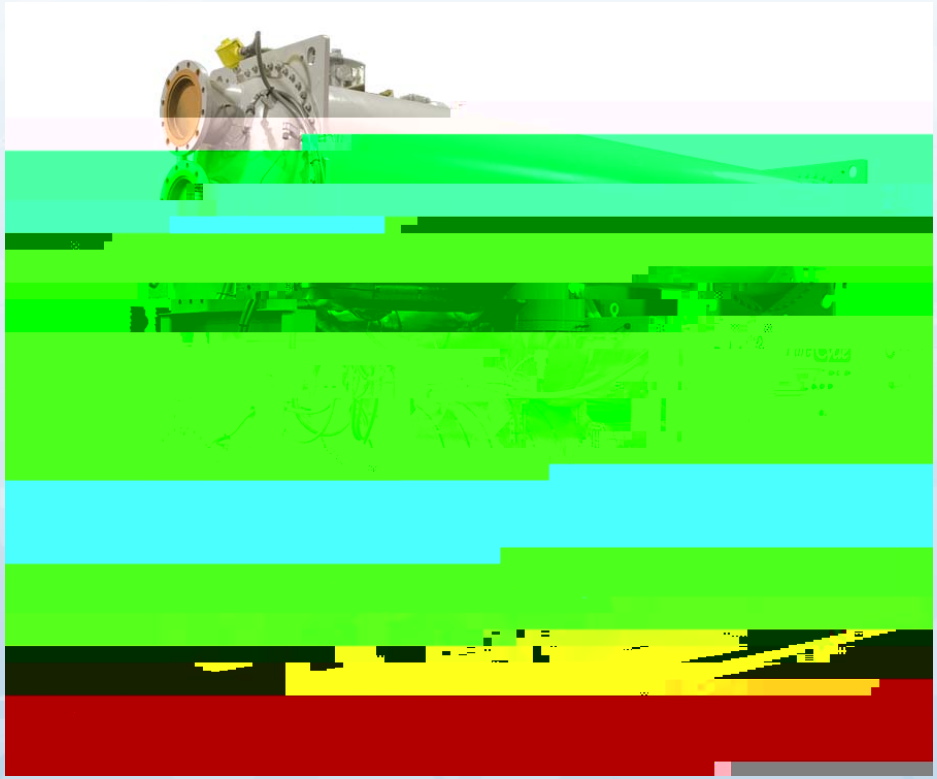
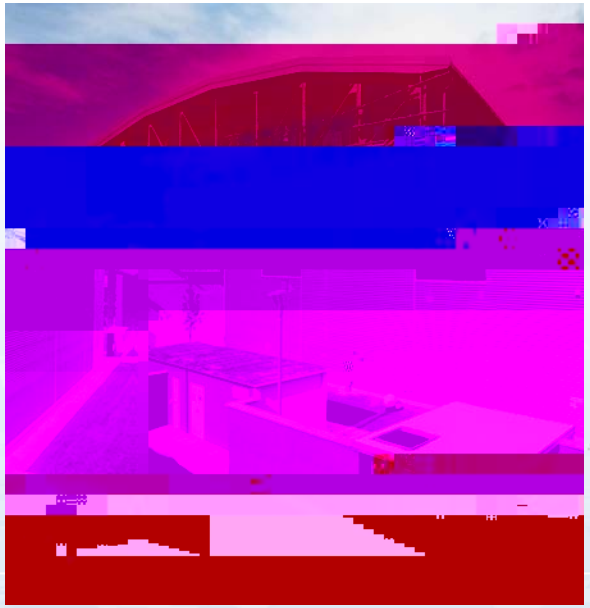
Pratt & Whitney
A United Technologies Company

Geothermal Power Generation From Oil & Gas Wells



An Overview of the PureCycle® Power System

Turboden Acquisition



Turboden Headquarters – Brescia, Italy

600KW ORC by Turboden Shown

100 ORC's Operating, 400KW – 2.2MW, High Efficiency, Proven Reliability

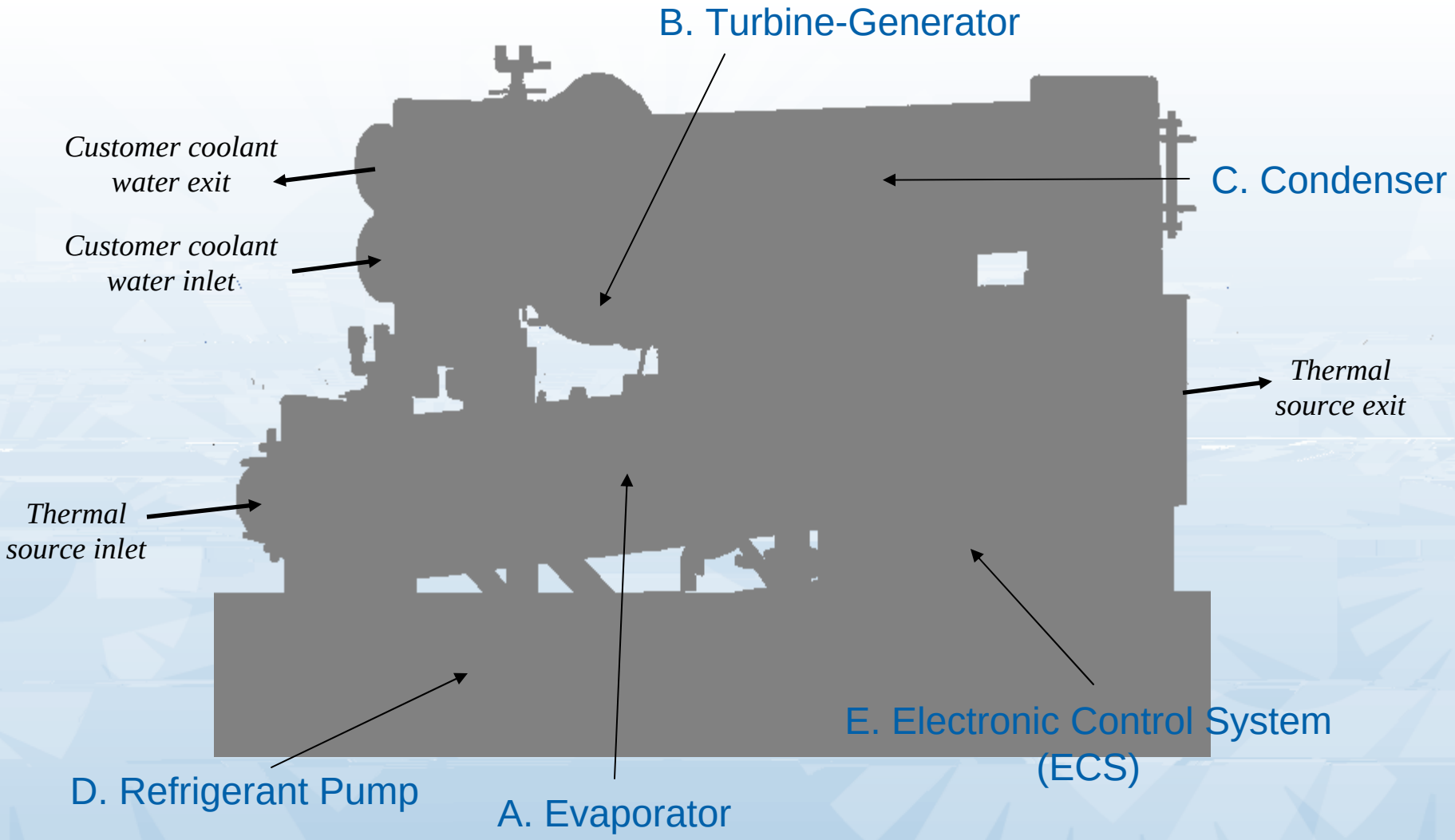
The PureCycle® Power System

Heat to Electricity Power Generation

- Zero fuel input costs - Hot Fluid
- Non Flammable Working Fluid
- 280KW of Renewable energy
- Modular and scalable for larger plants
- Off-the-shelf production; rapid deployment
- Low to moderate temps 195°F – 300°F
- Full remote monitoring and control
- Full service capabilities
- High power plant availability

Top Level Assembly

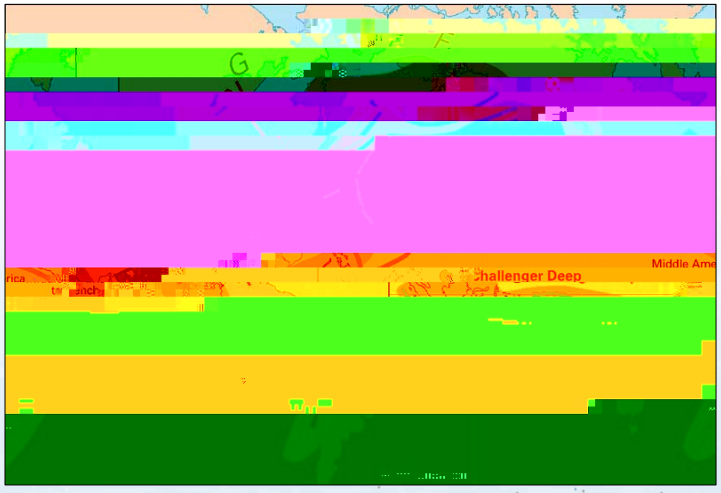
5 Major Components



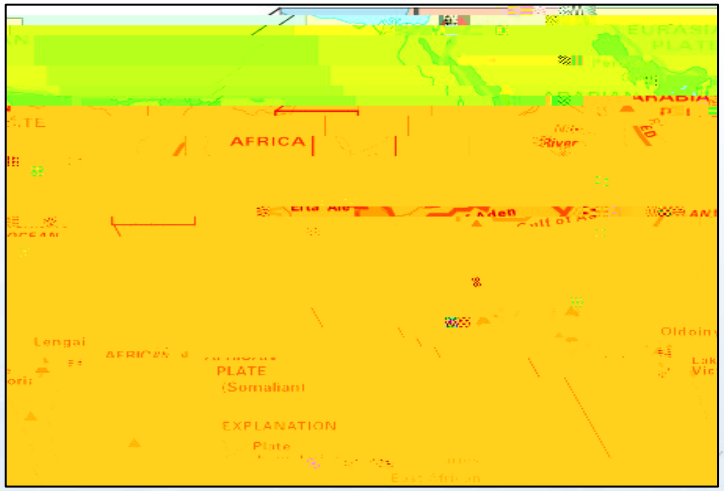
Key Global Geographies

Pratt & Whitney
A United Technologies Company

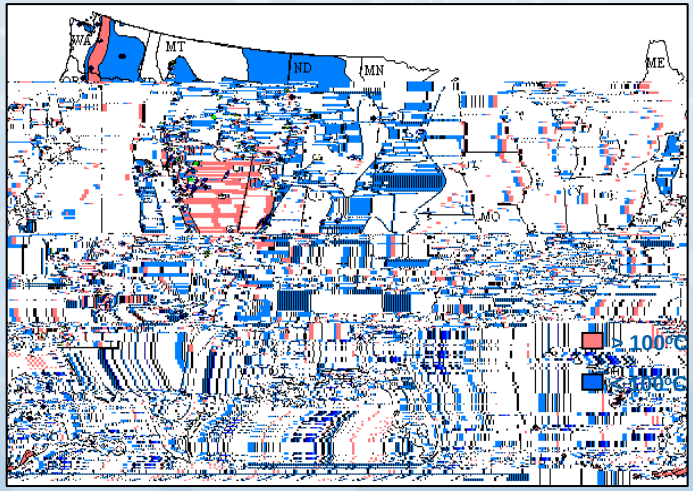
Pacific Ring of Fire



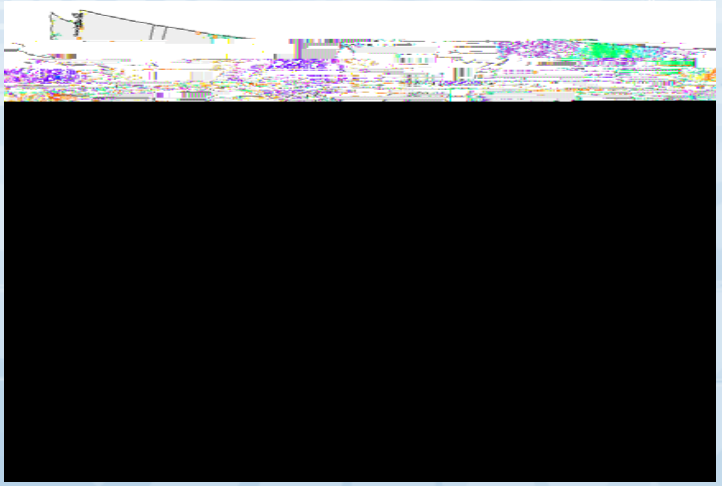
East Africa



United States



US Oil & Gas potential



Commercial Application

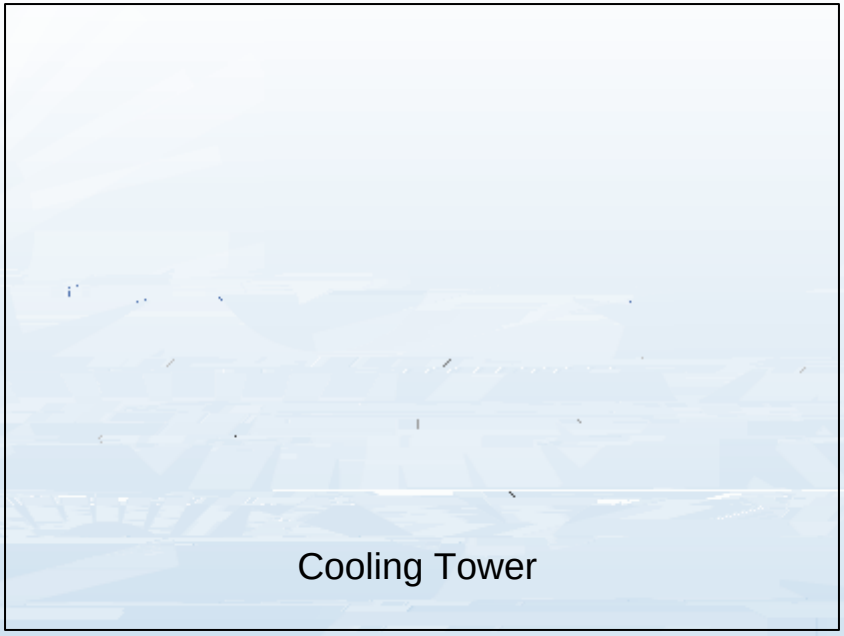
Pratt & Whitney
A United Technologies Company

Greenhouse in New Mexico

First Recip Application

Pratt & Whitney
A United Technologies Company

Industrial application in Guatemala



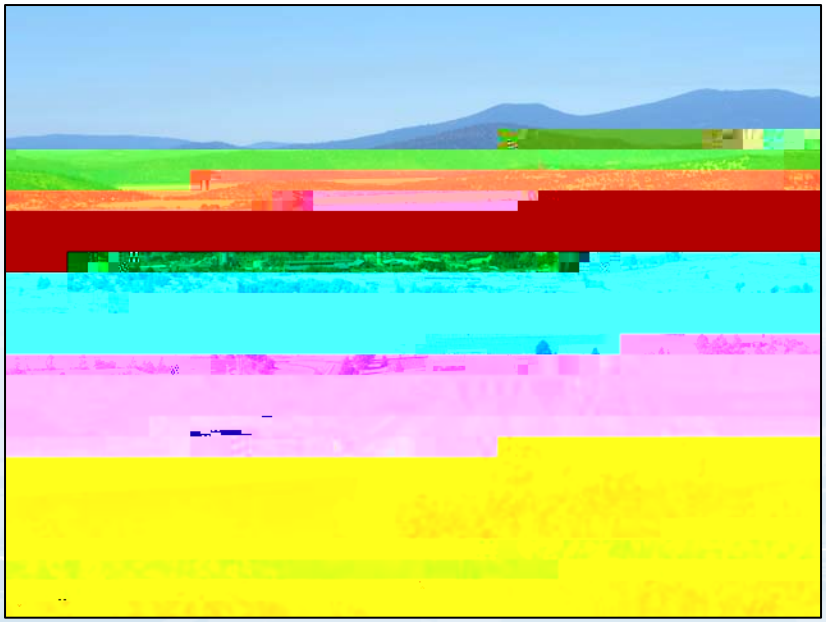
Cooling Tower

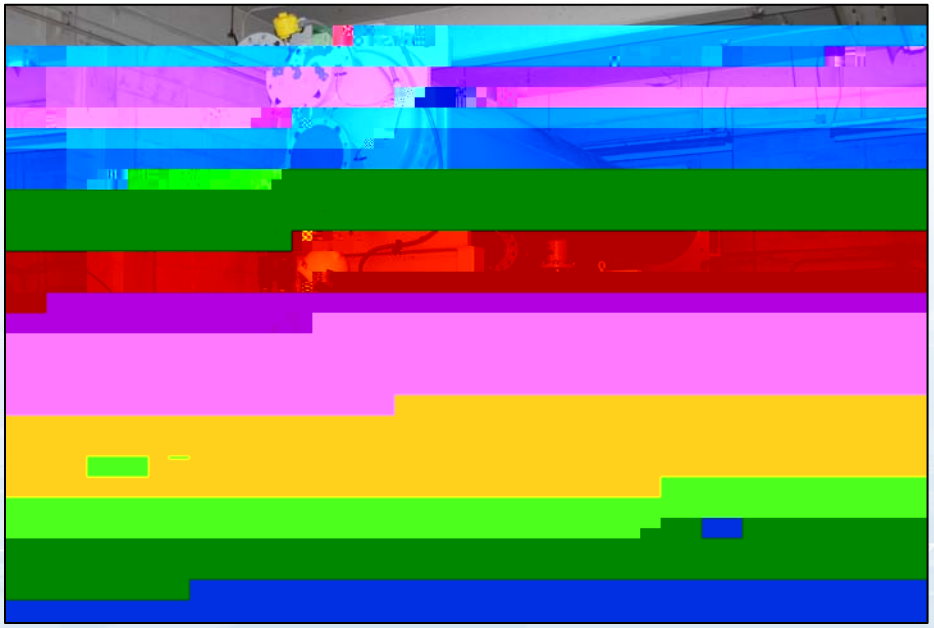
- Commissioned December 2008
- Operating on jacket water of 8MW reciprocating engine ~ 200kW net
- Displaces expensive fuel costs
- Supports green initiative of customer

LATEST INSTALLATION

Pratt & Whitney
A United Technologies Company

Oregon





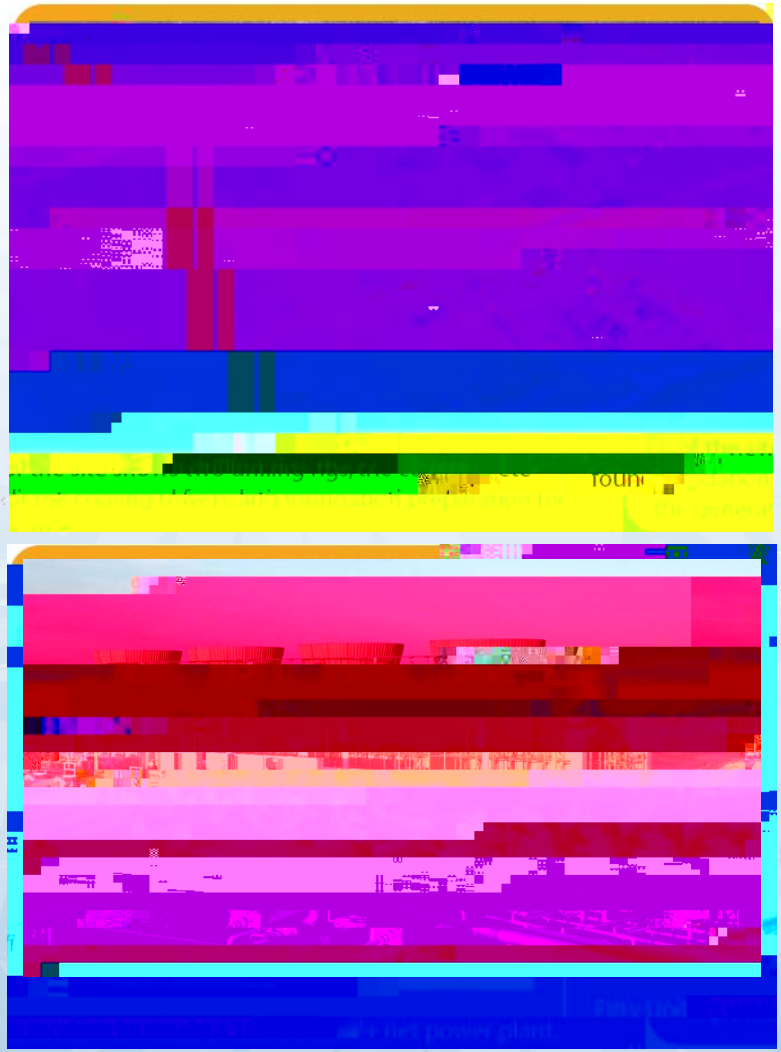
- First geothermal power plant in Oregon commissioned in Aug 2009
- Supplies 20% of the electricity for the campus
- ~ 195°F water at 320 GPM
- Unit will produce ~ 180 kW (summer) and ~ 200 kW (winter)

Utility Geothermal Application

Pratt & Whitney
A United Technologies Company

10 MW+ Net Renewable Power Sold to California Utility

- UTC teamed with Raser Technologies
- Modular, scaled approach for rapid power plant
- Power will be sold to under 15–20 yr PPA's*
- Full time UTC service technicians on-site
- Developing multiple projects in Western US over the next several years



* Power Purchase Agreement

First Oil and Gas Application

Pratt & Whitney
A United Technologies Company

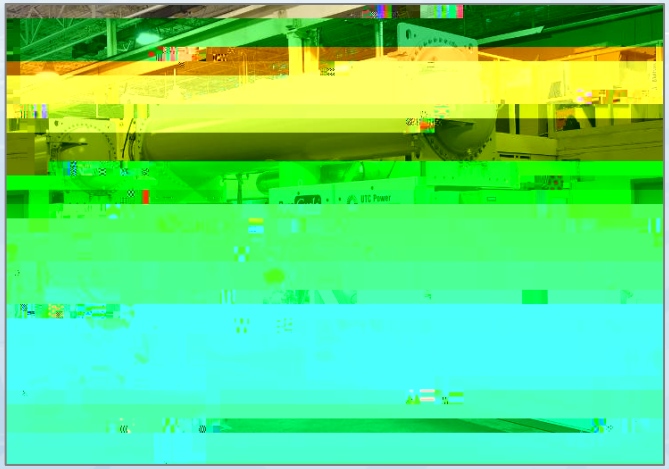
- Funded by DOE, UTC, Quantum & Chena
-

Production Facility

Pratt & Whitney
A United Technologies Company

Factory Assembled and Field Tested

- High-Volume, lean flow lines with demand flexibility
- Standardized assembly processes
- Leveraging UTC's high quality supply base and manufacturing technologies
- Delivered fully integrated and tested
- Shipped on standard trucking
- 16 week lead time



Environmental Benefits

Example – California

	CO_2	NO_x
Average annual reductions†		
PureCycle® 280	**871 metric tons***	**1.5 metric tons***
Model 280	**200 acres**	**88 cars**

† Based on a Nevada installation assuming 250 kW net power/unit

* Calculated using guidance from EPA's Combined Heat & Power office

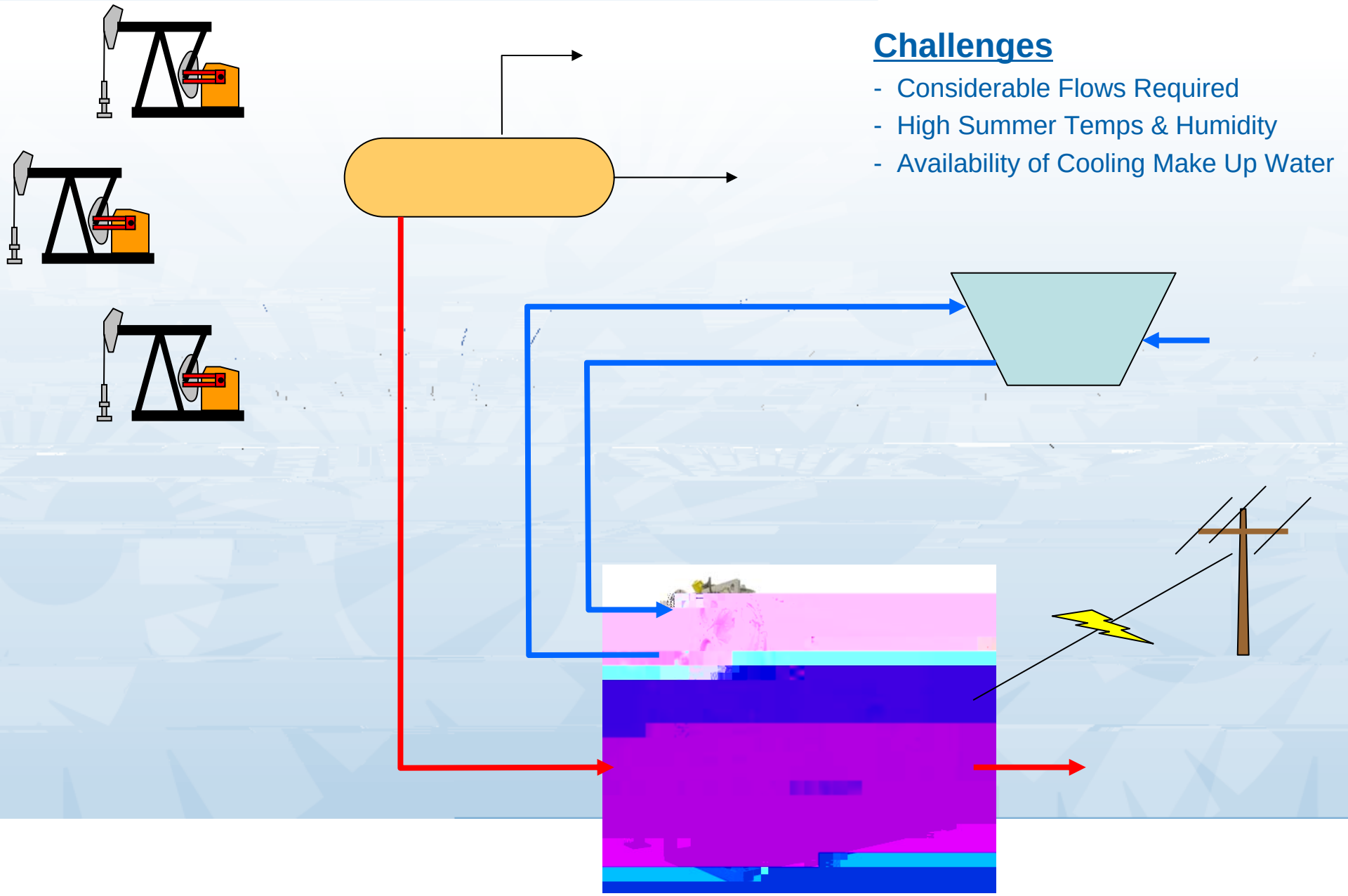
Services

Pratt & Whitney
A United Technologies Company

Full Range of Services

Challenges

- Considerable Flows Required
- High Summer Temps & Humidity
- Availability of Cooling Make Up Water



Texas Severance Tax Exemption

Pratt & Whitney
A United Technologies Company

- Severance Tax Exemption for Oil & Gas incidentally produced during Geothermal Energy Generation (Texas HB 4433 amended tax code Sections 201.060 and 202.063)

- Exempted tax:
  - 7.5% of the market value of natural gas produced
  - 4.6% of the market value of oil produced

- Effective September 1, 2009

- Currently no cap on amount of oil & gas incidentally produced

- Incentivizes oil & gas producers to utilize geothermal heated liquid to generate electric power.

Additional Potential Benefits

Pratt & Whitney
A United Technologies Company

- 2.1¢/KWhr Production Tax Credit (PTC) or
- 30% Investment Tax Credit
- Monetize Renewable Energy Credits (REC's), Carbon Credits
- Extend the economic life of wells
- Leverage exploration & production expertise to become geothermal power producers
- Create/Maintain Skilled Jobs

THANK YOU !

Michael Ronzello
Sales/Business Development Manager
PureCycle® Solutions
(860) 565-3617
michael.ronzello@pw.utc.com