A Super-Fast Geothermal Power Overview

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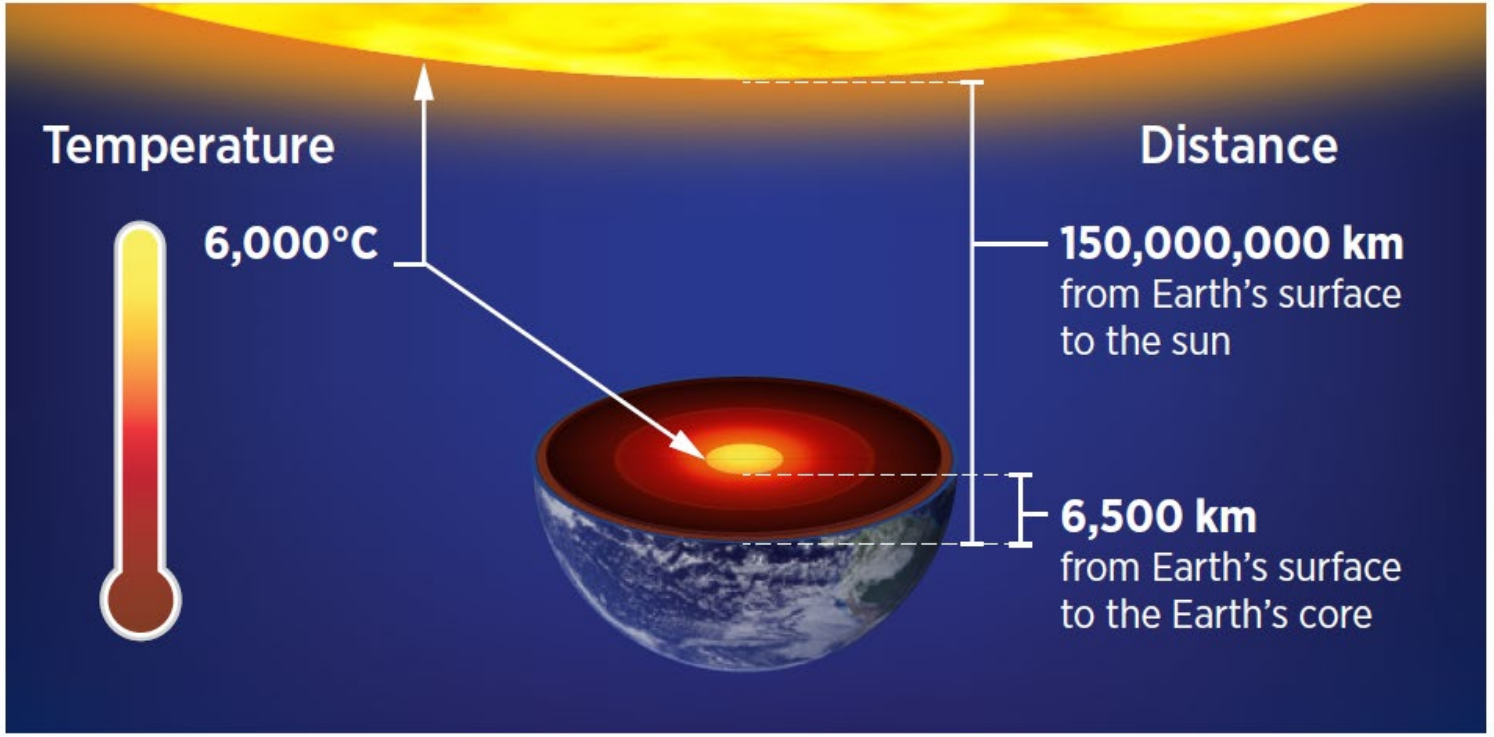
Bureau of Economic Geology

Intro – Earth's Heat

- **~47TW** of heat flow 24/7 out of the Earth
- Even better – **thousands of times this amount of energy is extractable heat stored in the upper 10 km of the crust**

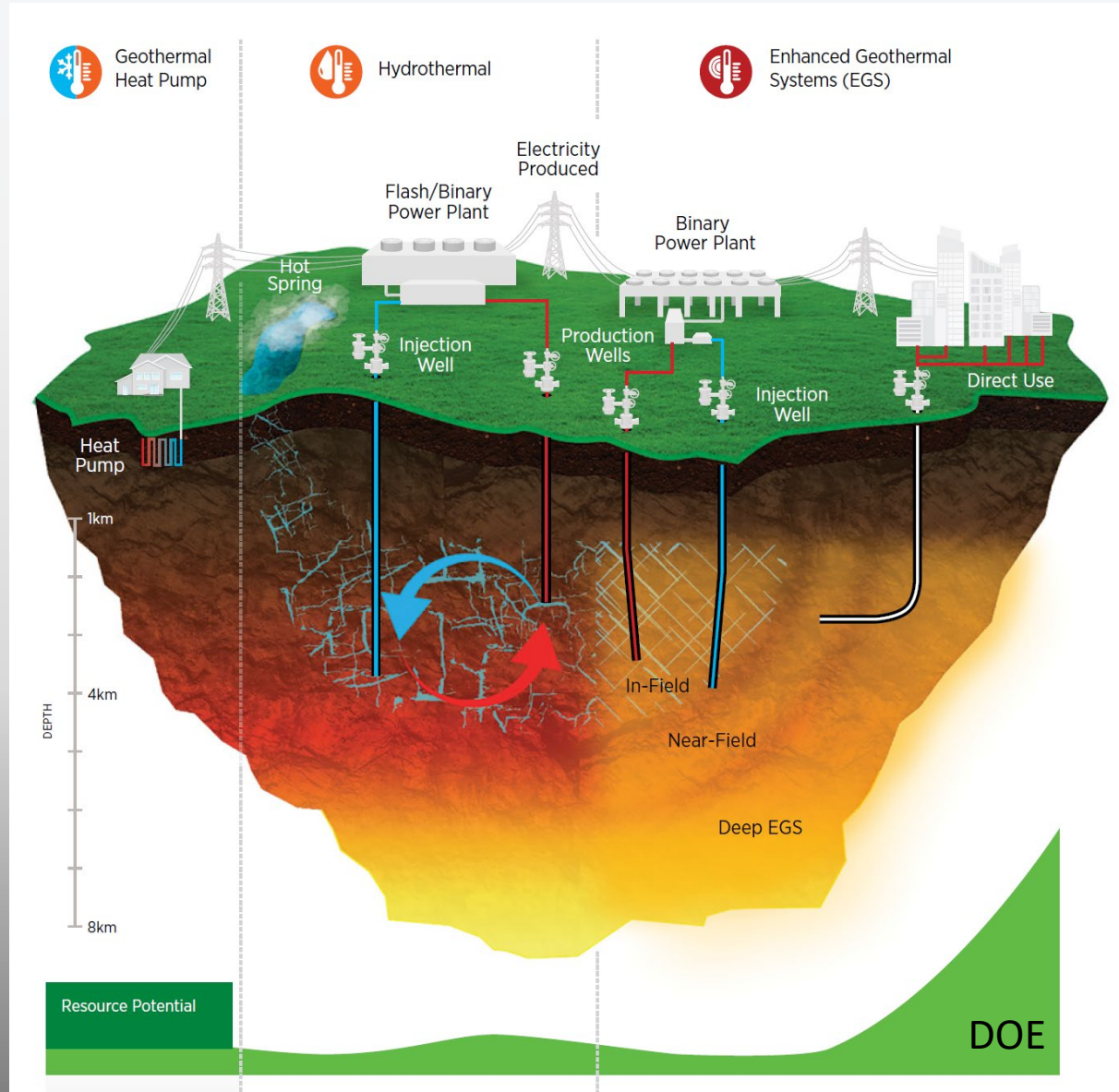
GeoVision, DOE



Geothermal Systems

(we are not talking heat pumps for your house)

- **All you need to generate power is a temperature difference** – between the rock at depth and the surface
  - In most power plants the heat is from burning fossil fuel or uranium, for geothermal we get the heat (free) from the Earth
- ***Conventional Geothermal***
  - **Mines hot water or steam** in the ground
- ***Geothermal Anywhere***
  - **Mines the heat in the rock**
  - Enhanced Geothermal Systems (EGS), Advanced Geothermal Systems (AGS), <u>*Closed Loop*</u> Geothermal Systems (CLGS) …naming is not settled…
- Unlike wind & solar, **All Geothermal are 24/7 – Baseload!!!**



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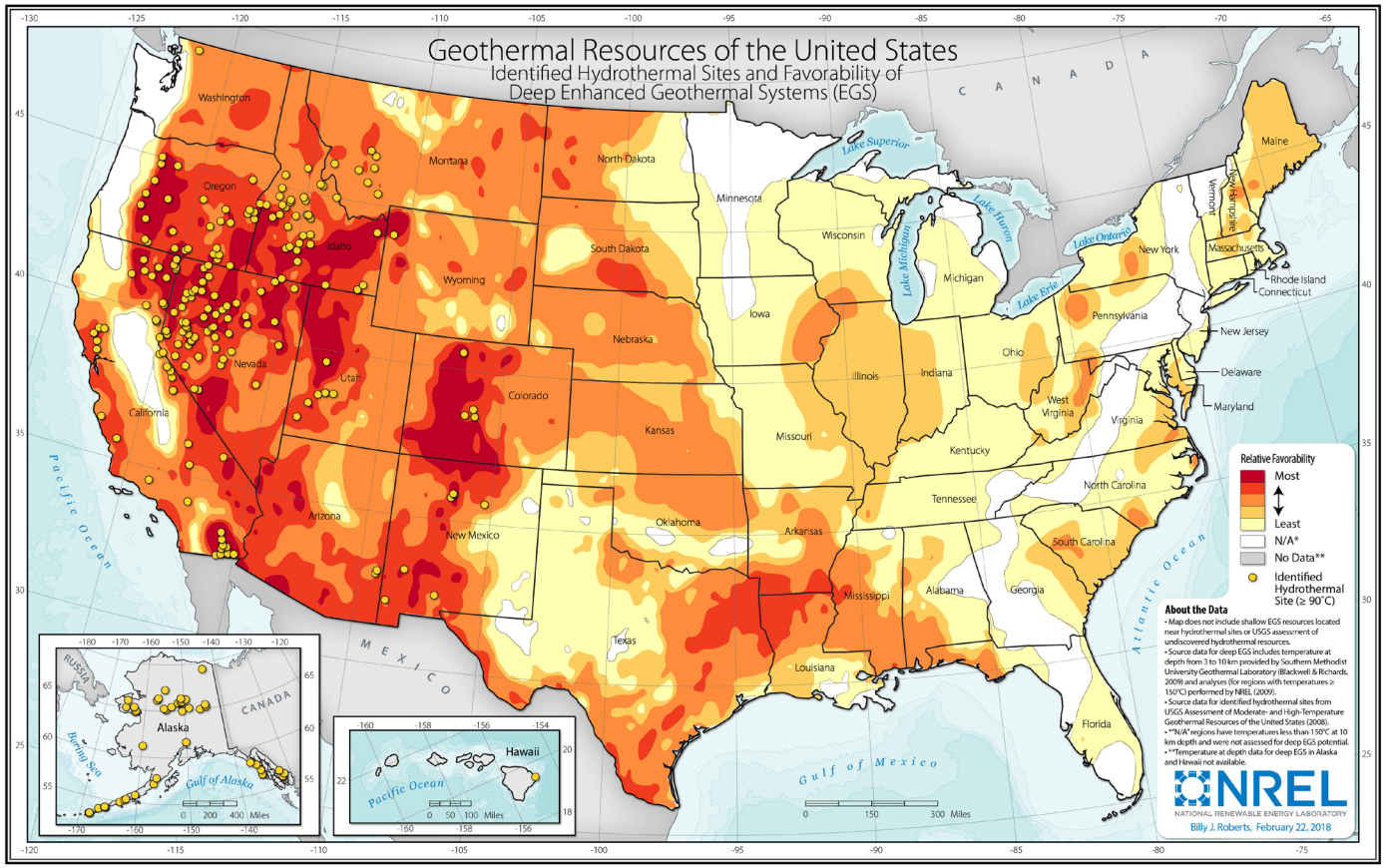
Intro – Plate Tectonics – *Conventional* Geothermal

- Determines the “Conventional” Resource Location
- US (west of the Rockies) is the world’s largest producer of geothermal energy but it is <0.5% of the US grid –
- Geographically very restricted
- Mature industry

https://energyeducation.ca/encyclopedia/Geothermal_electricity#cite_note-6 Adapted from: R. Wolfson, "Energy from Earth and Moon" in *Energy, Environment, and Climate*, 2nd ed., New York, NY: W.W. Norton & Company, 2012, ch. 8, pp. 204-224

Geothermal Anywhere

- Uses an artificial circulation system to “hoover up” heat, concentrate it and bring to the surface
- Renewable to semi-renewable
- **Opens up much more of the Earth to viable geothermal production**
- We have a Geothermal Anywhere **3MW** project, funded by the **US Air Force**, at Ellington Field JRB, **Houston**, Texas near shovel-ready
- **DoD** has issued a call for prototype plants at four bases

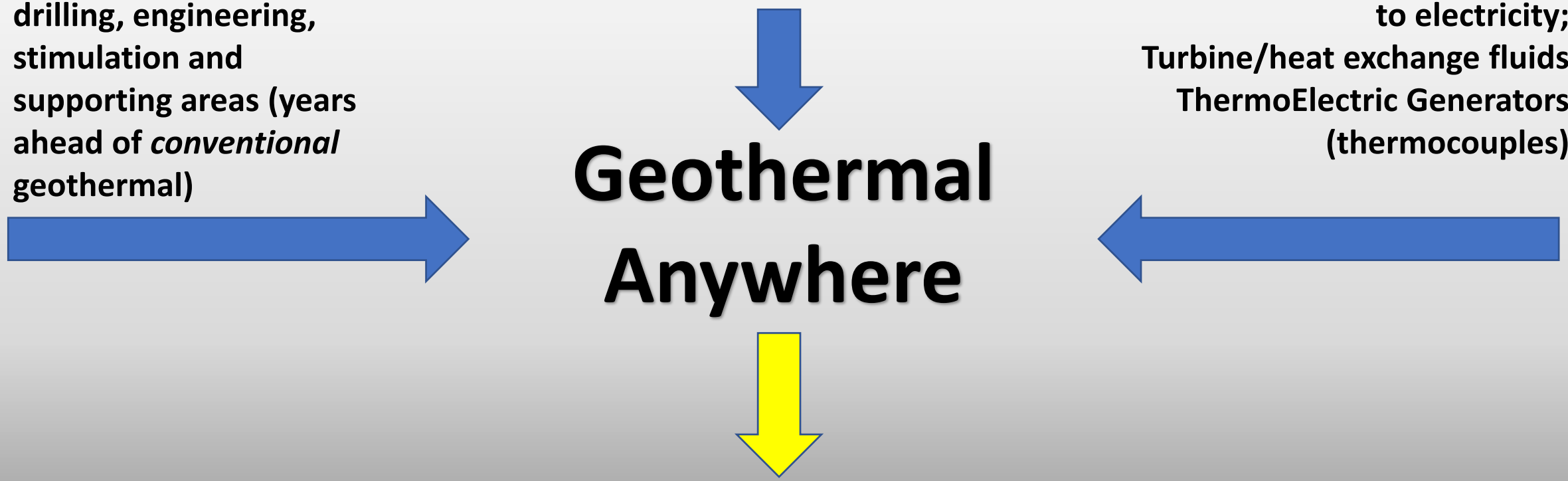


Why the excitement now?

Decarbonization requirements, ESG, Stakeholder Pressure

Advances in Oil & Gas drilling, engineering, stimulation and supporting areas (years ahead of *conventional* geothermal)

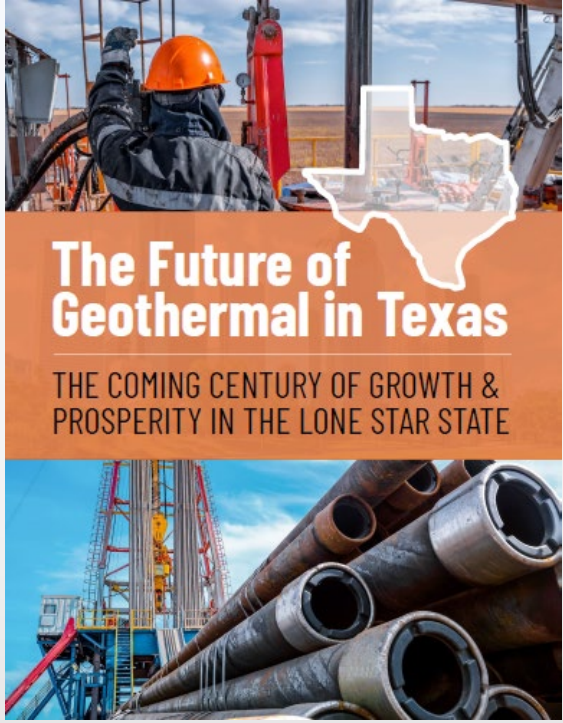
Advances in conversion of heat to electricity; Turbine/heat exchange fluids ThermoElectric Generators (thermocouples)

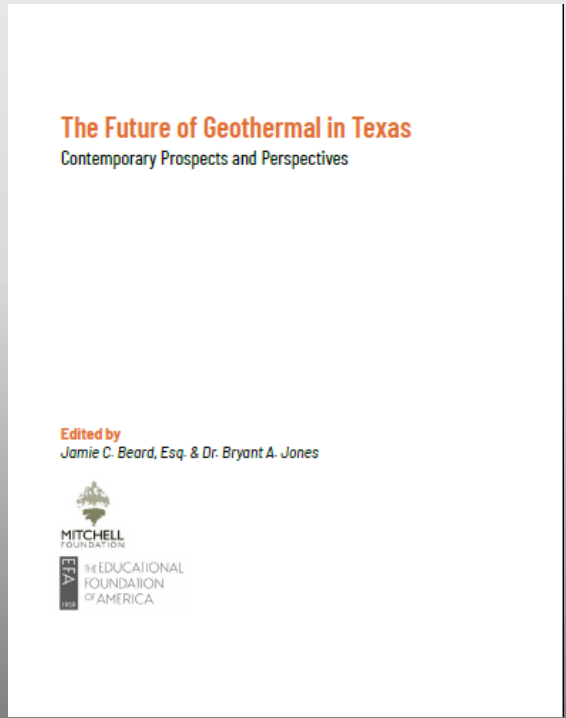


New methods for harvesting heat and producing energy

Recent Bureau work in Geothermal

- Resource assessments
- Induced seismicity monitoring
- Energy storage
- Direct use
- Powering CO2 capture and storage
- System modeling
- Big-data/ML applications
- Part of two teams with $150M research proposals under consideration
- Environmental impact
- Economics
- Social/DEI/ESG





https://cgmf.org/p/geothermal-energy-texas_report.html

https://energy.utexas.edu/research/geothermal-texas

By the way – there is geothermal in space

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