



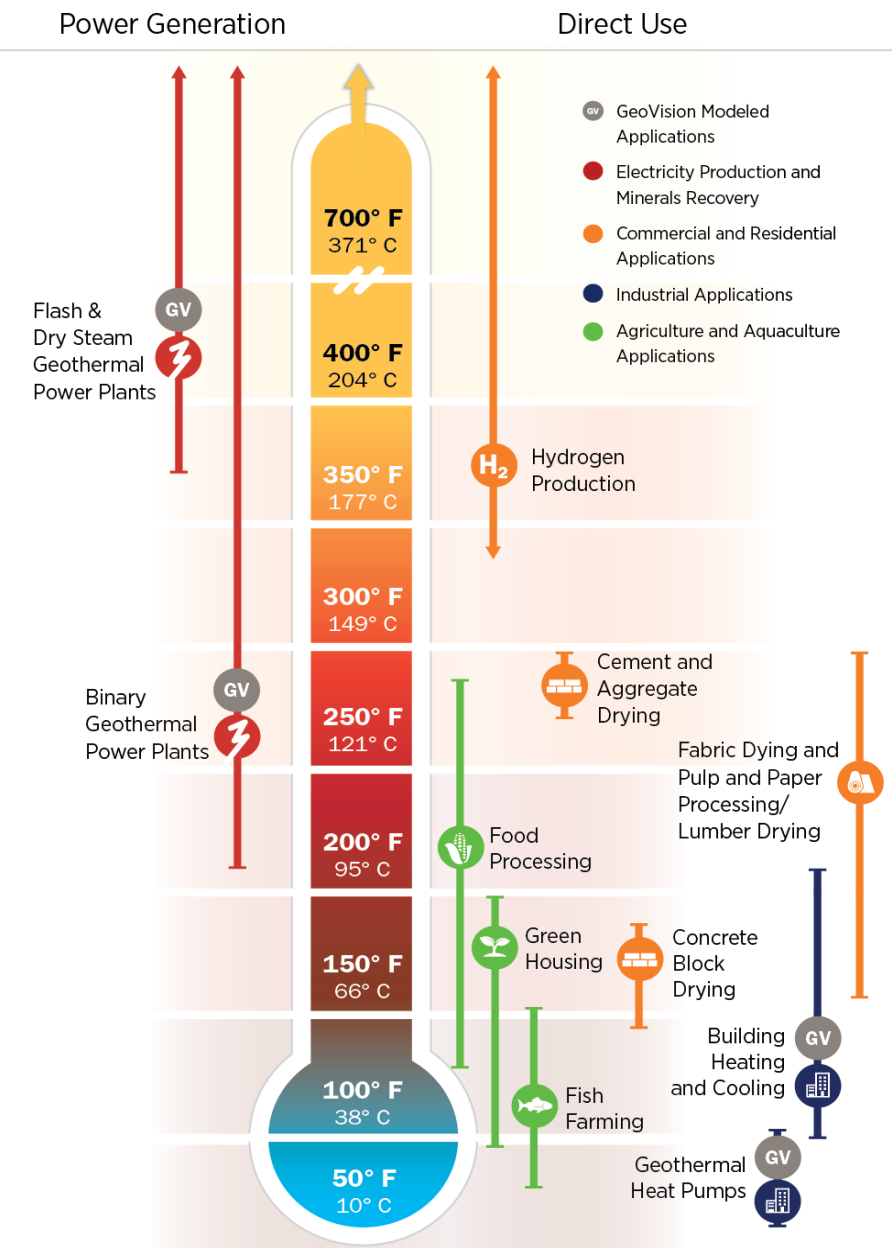
Enhanced Geothermal Shot Briefing *October 17, 2022*

Presenter

Lauren Boyd, U.S. Department of Energy
*Acting Director and Enhanced Geothermal Systems
Program Manager, Geothermal Technologies Office*

Geothermal Energy: America's Next Renewable Powerhouse

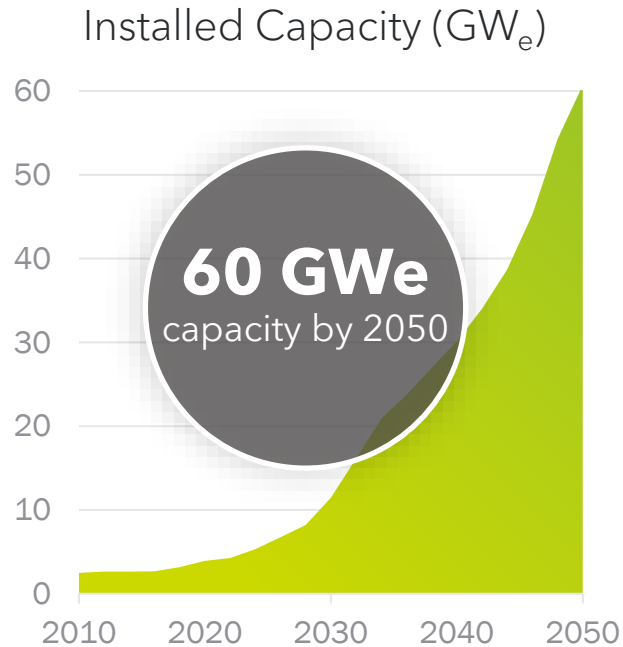
 Electric Power	• High temperatures (>300°F) • Wells up to many thousands of feet deep • Grid power
 Direct Use	• Moderate temperatures (80-300°F) • Wells hundreds to thousands of feet deep • Large buildings, agriculture
 Heating & Cooling	• Near-ambient temperatures (40-80°F) • Shallow trenches to wells hundreds of feet deep • Residential, light commercial



GeoVision Analysis: Geothermal Deployment Potential

ELECTRIC

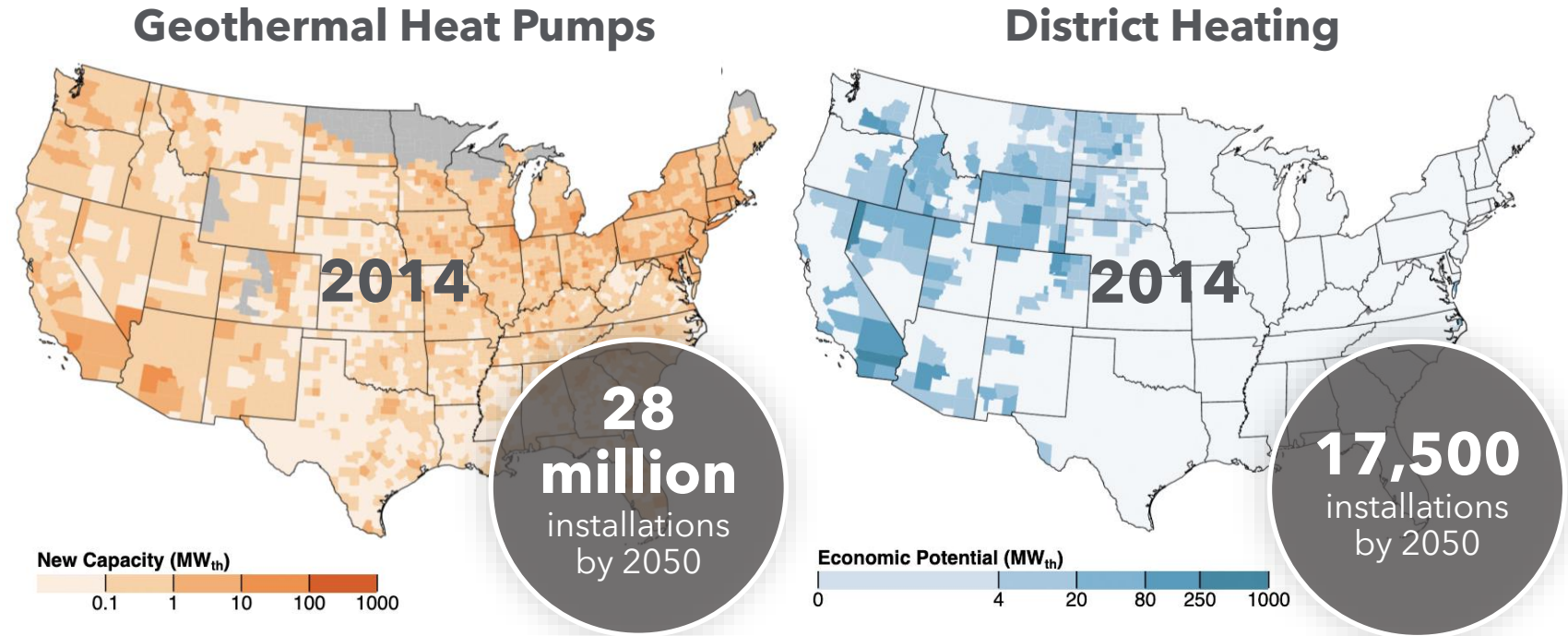
 **8.5%** of all U.S. generation by 2050



Source: Augustine et al. 2019

HEATING & COOLING

 **23%** of U.S. Heating and Cooling market by 2050

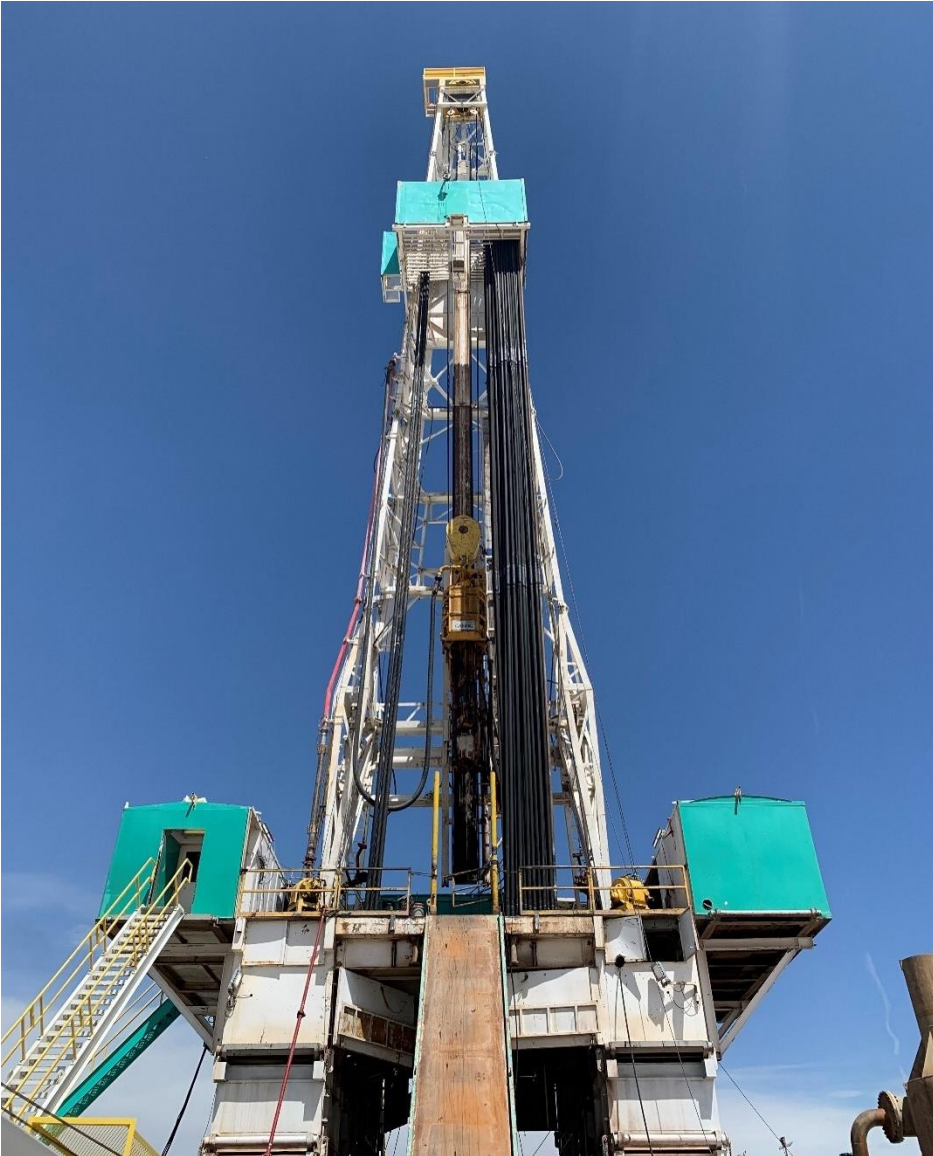


 up to **516 MMT**
of avoided CO₂e

 up to **1,281 MMT**
of avoided CO₂e

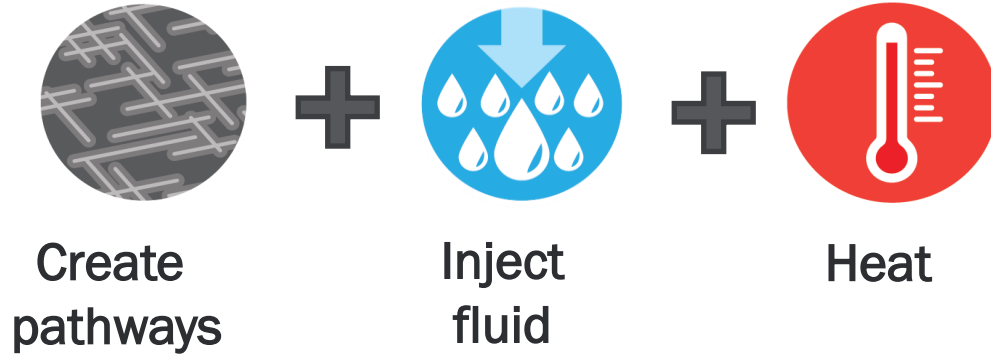
Total Emissions Reductions =
removal of **26 million** cars per year

Benefits of Geothermal Energy

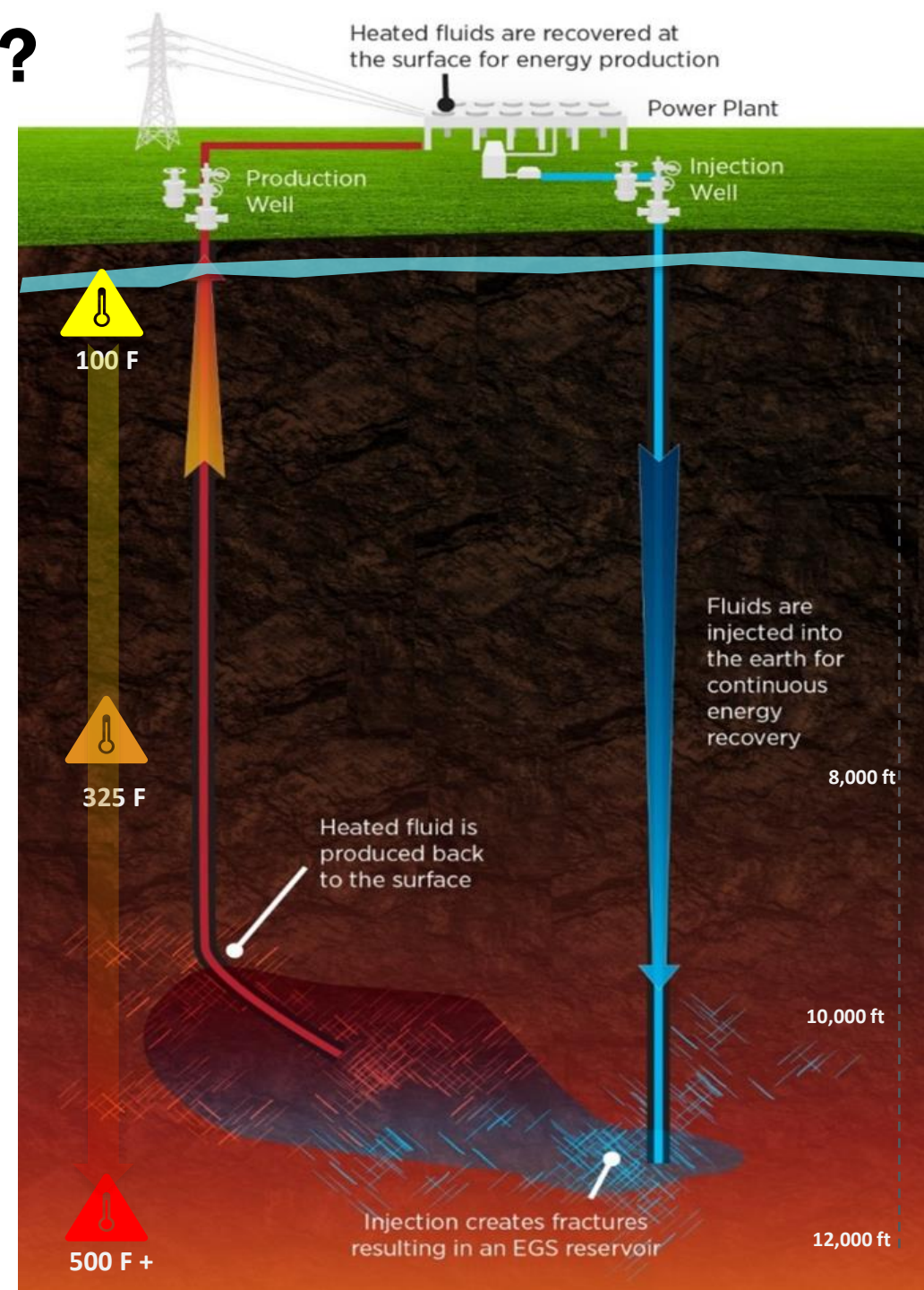


- Baseload power that can help balance intermittent generation from other renewables (solar, wind)
- Firm, flexible generation
- Space heating and cooling
- Smaller land footprint per MW than other renewables
- Combined hydrothermal and EGS industries can support up to 262,000 gross jobs by 2050
- Improved air quality, including reductions in SO_2 , NO_x , $\text{PM}_{2.5}$, and greenhouse gases

What are Enhanced Geothermal Systems?



- Create fractures in hot rock deep underground
- Inject a cool fluid into the earth so it returns to the surface hot
- Use the hot fluid to generate electricity or for heating



Enhanced Geothermal Shot – The Opportunity

The Enhanced Geothermal Shot will enable access to the five terawatts of heat resource in the United States, driving U.S. leadership in EGS and enabling a carbon-free energy future.

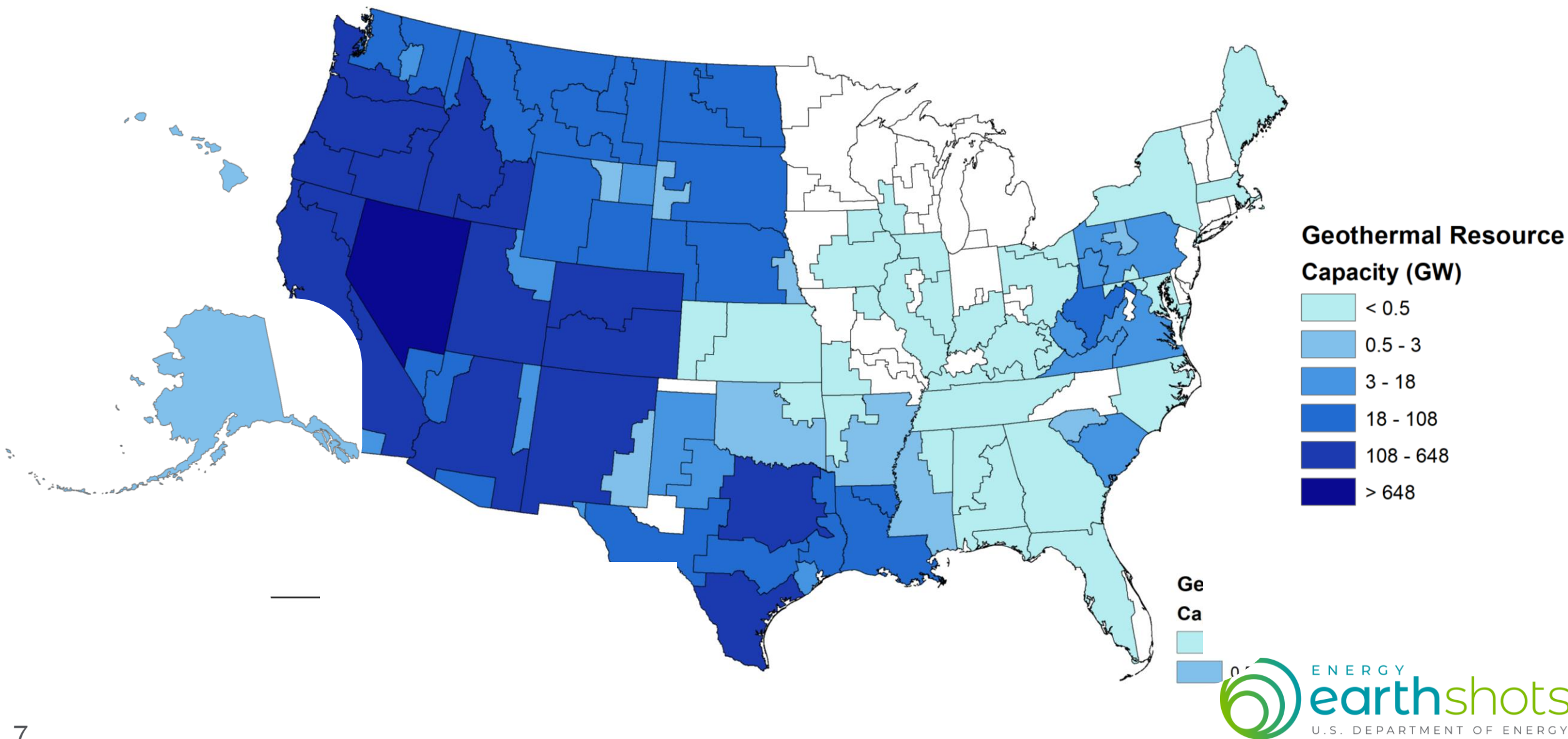
Why EGS?

Nationwide potential for
**CLEAN, FIRM, AND
DISPATCHABLE ELECTRICITY**



Widespread deployment of
**CARBON-FREE HEATING
AND COOLING**

U.S. Geothermal Resources



EGS Science and Technology Challenges

DEEP

4,000 to
>10,000 feet
in the
subsurface!



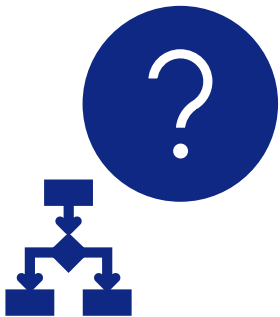
EXTREME

Hot, hard, abrasive
rock, corrosive
conditions

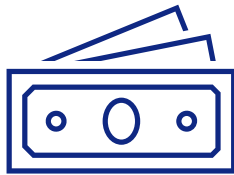


UNKNOWN

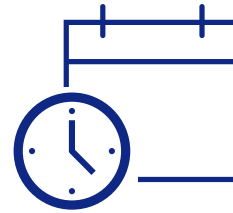
- Lack of data
- Lack of models
necessary to
approximate the
subsurface



Reduce the cost of enhanced geothermal system electricity to \$45/MWh, enabling deployment of 40 gigawatts by 2035



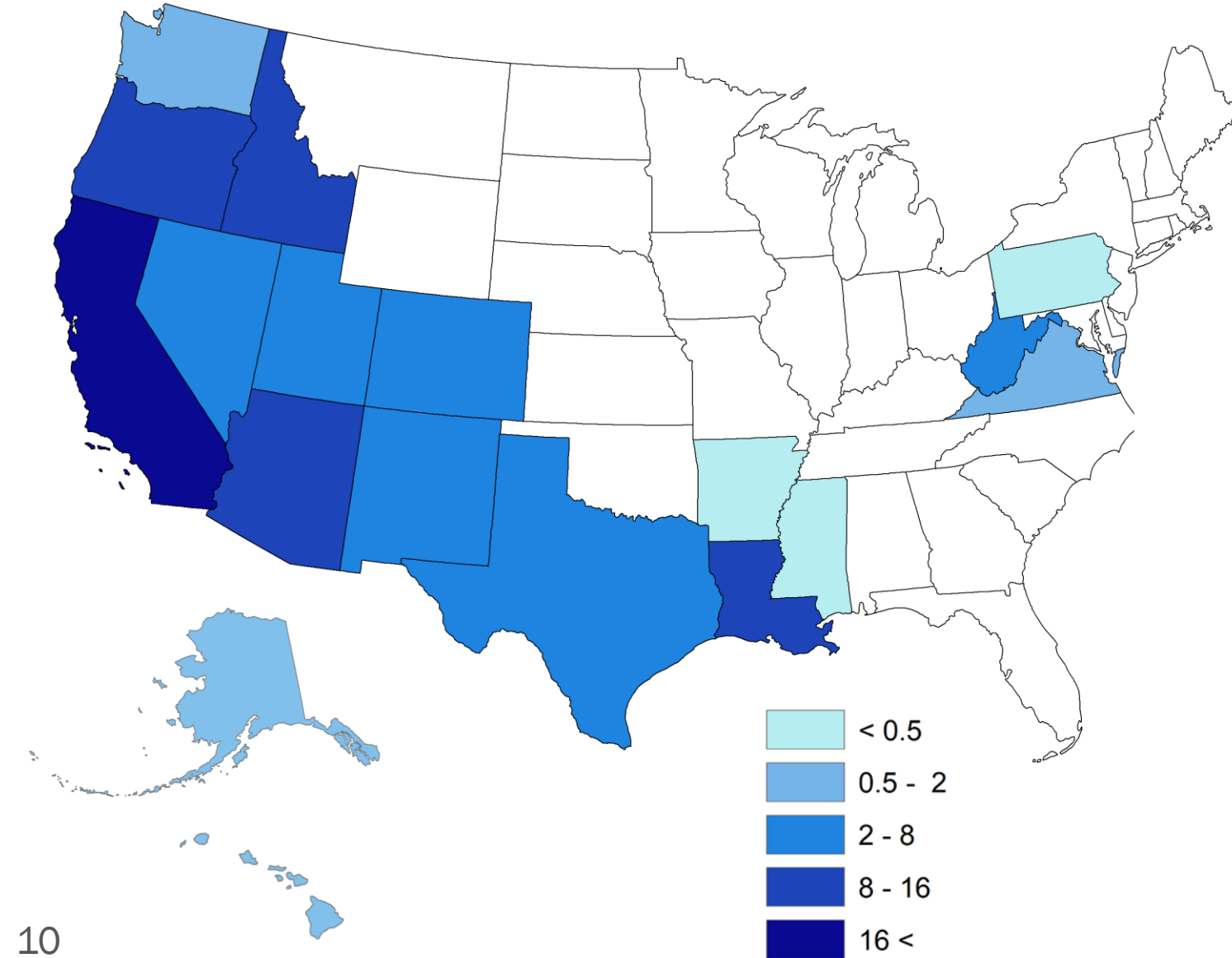
\$ 45/MWh



2035

Benefits of Realizing the Enhanced Geothermal Shot

2050 Deep EGS Deployment Capacity (GW)



Nationwide expansion of EGS for power



Clean heating & cooling for up to 45 million U.S. households



Drives just transition & leverages
140,000 fossil workers

Critical Technology Improvements to Achieve the Target



Resource Characterization

- Improved data gathering
- Improved resource identification with fewer wells
- Integration of High-Performance Computing



Well Construction

- Faster drilling
- More + larger wells
- Reduced cement and casing costs



Reservoir Production

- Higher fluid flow from wells
- Advanced wellbore completions (zonal isolation)



Plant

- Larger plants to accommodate higher fluid flow rates

Characterization, well construction, and reservoir production are interconnected and tightly coupled activities.

Interagency Stakeholders



Collaboration for nationwide geothermal resource assessment

Strong interest by TIP Directorate to partner on R&D initiatives

Collaborate on permitting through interagency working group

Ongoing collaboration to deploy geothermal power on military bases

External Stakeholders

Energy Justice and Environmental Concerns

- Robust community engagement process for research, development, and demonstration
- Address public concerns and perceived issues
 - *Induced seismicity, water usage, wildlife habitat*

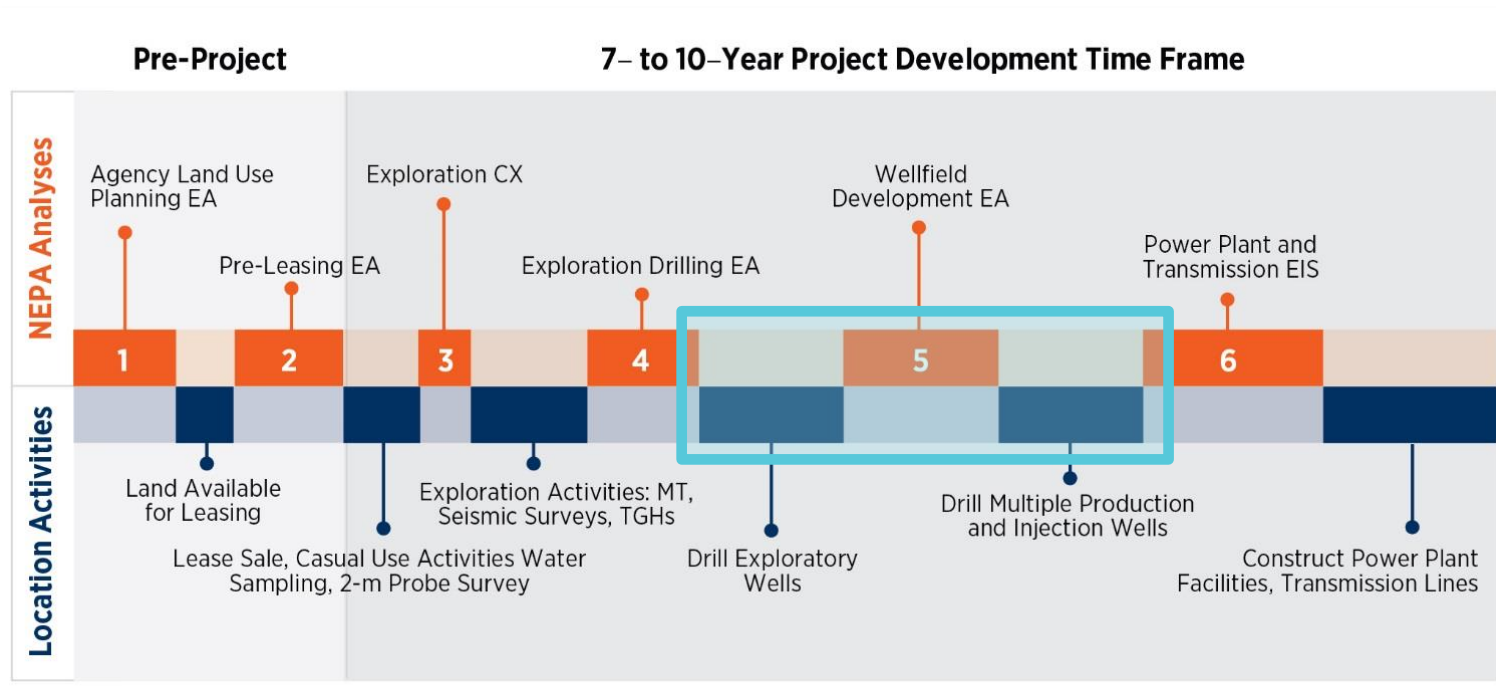
Industry

- Host industry roundtables
- Engage oil & gas, mining, and other subsurface operators to invest
- Utility engagement at the national, regional, and local levels

Labor

- Workforce analysis
- Union engagement (training, apprenticeships)
- Leverage oil and gas expertise

Geothermal Project Permitting Timelines



Regulatory uncertainty and inefficiency – particularly in drilling stages – create long and uncertain development timelines.____

Optimizing permitting timelines alone could increase installed geothermal electricity-generation capacity to 13 GWe by 2050.

- Federal interagency task force to address geothermal permitting timelines.
- Will provide recommendations directed toward federal agency regulators, California and Nevada state regulators, the National Renewable Energy Coordination Office, and relevant Congressional Committees



How Can You Stay Informed and Get Involved?

- GTO's Drill Down geothermal.energy.gov ("Subscribe to The Drill Down" box)
- GTO Funding Opportunities: geothermal.energy.gov (Select "Funding Opportunities" from dropdown menu)
- EERE's Weekly Jolt Newsletter: energy.gov/eere/eere-news
- EERE Funding Opportunities: energy.gov/eere/funding/eere-funding-opportunities



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