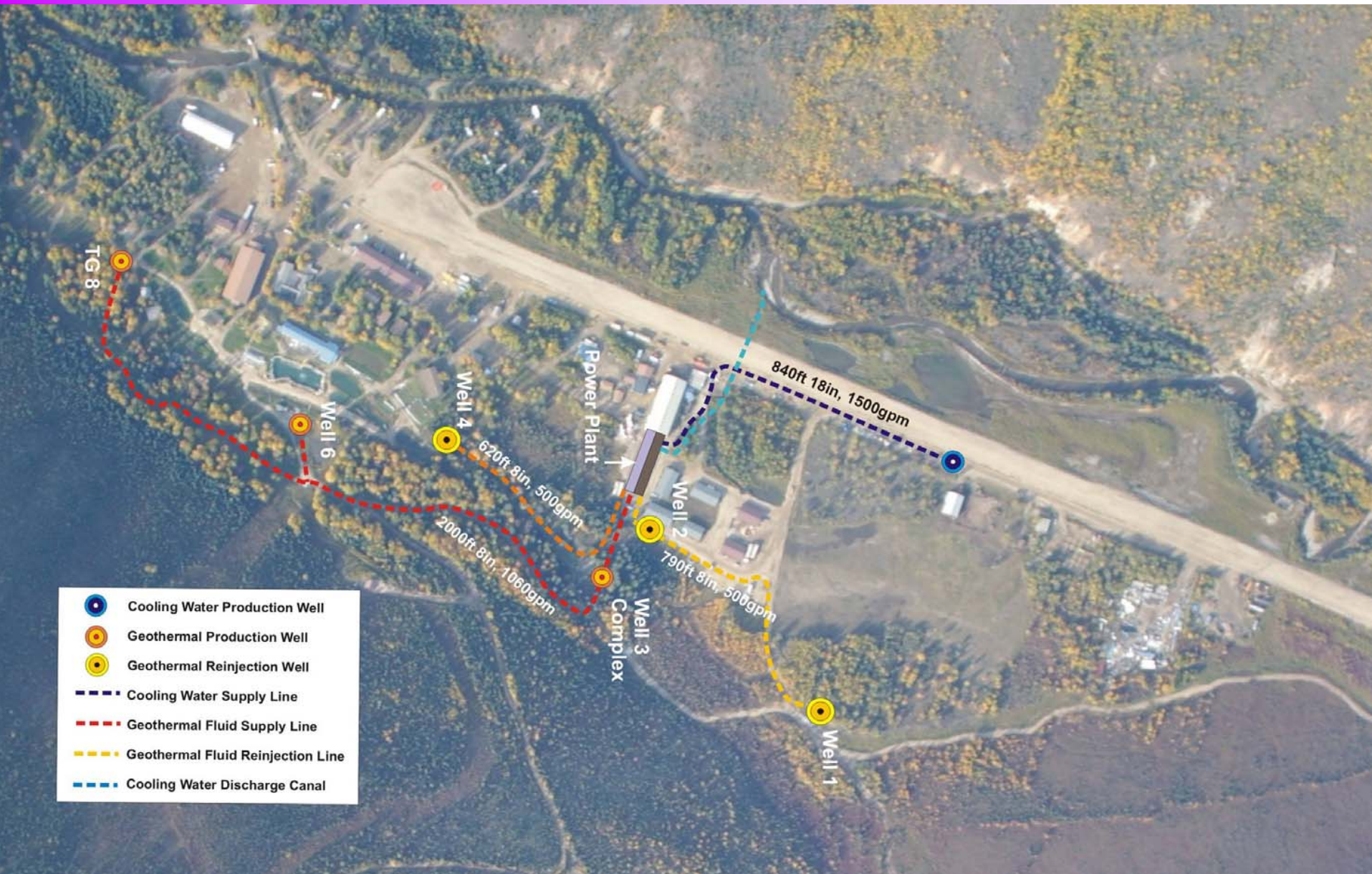


Chena Power Plant

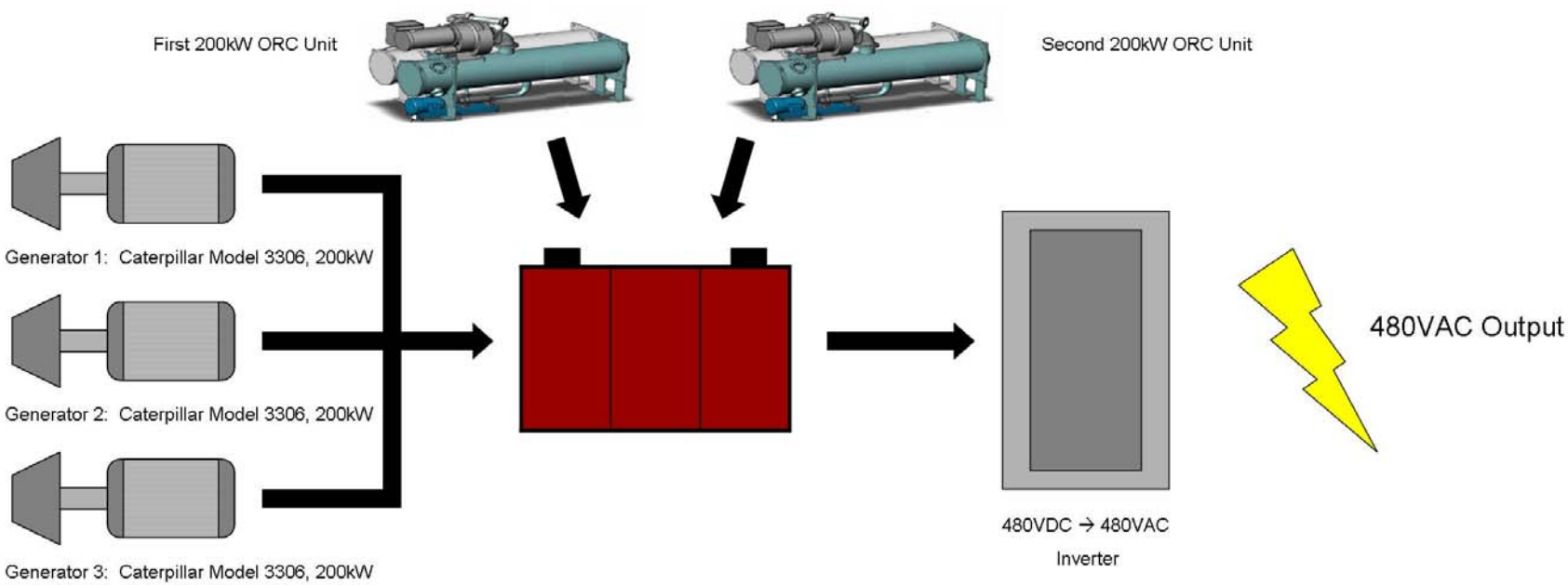
Battery and UPS System

UPS System (MGE)

Batteries 3MW Total

Battery and UPS System

Final configuration of Chena Power Plant; paralleling of generators and geothermal ORC units with 480VAC output



CHENA HOT SPRINGS RESORT

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