



# Geothermal Low-carbon Energy for Industry

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## Geothermal Energy for Industry

### Geothermal Resource Developments for Industrial Facilities (and former coal plants)

#### Eliminate Air Emissions While Providing Needed Baseload Power\*

- **Geothermal Energy generation provides continuous baseload power to users-consumers**
- **Industrial facilities & power plants burn fossil fuels to generate heat & electricity delivered to users on a local, regional or grid scale - yet emit CO2 and other substances**
- **Facilities and plants sited above/nearby significant geothermal resources may convert to geothermal energy plants**
- **Benefits the facility operators, environment, users-consumers, and local communities.**

“Greenification” of large industrial operations.

## Geothermal Energy for Industry



- **Blade sponsored research via successive Geothermal projects covering conversion of existing & former facility sites to geothermal power plants.**
- **Facility sites in California, Nevada & Texas.**
- **Problem statement: *Determine the geothermal plant LCOE – levelized cost of electricity for comparisons.***
- **All LCOEs were ‘Clean’ comparisons – No government funding, subsidies or incentives.**

## Geothermal Energy for Industry

### *Geothermal Drilling Technology Today*

- ✓ **Drilling & Completing Ultra-Hot & Deep Wells Is Real - and Ongoing.**
  - ❖ **Geothermal wells in Iceland to magma.**
  - ❖ **Geothermal Fields in 'Ring of Fire' (Indonesia, Philippines, Japan, ... ).**
  - ❖ **Thermal & steam flood injection & producing wells in CA, AB, Kuwait, Oman, ... .**
  - ❖ **Oil & gas wells to +37,000 ft.; +550 deg F; +32,000 psi.**
  
- ✓ **Wells & Field Development Drilling & Completing -**
  - ❖ **Technologies & Engineering Established. – Used 10 years ago.**
  - ❖ **Today More Advanced & Enhanced.**
  - ❖ **Costs Way Down.**
  - ❖ **Expertise Essential – yet, Engineering, Services & Equipment Available.**

## Geothermal Energy for Industry



- GreenFire Energy Downhole Loop Circulation using Supercritical CO<sub>2</sub>.
  - ❖ COSO Pilot Installation 4 weeks away.
- Blade Providing Downhole Drilling & Completion Thermal Analyses.
- Contacted for Screening Huge Operating Texas Industrial Facility – for Geothermal Energy + CCSS\*.
  - ❖ European facility expected to follow.



\*CCSS – carbon capture, storage & sequestration – provides CO<sub>2</sub> for -

- industrial reuse & profitable product stream, and/or
- subsurface resource enhancement.

# Geothermal Energy for Industry



## Why Industrial Facilities (or Former Coal Plants)? (1)

Every Sustainable Project Requires a Wide Range of Considerations Beyond Technological Success.

### ❖ Site Footprint –

- Size, terrain

### ❖ Site Location

- Access to supply & market

### ❖ Permitting

- Use & discharge, esp. air, water, effluent.

### ❖ Local Social Acceptance

- Wanted in & by community

### ❖ Security

### ❖ Electric Power Delivery –

- Generate Power: Site --> Grid
- Use Power: Grid --> Site
- Both: Generate & Use

### ❖ Access to Water

- For Cooling or Make-up

### ❖ Qualified Labor

- Trained Locals Operate & Maintain

### ❖ Ready Suppliers & Support

# Geothermal Energy for Industry

## Why Industrial Facilities (or Former Coal Plants)? (2)

Every Sustainable Project Requires a Wide Range of Considerations Beyond Technological Success.



### ❖ Existing Site Infrastructure –

- Roads, Gates, Slabs, Drainage
- Offices, Communications
- Buildings, Warehouses, Storage
- Maintenance Shops
- Material Handling, Vehicles, Cranes

### ❖ Asset Reuse Potential (limited) –

- Foundations
- Vents, Stacks
- Pumps

## Geothermal Energy for Industry

Technology Constantly Improving Economics & Efficacy

- ✓ Faster, Cheaper Drilling & Well Costs
- ✓ High Efficiency Heat Transfer
- ✓ Labor Expertise Available & Cross-Train
  - *Qualified Personnel for Project Management, Operations & Maintenance*
- ✓ Continuous Baseload Electricity
  - *No Energy Storage Required*
- ✓ Repurpose Existing Sites & Transmission
  - *No New Surface Disturbance*
- ✓ Clean & Sustainable
  - *No Bird Kills.*



# Geothermal Energy for Industry



## Screening Plants & Facility Sites for Geothermal

- Understand the Drivers and Footprint Required – Initial and Growth Stages
- Cross-reference Plant or Facility Sites Above Geothermal Resources
  - ❖ Site may be:
    - Existing & Operating –
      - clean energy as supplement or replacement for fossil fuels
      - lowered carbon footprint
      - CO2 direct reuse / conversion to products
    - 'Former' – shut-down, decommissioned, or partially cleared.
- Rank Geothermal Resource Potential
- Cross-reference Plant or Facility Site Needs

✓ *Do Screening Analysis for Site Operators.*

# Geothermal Baseload



***Thank You.***

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***\*Blade Expertise for Geothermal Site Evaluations & Wells.***