

# ***Geothermal Operations - State Regulatory Forum***

July 22, 2025



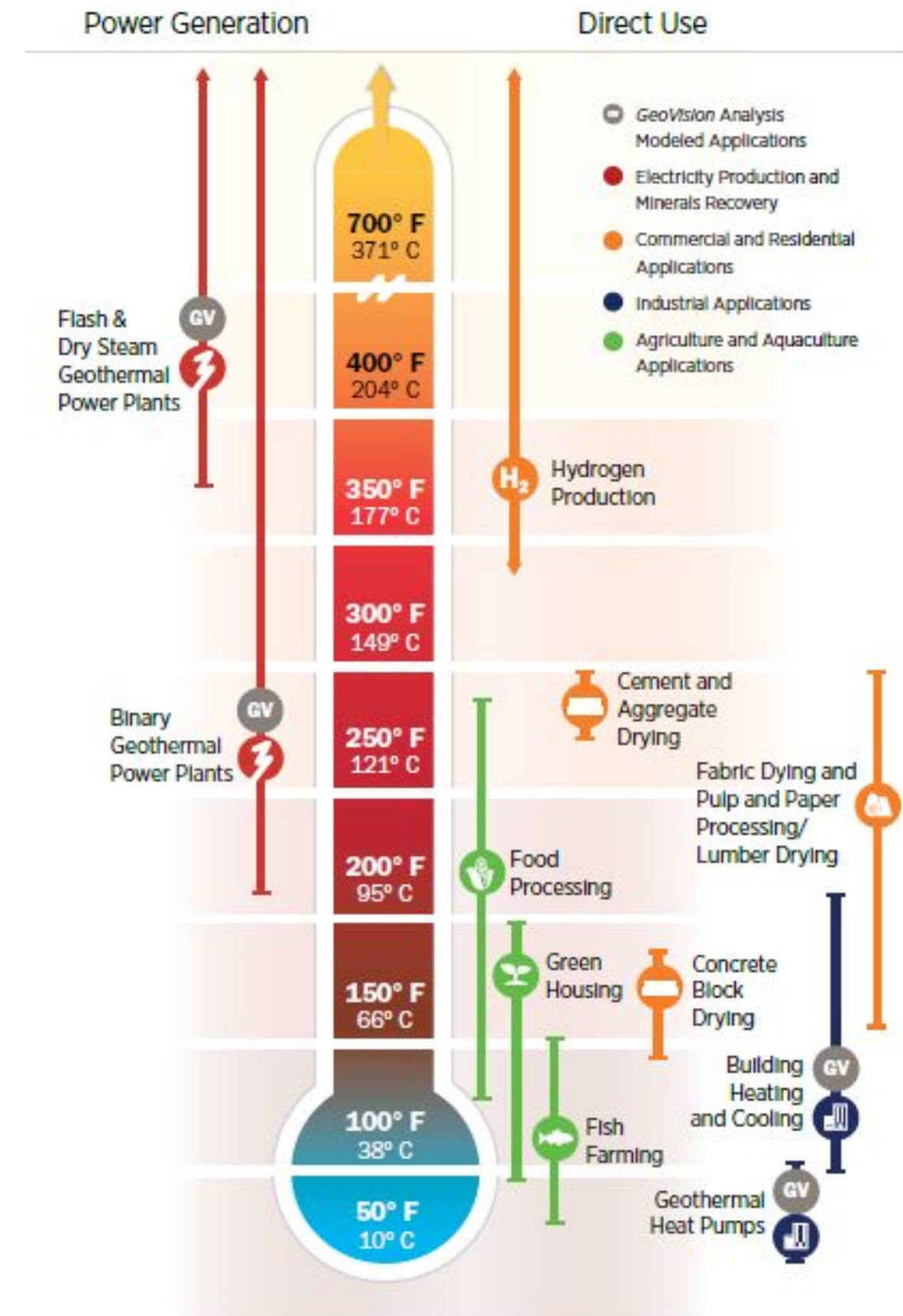
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# Geothermal Uses

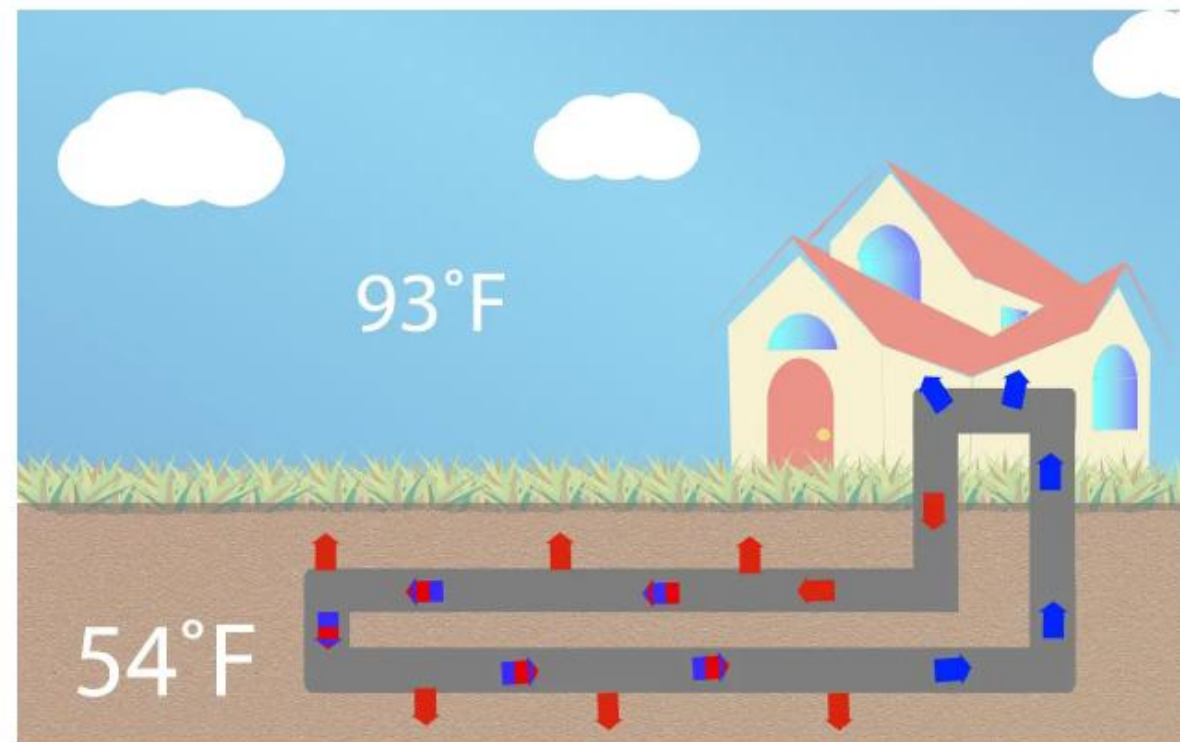
- Geo-exchange systems
  - Thermal Energy Networks
  - Heat pumps
- Direct Use
- Electricity Generation



# Geo-Exchange Systems

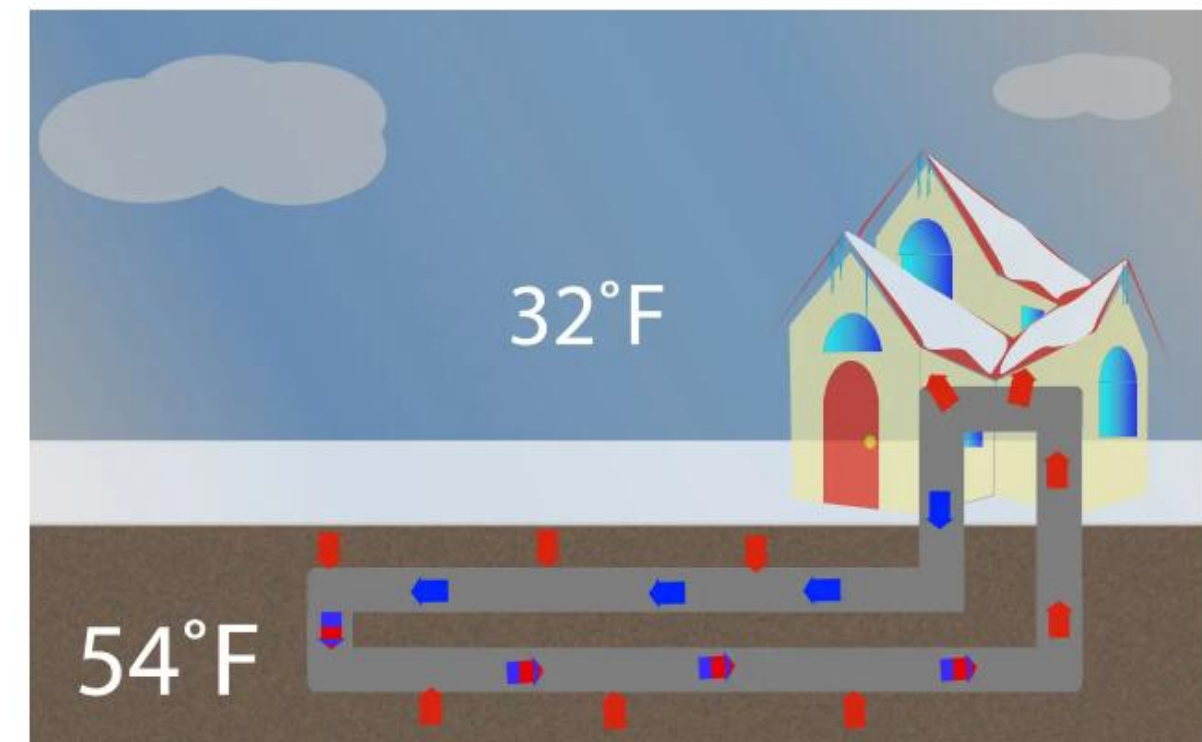
- The earth is used as a thermal reservoir to heat and cool surface structures
- Heat pumps
- Thermal energy networks
  - CMU

**Geo-exchange Cooling**



In the summer months, heat is drawn from the building and transferred below ground.

**Geo-exchange Heating**



In the winter months, warm air is drawn from the ground and transferred into the buildings.



# *Direct Use*

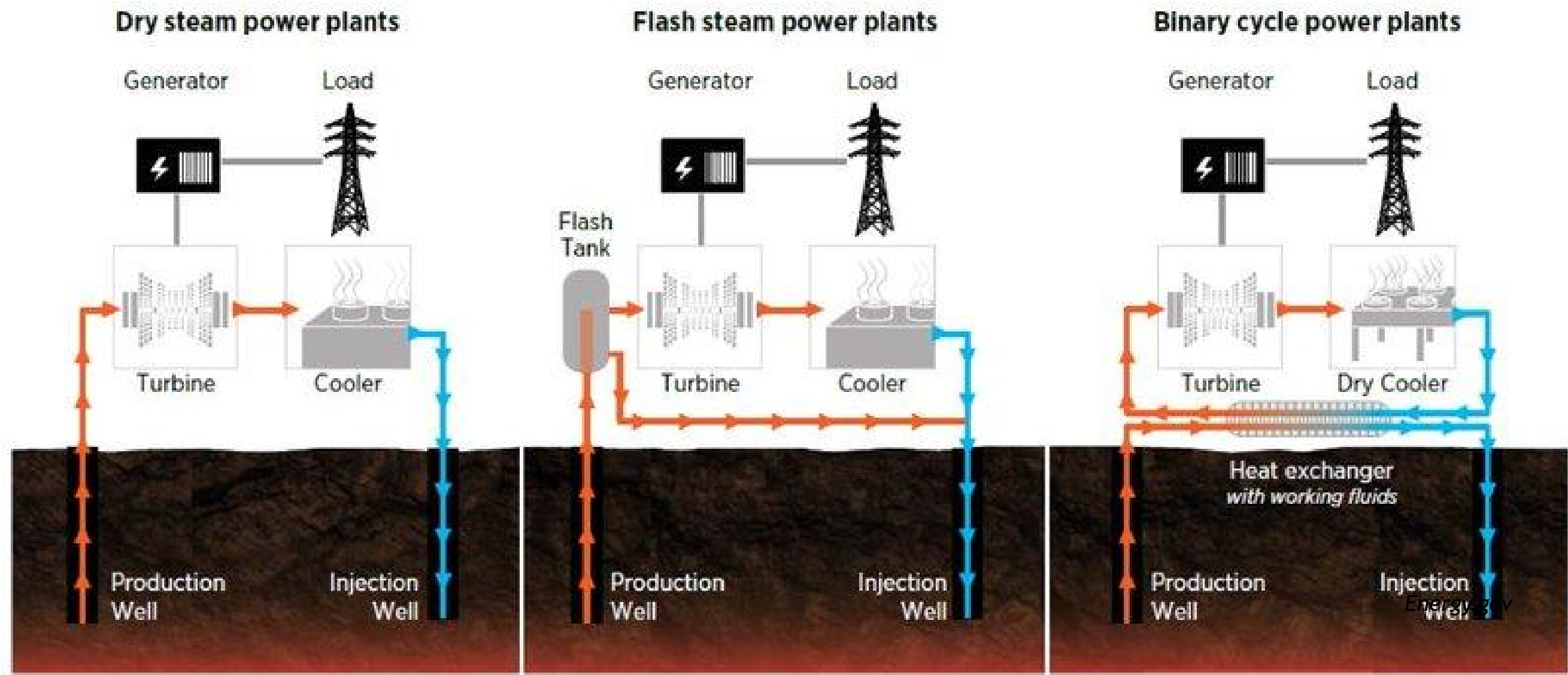
- Thermal energy is used as heat with no energy conversion
- Spas
- Snow melting
- Greenhouses
- Fish farming
- Industrial use
- Space heating and more





# Electricity Generation

- Thermal energy is converted into electricity



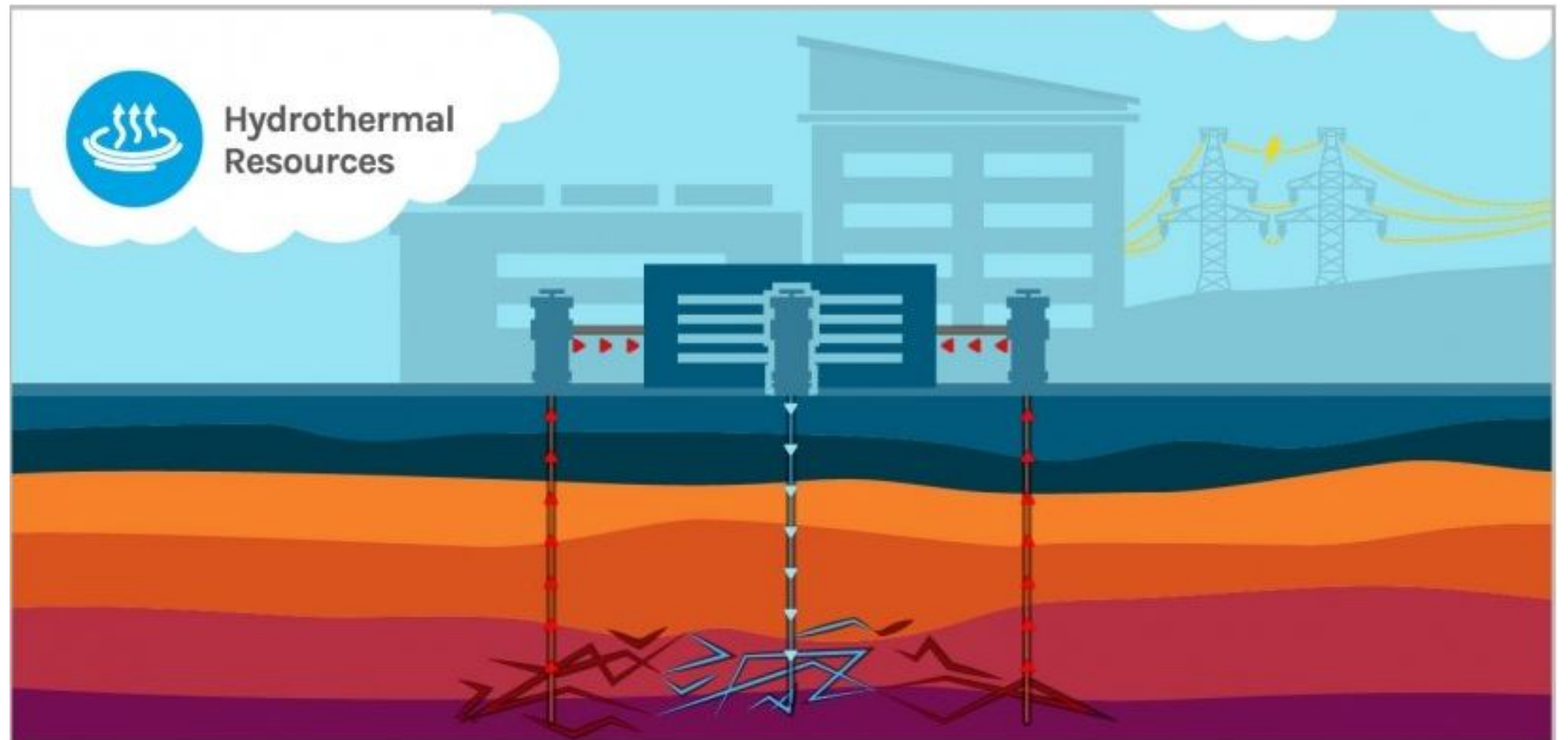
# *Deep Geothermal Strategies*

- Conventional Geothermal Systems
- Enhanced Geothermal Systems (EGS)
- Advanced Geothermal Systems (AGS)
- Oil and Gas Well Repurposing



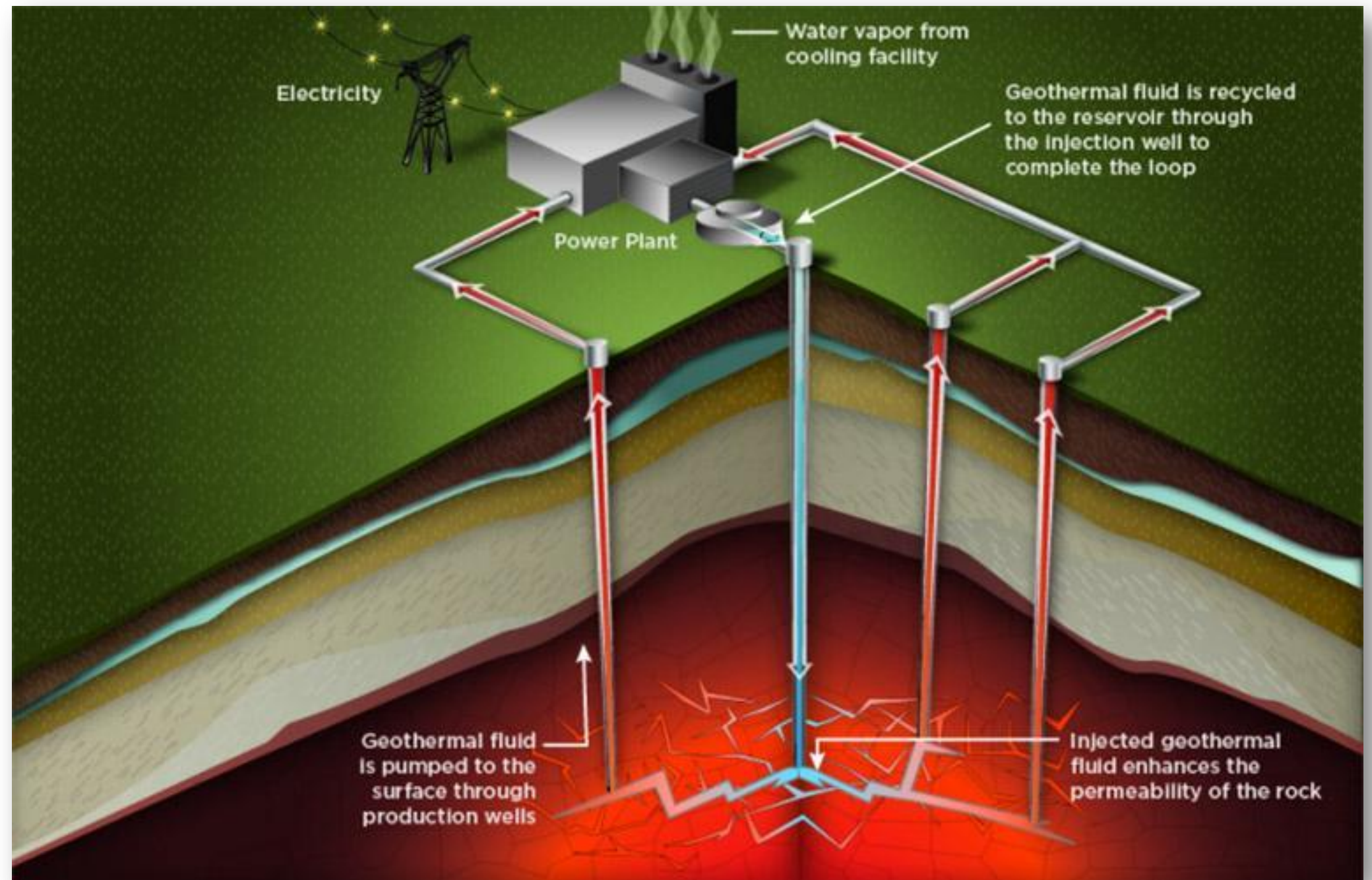
# Conventional Geothermal Systems

- Hydrothermal systems - considered conventional geothermal - uses existing technologies and does not require enhanced or human-made reservoirs
- Requires 3 main elements - heat, water, and permeability
- Typically present along plate boundaries but technology improvements may open up additional resources like this in other areas



# Enhanced Geothermal Systems

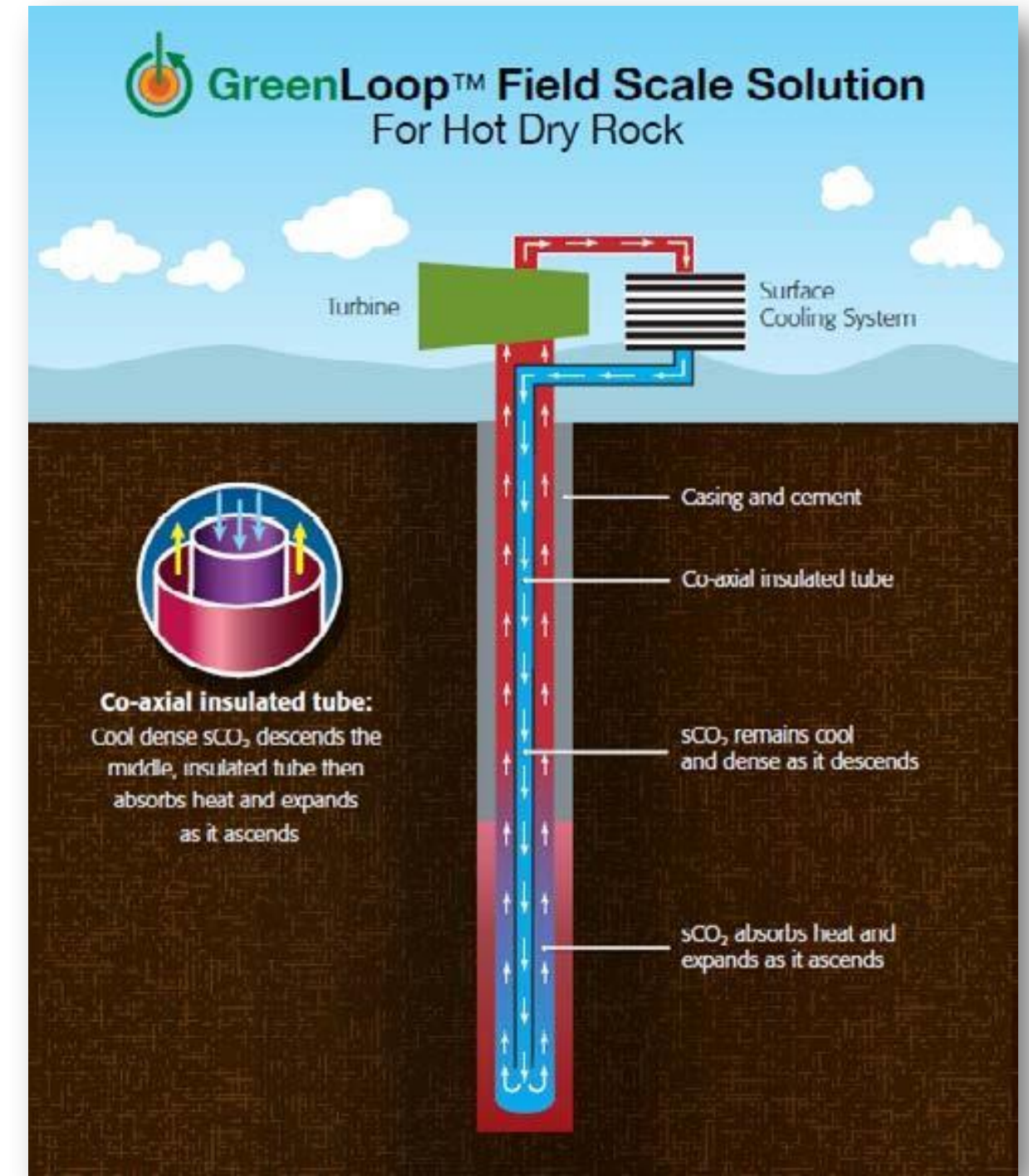
- Deployed where there are high subsurface temperatures, but low water volume and/or rock permeability
- Can inject water sourced from outside the target formation into an engineered reservoir
- May require stimulation of the reservoir for increased permeability
  - Geothermal wells will be stimulated less often than oil and gas wells with different strategies that are generally less impactful





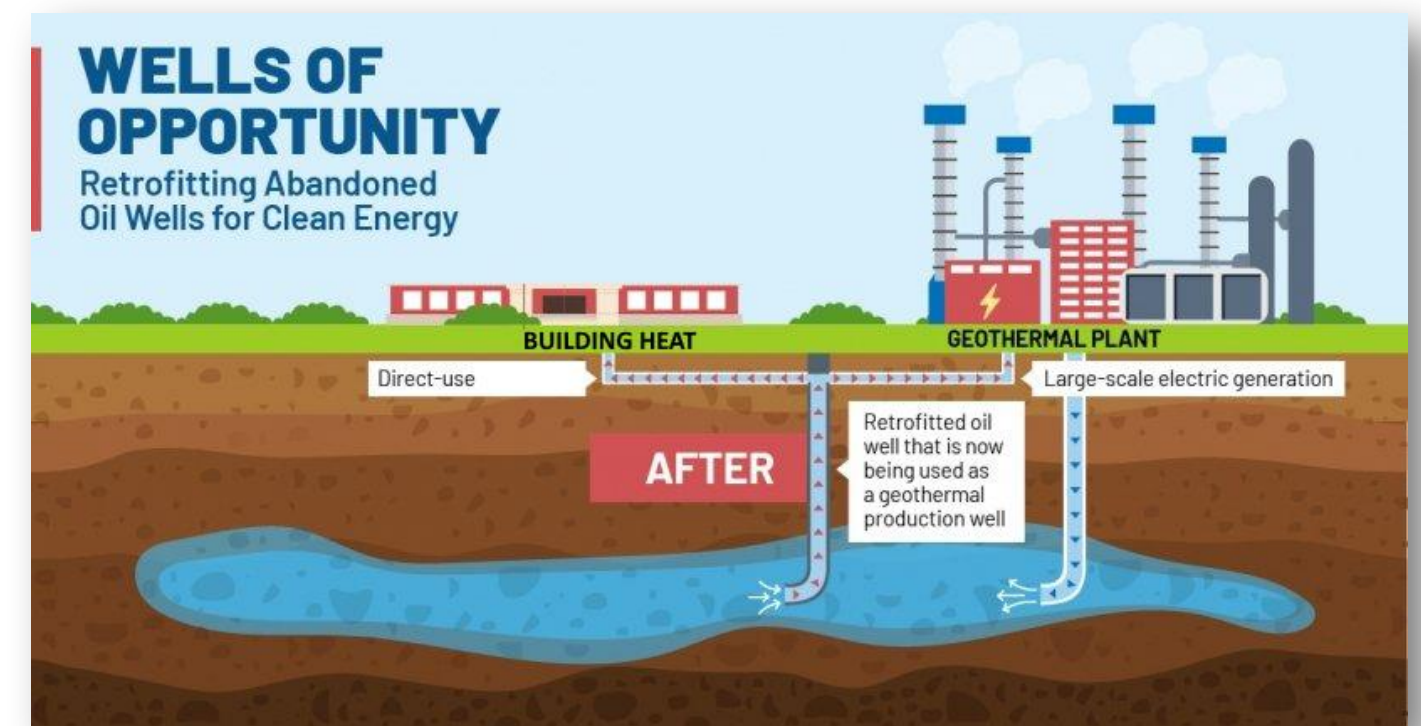
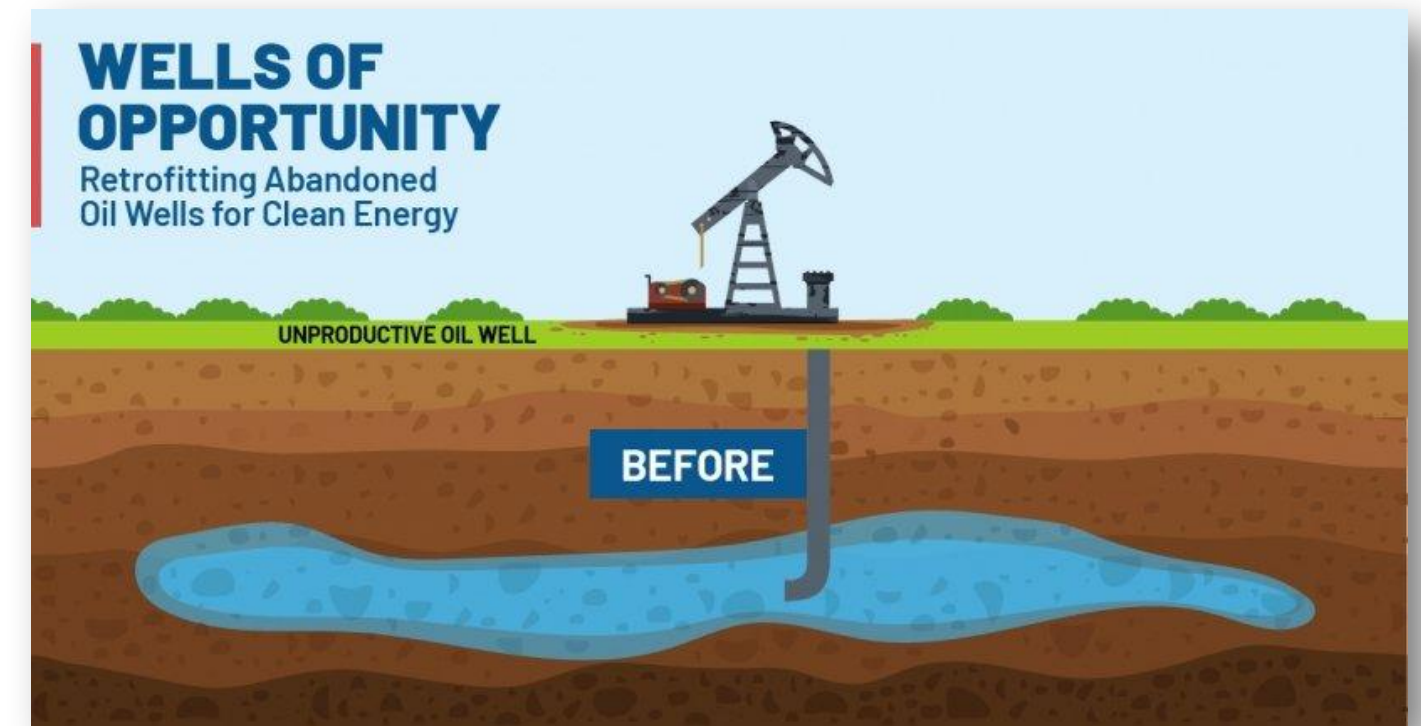
# Advanced Geothermal Systems

- Systems that circulate fluid in a closed loop and do not exchange fluids with the subsurface
- Subsurface conductive heating
- Deep and long well bores and downhole construction
  - Can include several smaller wellbores (sidetracks) in the deep subsurface connected to a single wellbore that extends to the surface
- Challenging economics with new strategies being investigated
- With additional technology advancements, future potential to be implemented in a variety of areas



# Well Repurposing

- Co-production - generating energy or directly using heat from existing oil and gas wells
  - Can reduce on site emissions and/or the heat can be utilized in close proximity to the producing well
- Conversion for direct use or local energy needs
  - This would convert the wellbore for use and no longer function as an oil and gas well
  - All wells considering conversion will need to be evaluated in the context of the new use strategy and wellbore integrity must be confirmed





# *Discussion Topics*

- Water rights and geothermal development
- Geothermal technology types
  - Variable in scale and strategy
  - Technologies as a driver for policy development?

# *Water and Geothermal*

- Property rights - water, minerals, something else?
  - Different from other operations as the primary target (heat) is a fluid property versus a tangible substance but its extraction can impact other operations and property
  - Many operations use groundwater or move groundwater, but some do not
  - Federally, geothermal resources are considered a mineral
- Private vs Public resource
- Water rights are complicated in the dryer states and processes did not necessarily contemplate geothermal resource development
- There is likely no one size fits all answer



# *Water and Geothermal*

- Colorado strategy
  - Leverage existing water right structure - tributary/nontributary
  - Leverage existing state agency expertise
  - DWR regulates water rights and shallow geothermal
  - ECMC regulates deep geothermal and privately owned resources
- What are the most important aspects to consider in terms of groundwater use in geothermal operations?
- How can groundwater use and other types of geothermal (that do not use water) be addressed effectively and efficiently?
- Other thoughts or questions?

# *Geothermal Technology Types*

- Can look a lot like oil and gas operations, water wells, injection operations, or something completely different
- Exploration, production, and distribution considerations
- As regulators, how do we approach highly variable operations with differing impacts?
- What can we do to address barriers while retaining protections?
- Should technologies drive policy development? How to strike the right balance?
- Other thoughts or questions?



# *Summary and Next Steps*

- What steps can we take in this forum to address some of these concepts?
- What other topics should we discuss?

# *Questions?*

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