From Alaska to Florida

Finding the Heat for Community Development

Presented by: **Bernie Karl, Chena Hot Springs Resort**

SMU Geothermal Meeting: Dallas, TX, June 17th, 2008

Chena Hot Springs

Chena Hot Springs

Chena Hot Springs

- Semi remote site
- Electric Power 30¢/kWhr
- Load 180kW-380kW

- Average $1000/day spent on diesel fuel in 2004
- $550,000 per year in fuel costs at today's price

Chena Hot Springs VISION:

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

District Heating

- First geothermal well drilled in March 1998

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- First geothermal well drilled in March 1998
- All buildings on property are heated geothermally using ~300gpm of 165° F water
- Estimated yearly savings of $383,000 in heating fuel coats

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

Greenhouse & Gardens

Geothermally Heated Greenhouse #2 at Chena Hot Springs Resort

Aurora Ice Museum

CHENA HOT SPRINGS RESORT Alaska

CHENA HOT SPRINGS ABSORPTION CHILLER

Monument Creek Provides Cooling Water (~40F)

Geothermal Wells Provide Hot Water (~165F)

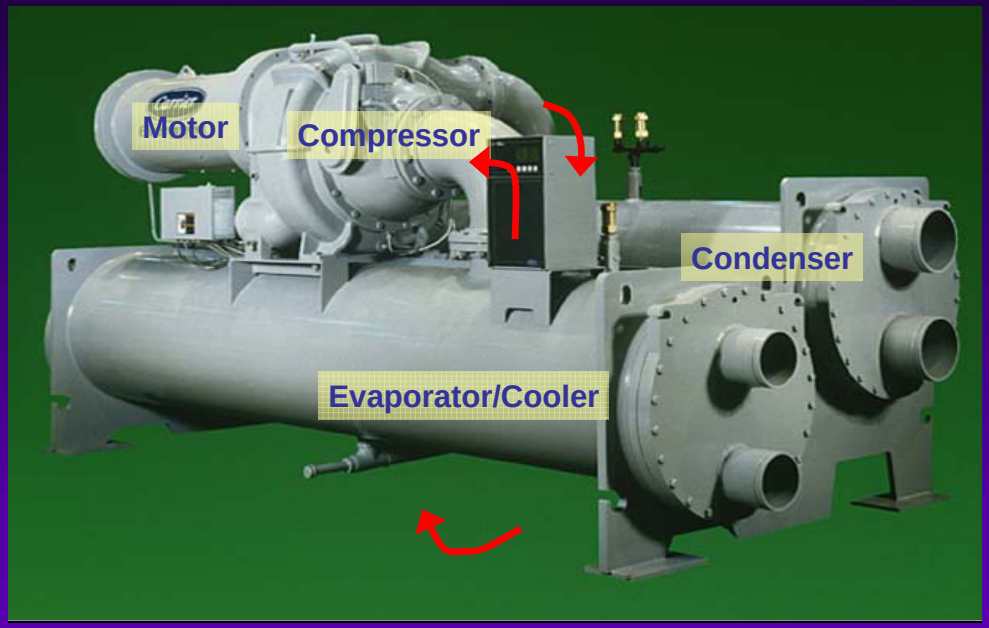
Approximately 15 tons of Refrigeration Required for Ice Museum (180,000 BTU per hour)

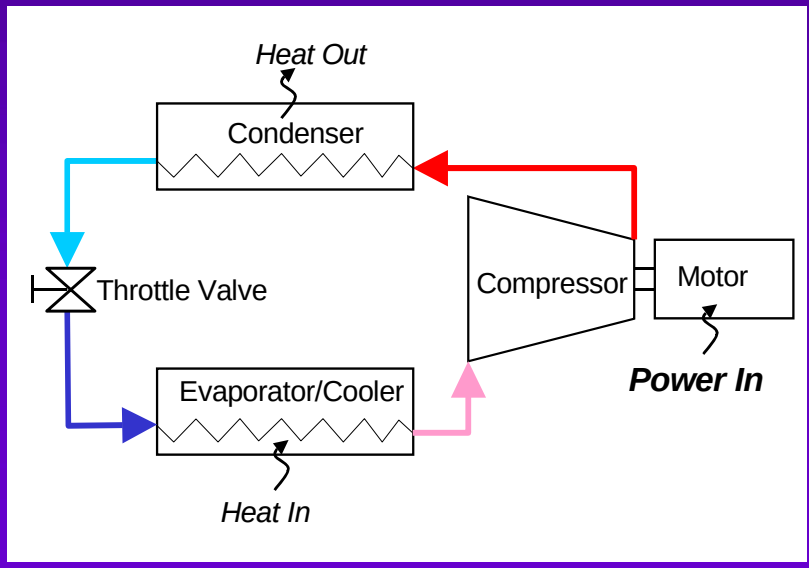
Chena Power Plant

United Technologies Corporation
Department of Energy

Chena Hot Springs/Chena Power
Alaska Energy Authority

UTC PureCycle 225

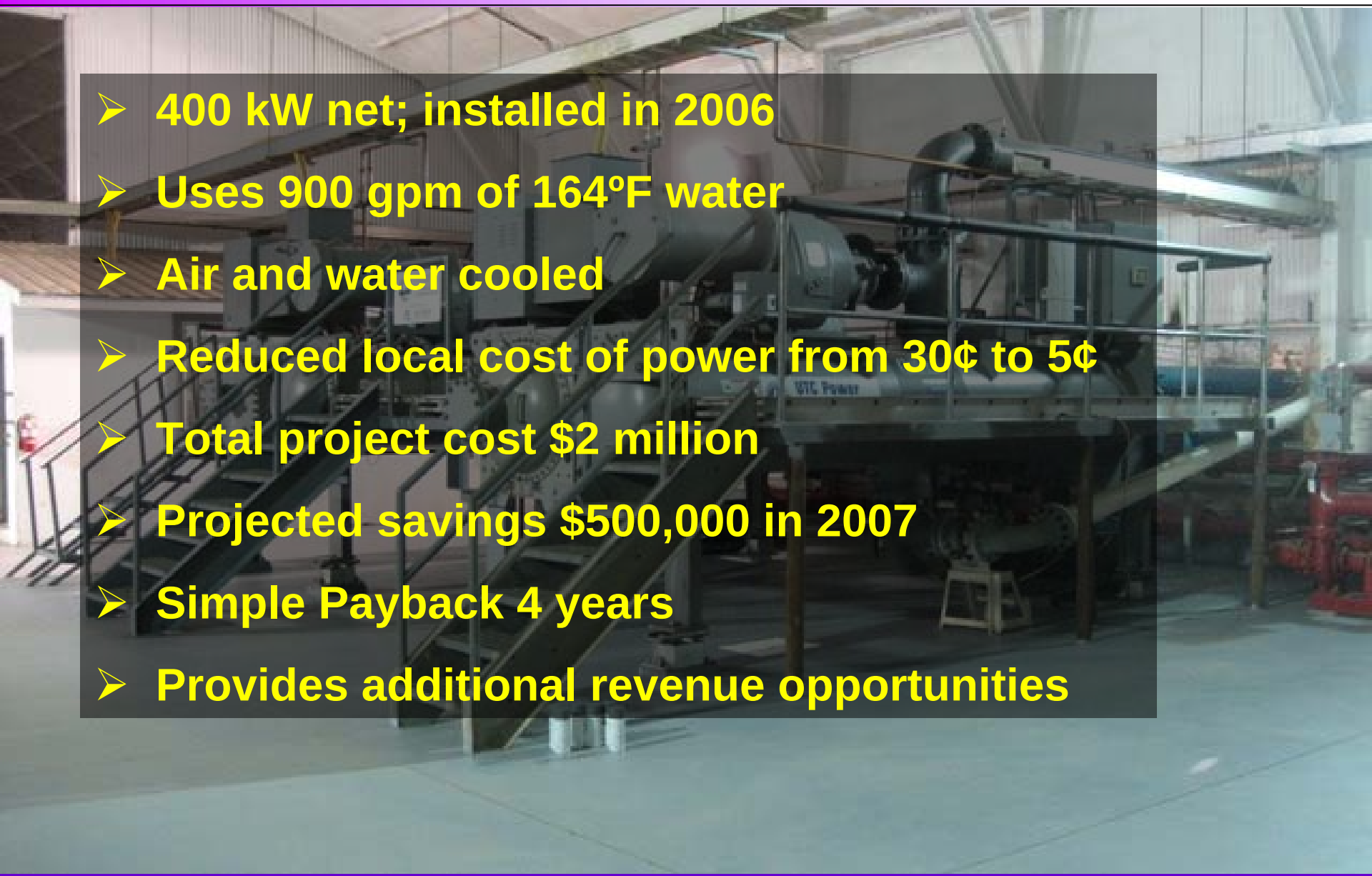




Refrigeration Cycle

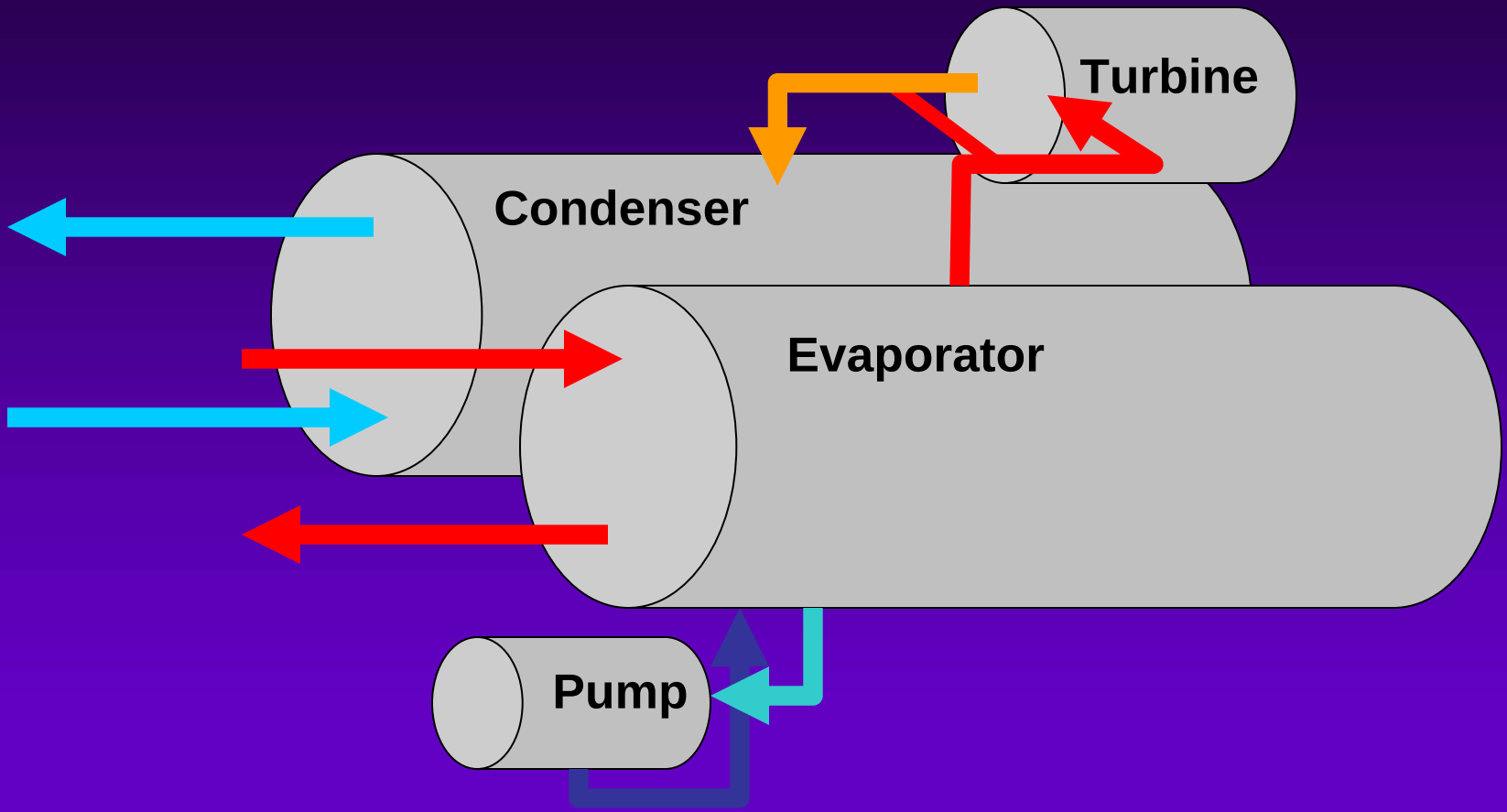
Chena Power Plant

Chena Power Plant



- 400 kW net; installed in 2006
- Uses 900 gpm of 164ºF water
- Air and water cooled
- Reduced local cost of power from 30¢ to 5¢
- Total project cost $2 million
- Projected savings $500,000 in 2007
- Simple Payback 4 years
- Provides additional revenue opportunities

Chena Power Plant



Hot Water Supply

Hot Water Supply

Cold Water Supply

Cold Water Supply

Air Cooled Condenser

Battery and UPS System

UPS System (MGE)

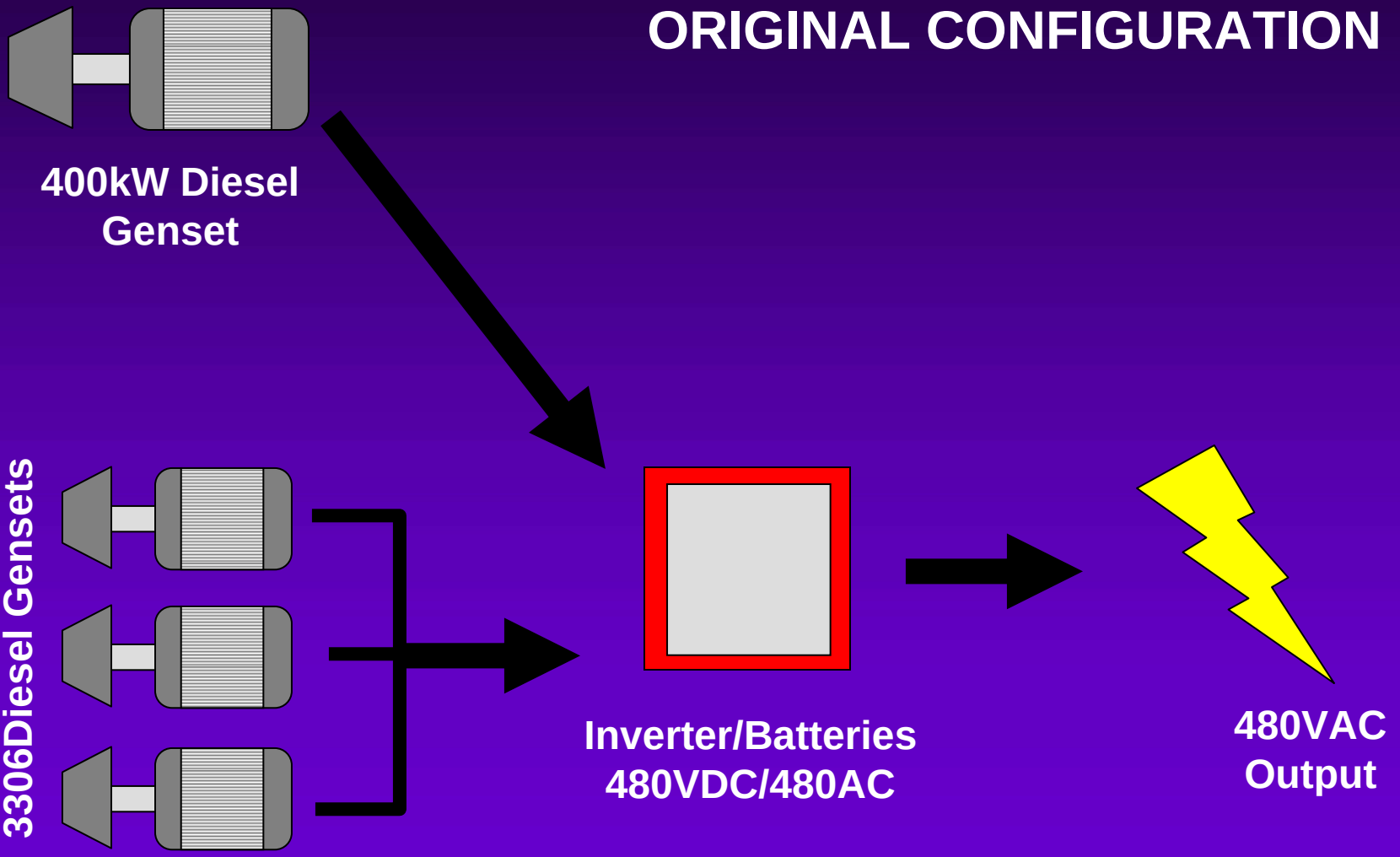
Batteries 3MW Total

Geothermal Energy is an ideal base load – doesn't depend on sun, wind, rainfall. 99% Availability is common.

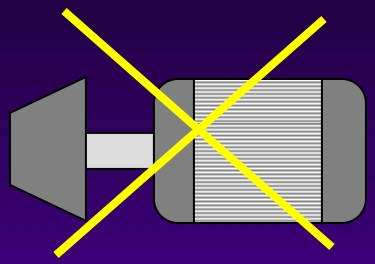
Cannot respond quickly to load fluctuations

Battery and UPS System

ORIGINAL CONFIGURATION

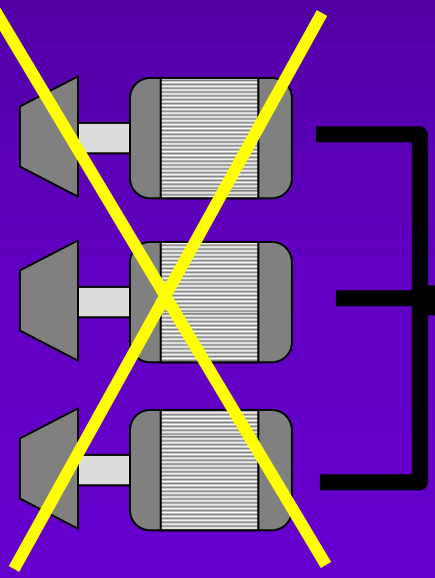


Battery and UPS System

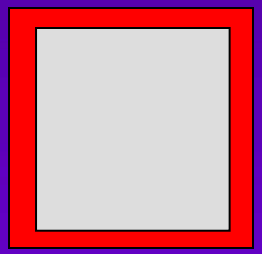


400kW Diesel Genset

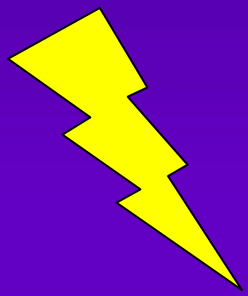
Excess Power to Charge Batteries



200kW Cat 3306Diesel Gensets



Inverter/Batteries 480VDC/480AC



480VAC Output

The bottom line

August 20th 2006 – December 31st 2007	
Hours of Operation	
Availability	
Capacity	
Gallons Diesel Offset	
$ Saved	
Tons CO_2 Avoided	

The bottom line

August 20th 2006 – December 31st 2007	
Hours of Operation	10,850
Availability	
Capacity	
Gallons Diesel Offset	
$ Saved	
Tons CO_2 Avoided	

The bottom line

August 20th 2006 – December 31st 2007	
Hours of Operation	10,850
Availability	95%
Capacity	
Gallons Diesel Offset	
$ Saved	
Tons CO_2 Avoided	

The bottom line

August 20th 2006 – December 31st 2007	
Hours of Operation	10,850
Availability	95%
Capacity (Ave output 175kW)	87.5%
Gallons Diesel Offset	
$ Saved	
Tons CO_2 Avoided	

The bottom line

August 20th 2006 – December 31st 2007	
Hours of Operation	10,850
Availability	95%
Capacity (Ave output 175kW)	87.5%
Gallons Diesel Offset	148,785
$ Saved	
Tons CO_2 Avoided	

The bottom line

August 20th 2006 – December 31st 2007	
Hours of Operation	10,850
Availability	95%
Capacity (Ave output 175kW)	87.5%
Gallons Diesel Offset	148,785
$ Saved	
Tons CO_2 Avoided	

The bottom line

August 20th 2006 – December 31st 2007	
Hours of Operation	10,850
Availability	95%
Capacity (Ave output 175kW)	87.5%
Gallons Diesel Offset	148,785
$ Saved	$365,555
Tons CO_2 Avoided	

The bottom line

August 20th 2006 – December 31st 2007	
Hours of Operation	10,850
Availability	95%
Capacity (Ave output 175kW)	87.5%
Gallons Diesel Offset	148,785
$ Saved	$365,555
Tons CO_2 Avoided	~ 1500

The bottom line

2007 Survey Results:

- 14% of visitors listed the Renewable Energy Projects as the #1 reason for coming to Chena Hot Springs during the summer of 2007
- Average 6.5 people per day participated in the free renewable energy tour (43% Alaskans)
- 11% increase in revenue during the same time period
- Over 600 students have participated in the tours

Chena Hot Springs Resort Alaska

Special thanks to the Department of Energy, the Alaska Energy Authority and the Denali Commission for their continued involvement and assistance.

U.S. DEPARTMENT OF ENERGY

DENALI COMMISSION ALASKA

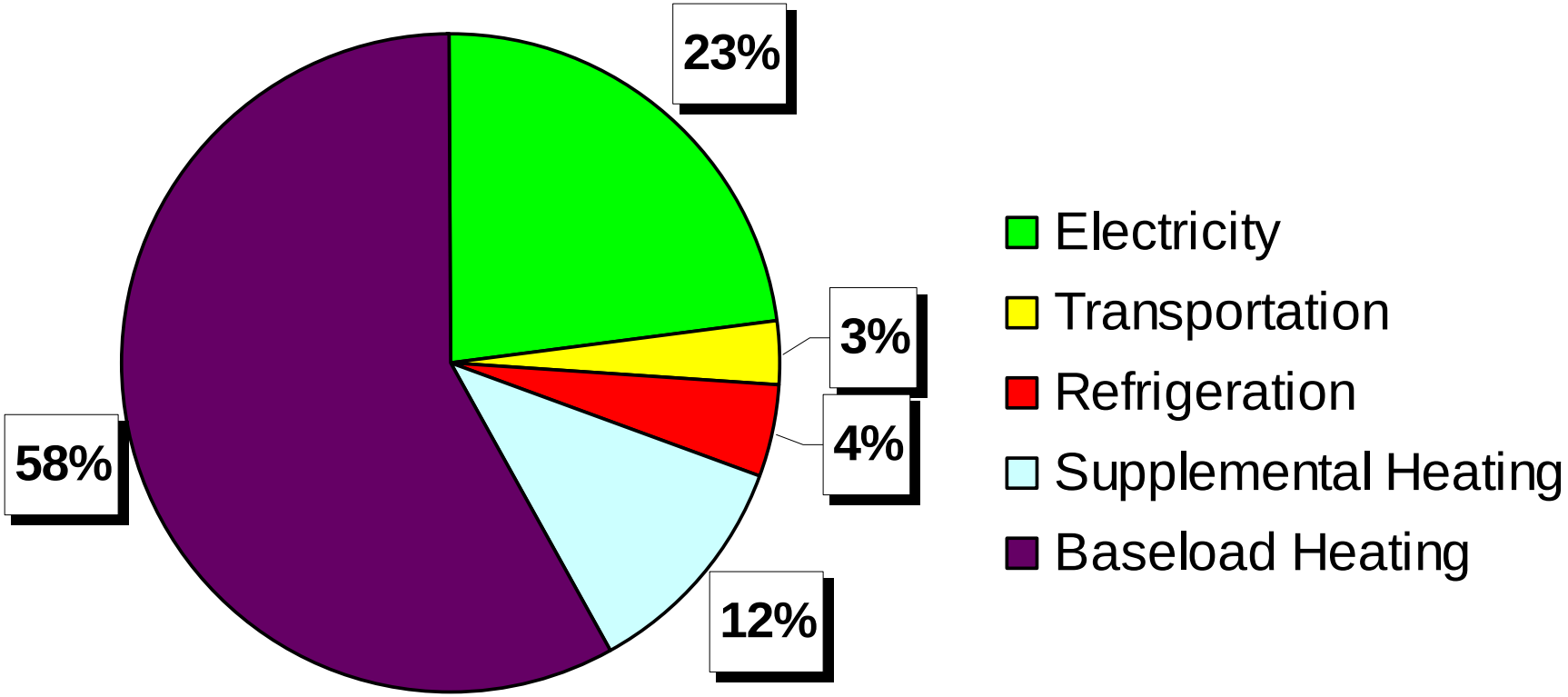
ALASKA ENERGY AUTHORITY

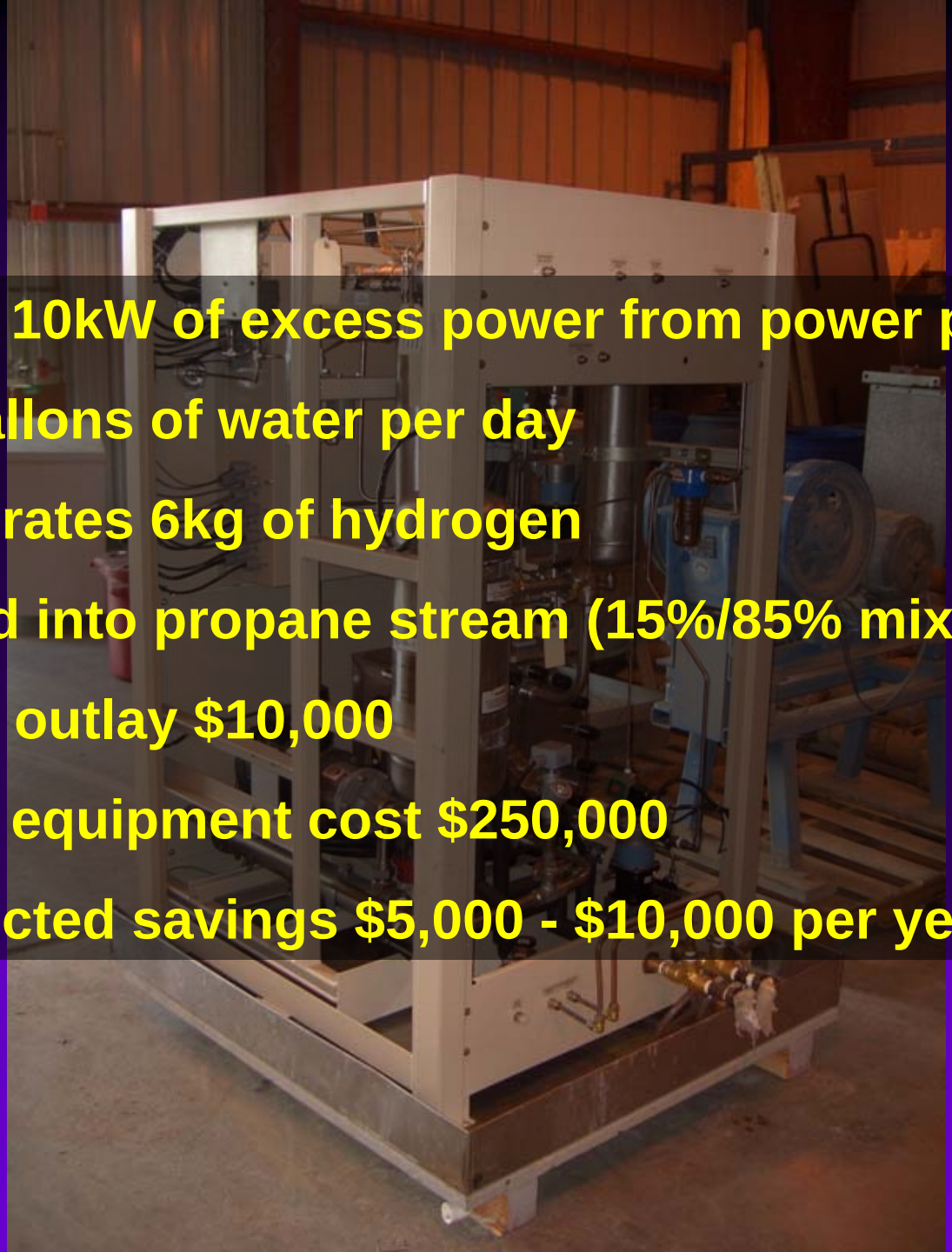
Project Awards and Recognition

Project of the Year
Renewable Energy Category
Power Engineering Magazine
PowerGen Conference 2006

2007 R&D 100 Award

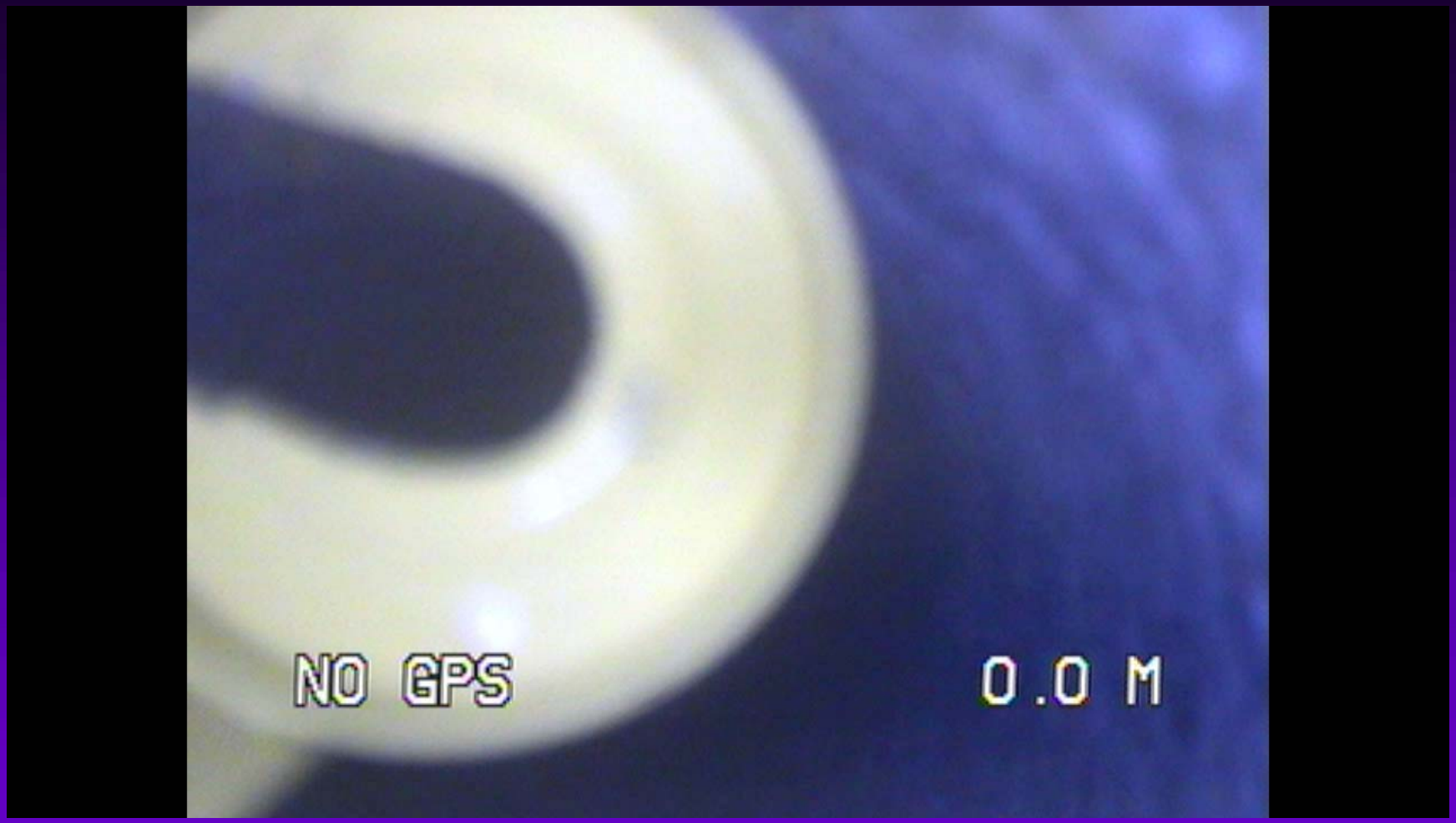
Energy Use at Chena Hot Springs (total 850 kW_{eq})





- Uses 10kW of excess power from power plant
- 50 gallons of water per day
- Generates 6kg of hydrogen
- Mixed into propane stream (15%/85% mix)
- Cash outlay $10,000
- Total equipment cost $250,000
- Projected savings $5,000 - $10,000 per year


CHENA HYDROGEN
PRODUCTION FACILITY



Xv

Today Show Video


QUANTUM
RESOURCES
JAY, FLORIDA

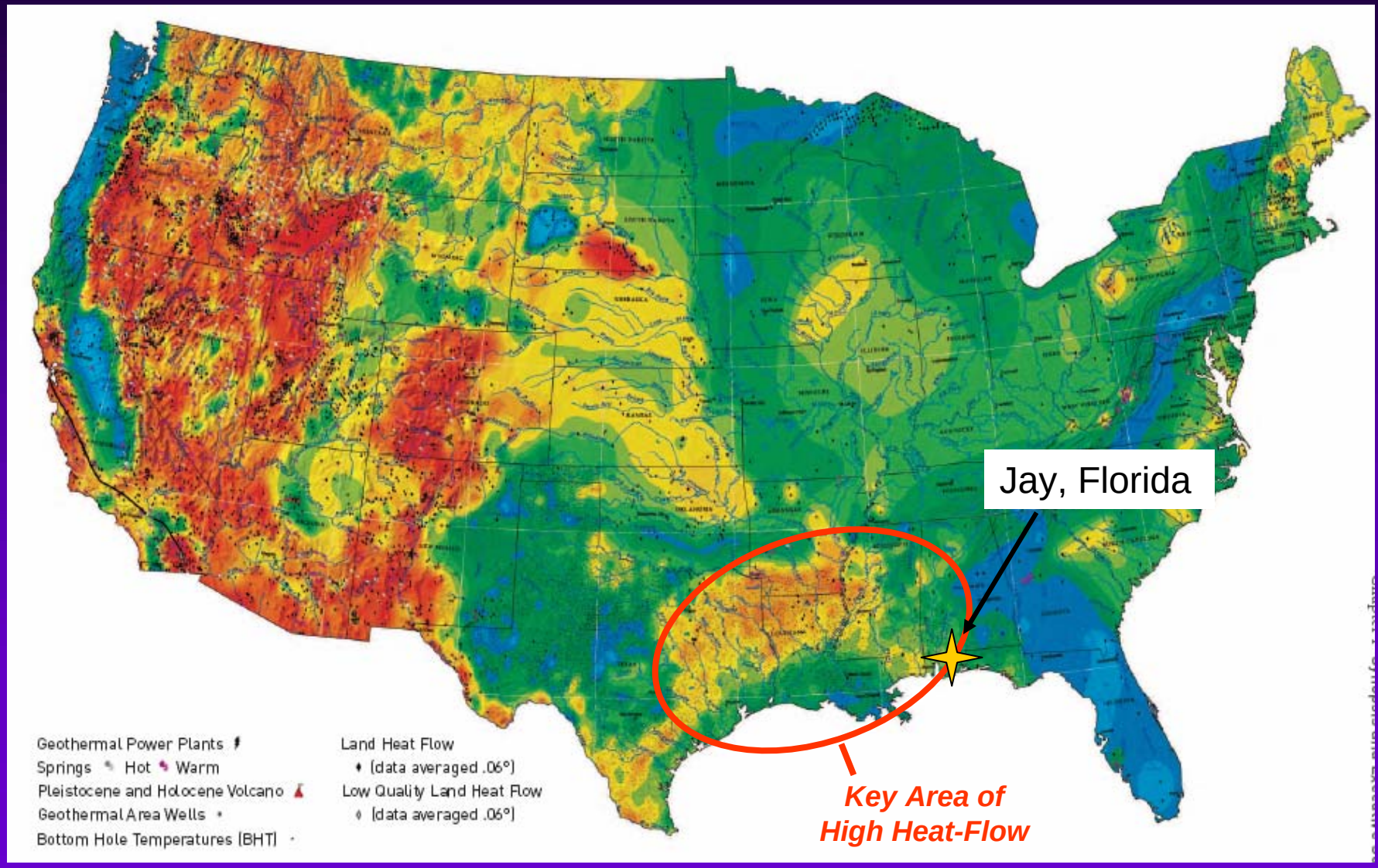
Quantum Resources

PROJECT PARTNERS:

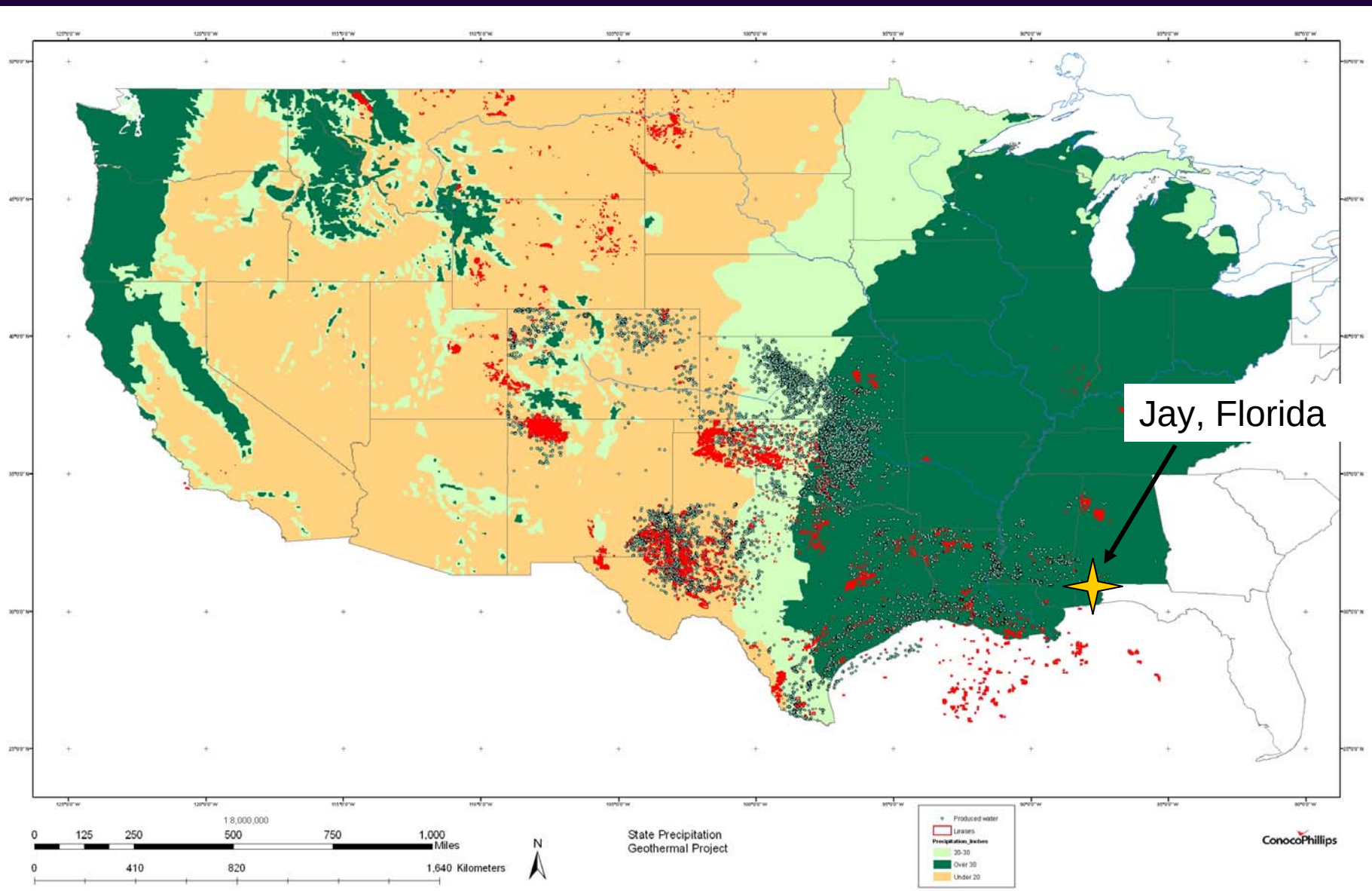
- **UTRC**
- **UTC Power**
- **Chena Power**
- **Quantum Resources Management**
- **Department of Energy**


Chena Hot Springs
4,732 miles
Jay, Florida

Quantum Resources



Quantum Resources



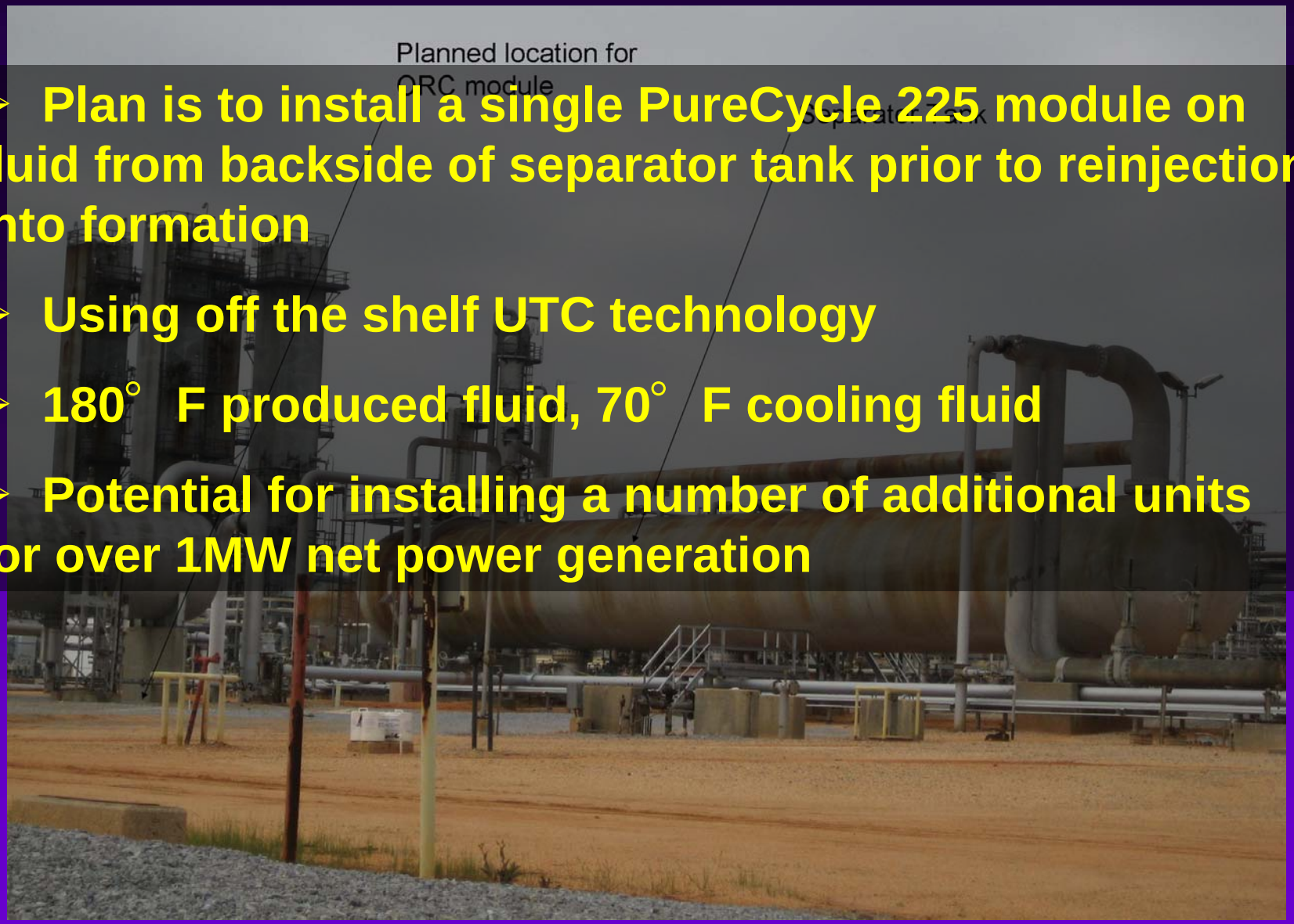
Quantum Resources

Quantum Resources

- Owned and operated by Quantum Resources
- Field discovered in 1970
- Over 400 million barrels of oil have been extracted
- 20 million barrels estimated remaining
- 4,500 barrels per day of crude produced
- 120,000 barrels per day of co-produced water at 200° F
- Hot water represents ~95% of fluid stream

Quantum Resources

Quantum Resources



- Plan is to install a single PureCycle 225 module on fluid from backside of separator tank prior to reinjection into formation
- Using off the shelf UTC technology
- 180° F produced fluid, 70° F cooling fluid
- Potential for installing a number of additional units for over 1MW net power generation

CHENA HOT SPRINGS RESORT

www.chenahotsprings.com

Mile 56 Chena Hot Springs Rd, Fairbanks, AK

(907) 451-8104

Bernie Karl

Proprietor

recycle@polarnet.com

(907) 451-8104

CHENA HOT SPRINGS RESORT
Alaska