

# The Heat Beneath Our Feet

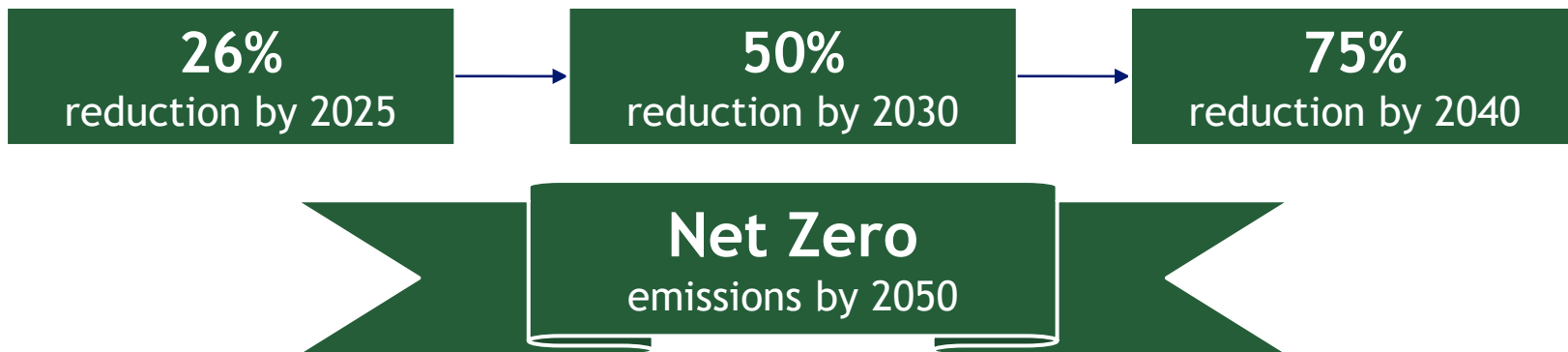
Colorado's Geothermal Energy Policy



# Colorado's Climate Goals

## Statewide Greenhouse Gas (GHG) pollution reduction goals (HB19-1261 and SB23-016)

“Colorado shall strive to increase renewable energy generation and eliminate statewide greenhouse gas pollution by the middle of the twenty-first century and have goals of achieving, at a minimum, a . . .”



\*relative to 2005 GHG pollution levels



# Clean Electricity Progress in Colorado

Utilities operating >99% of fossil fuel power plants in CO committed to meet at least an 80% GHG emissions reduction by 2030; required to submit Clean Energy Plan to Public Utilities Commission.

## Xcel Energy

- Reduces GHG 85% by 2030
- Closes all coal plants 2031
- Adds 2,600 MW of new renewable resources

## Holy Cross Energy

- Reduces GHG 99% by 2030
- 100 MW new wind, 35 MW new solar, 5 MW additional hydro, 25 Mw solar + storage

## Black Hills Electric

- Reduces GHG 90% by 2030
- 70% emission reduction by 2023 with 200 MW solar project.

## Colorado Springs

- Reduces GHG 80% by 2030
- 32% renewable energy by 2030
- Closes all coal plants by 2030

## Platte River Power

- Reduces GHG 87% by 2030
- Close all coal plants by 2030
- Add 400 MW of renewables

## Tri-State G&T

- Reduces GHGs 84% by 2030
- Close all CO coal plants by 2030
- Add 900 MW wind, 900 MW solar, 200 MW battery storage



# SB21-264: Clean Heat Framework

- Requires investor-owned utilities to file plans with the PUC to provide rebates and incentives to help consumers shift from gas to electric appliances.
- Gas distribution utilities required to submit clean heat plans with the PUC on how they will reduce GHG emission levels by 4% in 2025 and 22% in 2030 below 2015 levels.
- These plans will help gas utilities transition the businesses and the services they provide to their customers to better align with the state's greenhouse gas emissions reduction targets.

# Where does geothermal fit in Colorado?



# Why geothermal in Colorado?

- Colorado has a goal of **net-zero emissions by 2050**
  - 80% renewable electricity by 2030
  - 100% renewable electricity by 2040
- Geothermal electricity provides **clean, firm electricity**, which is pivotal to achieve a fully renewable electric grid
- Geothermal heating and cooling is an **economical and dependable** electrification solution for consumers and utilities alike
- Geothermal energy is a key tool for **community resilience** in the face of extreme weather events

# Addressing Utility Nightmares

## *What's a scenario that keeps utilities up at night?*

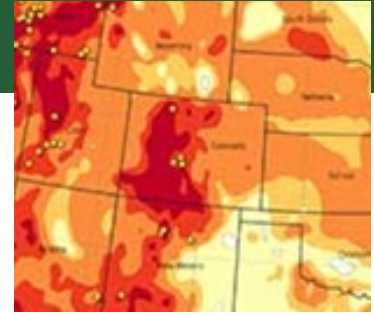
- Rural mountain community at the end of a radial system has recently electrified
- A blizzard arrives on a Friday evening during peak ski season, just as hundreds or even thousands of newly arrived electric vehicles plug-in



## *Geothermal energy can help address this challenge!*

- Geothermal energy can provide both **locally produced electricity** and **district heating** to meet this potential extreme peak demand

# Deep Geothermal Opportunities

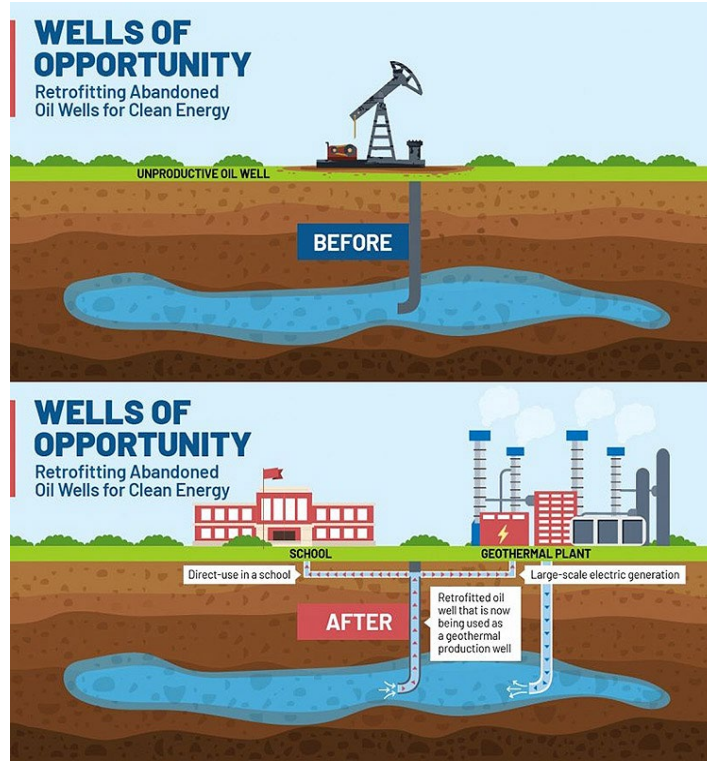


- Colorado has the second largest heat flow anomaly in the U.S., with the potential to produce up to **2 to 8 GW of electricity capacity by 2050** (NREL/Enhanced Geothermal Shot)
- Advancements from the oil and gas industry now allow us to access **high temperature heat deep underground**; with DOE funding, the GLADE project in Colorado to reach depths of 20,000+ feet
- Colorado will have over several gigawatts of **transmission capacity** open up as coal-fired power plants are retired by 2031





# Repurposing Oil Wells



Source: [National Renewable Energy Laboratory](#)



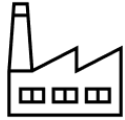


# Thermal Energy Networks

## Heat Producers



Data Centers



Factories



Hot spring runoff



Sewage



Oil & Gas



Building cooling



Grocery Stores



Ice rinks

## Heat Consumers



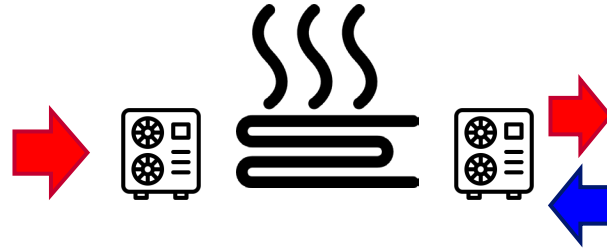
Building heating



Agriculture



Snowmelt



## Geothermal Exchange System

*System is sized, monitored and actively managed to balance heating and cooling needs throughout the year, ensuring efficient ground temperatures*





# Case Study: Colorado Mesa University

- 1.2 million sq feet networked with diversity of heating/cooling needs
  - 3,113 ton cooling load
  - 2,728 ton heating load; No use of boilers in 22'-23' heating season
- Compared to a conventional system:
  - ~650 kW demand reduction (13%)
  - ~1.3 GWh energy savings (10%)
  - ~58,000 Dth natural gas savings (55%)
  - ~10 million gallons water savings
- \$1.5 million savings per year have resulted in a 2% reduction of student tuition



CMU networked geothermal efficiency vs. a standard system

	Networked Geo COP	Conventional COP
Spring	7.0	1.9
Summer	3.6	3.4
Fall	5.8	2.0
Winter	8.9	1.2
Overall	5.7	1.9

Source: Evaluating a Community Ground Source Heat Pump System at Colorado Mesa University, 2023





# Case Study: Brown Ranch goes geothermal

STEAMBOAT  
**PILOT&TODAY**

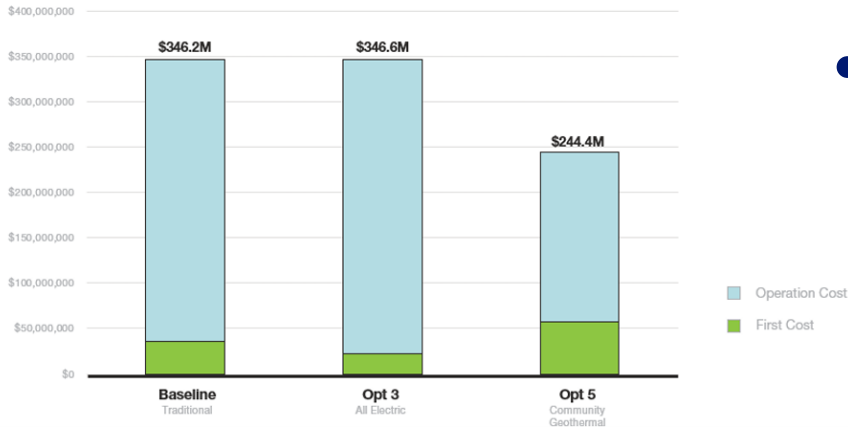
February 11, 2023

Brown Ranch to utilize  
geothermal heating system



- Proposed 1,100+ home community
- Study showed networked geothermal system has nearly double upfront cost, but-
- Community would realize **\$100 million of savings** over 30 years compared to a traditional or all electric approach with ROI of ~10 years

Figure 5-6  
Life Cycle Cost Summary over 30 Years



[Source](#)



**COLORADO**  
Energy Office

# Renewed Workforce Opportunities

- Colorado has over 33,400 miles of gas distribution pipelines (NCEL, 2011) and over 54,000 natural gas and oil workers (API, 2023)
- Geothermal energy networks for heating and cooling use the **same type of pipes** as gas networks, requiring the **similar workforce skills** to build and facilitate these systems
- Deep geothermal projects require the **same drilling technology** as the oil and gas industry to access high temperature heat many thousands of feet below

# Western Governors' Association HBOF Initiative



As chair of the WGA, Governor Jared Polis launched The Heat Beneath Our Feet initiative in 2023 to examine opportunities for and barriers to the accelerated development and deployment of geothermal energy technologies.



[Read report](#)

# Topline WGA HBOF Recommendations

Improve resource  
assessment and data  
collection

Mitigating risk in  
drilling and  
exploration

Optimizing  
permitting and  
improve regulatory  
certainty

Increasing  
awareness and  
education to  
develop geothermal  
markets

Expand funding  
opportunities

Implementing  
incentives for  
consumer adoption

Developing a  
workforce and  
contractor  
ecosystem

# HB23-1272: State Geothermal Tax Credits

Geothermal Electricity	2024 - 2033
Investment Tax Credit	30% - 50% ITC, merit-based \$5 million cap per project Program cap of \$35 million
Production Tax Credit	\$0.003/kWh or \$3/MWh

Heat Pump Technology (per residential unit)	2024 - 2025	2026 - 2029	2029 - 2033
Air-Source	\$1,500	\$1,000	\$500
Ground-Source, Water-Source, or combination system including either	\$3,000	\$2,000	\$1,000
Heat Pump Water Heater	\$500	\$250	\$250

*The nonresidential building rate is the tax credit multiplied by the number of increments of 4 tons up to 100 tons per building.*

*Thermal energy networks may combine the credit per connected residential unit and nonresidential building.*





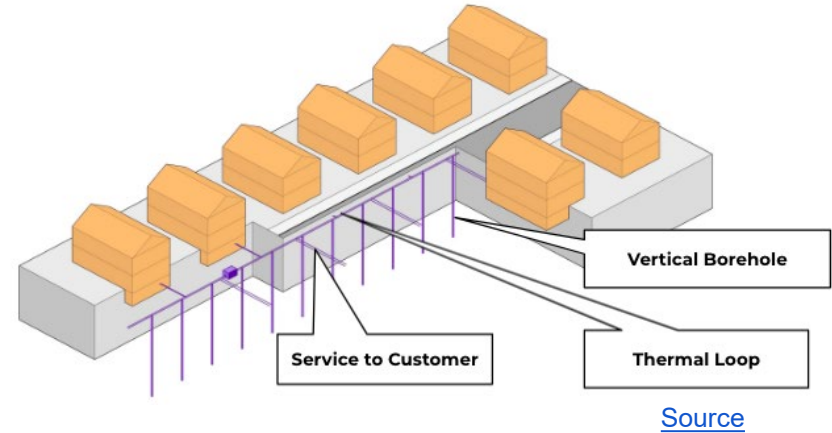
# HB23-1272: Heat Pump Contractor Certification

- Contractors administering state tax credits must be certified by the CEO
  - Streamlines credit for consumers
  - Provides needed market data to better inform future policy to support the sector; workforce development
- Contractors may retain a percentage of the tax credit (e.g. 10% or \$300 per GSHP)



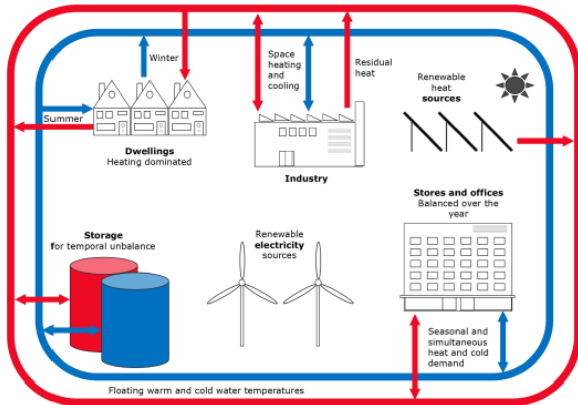
# HB23-1252: Thermal Energy Networks

- Gas utilities may propose thermal energy networks to PUC not otherwise included in a clean heat plan (SB21-264) or DSM filing
- Pilot geothermal project required for utilities over 500k customers (Xcel Energy) to be filed by September 1, 2024 with an assessment of its potential and models / mechanisms for widespread adoption
- Before Jan. 1, 2025, PUC shall initiate proceeding to determine commission rulemaking or legislative changes are needed to facilitate development of thermal energy



# HB22-1381: CEO Geothermal Energy Grant Program

\$12 million in grants to support the use of zero-emission, geothermal energy for electricity generation and space/water heating and cooling in homes, businesses, and communities.



Stef Boesten, et al, Adv. Geosci., 49, 129–136, 2019.  
<https://doi.org/10.5194/adgeo-49-129-2019>



Single-Structure Geothermal Grant



Community District Heating Grant



Geothermal Electricity Grant

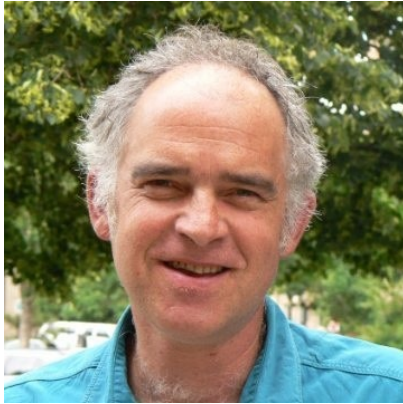
The first Request for Applications will launch no later than November 14, 2023



# HB 23-285 Energy and Carbon Management Commission

- Addresses regulatory approvals for deep geothermal development
- Broadened former mission of Oil and Gas Conservation Commission to better align with current and future needs
- ECMC will regulate underground carbon dioxide sequestration, hydrogen storage and pipelines, deep geothermal in addition to oil and gas
- Goal to develop straightforward permitting deep geothermal projects

# Thank you!



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Stay grounded as Colorado  
geothermal heats up:  
[Join the CEO GEO newsletter!](#)

Program information is available at:  
[energyoffice.colorado.gov/geothermal  
-energy-grant](https://energyoffice.colorado.gov/geothermal-energy-grant)





# Single-Structure Geothermal Grant

Applicants constructing a new building and are installing a geothermal system as primary heating and cooling system for the building. Must meet 2021 IECC or newer, and use licensed plumbing or mechanical contractors with apprenticeship program.

Building Type	For-Profit \$/ton	Non-Profit \$/ton	Tonnage Limit
Non-Residential	\$2,000	\$3,000	100
Multifamily	\$2,000	\$3,000	100
Single-Family	\$2,000	\$2,000	5 tons

Limited to 100 buildings per contractor. The use of funds for building retrofits is being assessed. 80% of total fund may be awarded to SSG Grants, with at least 25% of SSGG must be awarded to low-income, disproportionately impacted, or just transition communities.





# Community District Heating Grant

Applicants constructing ground-source, water-source, or multi source thermal systems that serve more than one building.

Project Type	Eligible Funding	Stipulation
Scoping Study	Up to \$100,000 per project	Determine GHG reduction potential and reasonable-costs
Detailed Design Study	Up to \$500,000 per project	Evaluate issues, legal and financial responsibilities
Installation	Up to \$500,000 per project	Up to 50% of the first \$1 million in project costs

Parties involved with the application may not apply for more than 2 grants per year. Up to 25% of fund may be awarded to CDHG and prioritize projects in low-income, disproportionately impacted, or just transition communities and maximize projects that would not otherwise occur.





# Geothermal Electricity Generation Grant

Applicants developing geothermal electricity generation and/or projects which pair with electrolyzers to produce hydrogen from geothermal energy generation.

Study Type	Eligible Funding
Identify and explore suitable resources (<\$1 million)	Up to 50% of study cost (\$500k max) Up to 60% of study cost if includes hydrogen production or direct air capture (\$600k max)
Identify and explore suitable resources (>\$1 million)	Up to \$500,000 per project; and,
Resources needing confirmation through drilling & testing	Up to an additional \$500,000 may be awarded by CEO

Eligible for local governments, corporations, and gas or electric service public utilities. A person may apply for more than one cost-matching grant in a year for <\$1m project; no more than 2 grants >\$1m. Up to 40% of total money in fund may be awarded through grants to support geothermal electricity generation and resource development, which may include hydrogen generation produced from geothermal energy.

