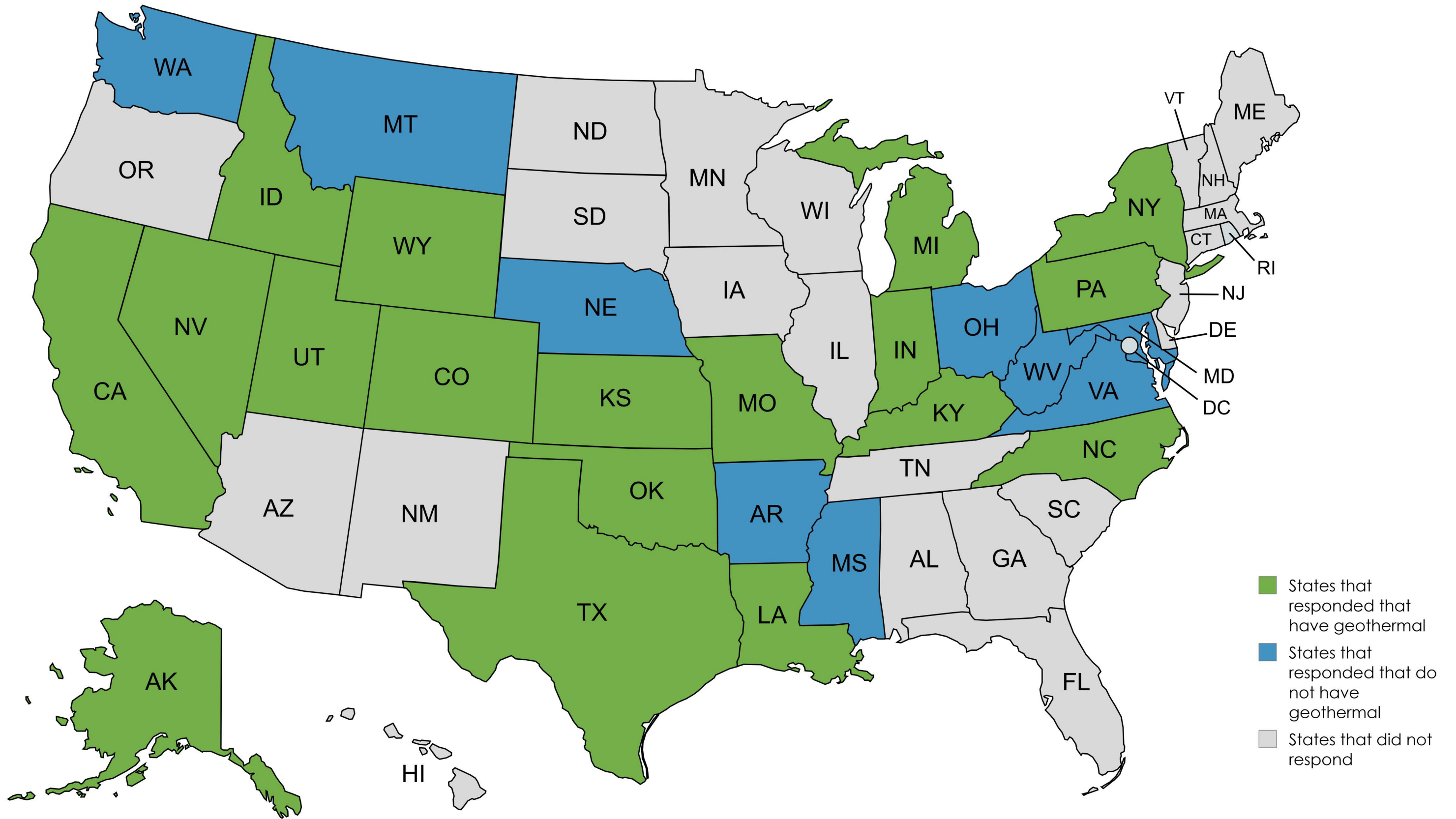


# **Geothermal Operations: Exploring the Need for a State Regulatory Forum**

## **Survey Results**



2025



## I. Regulation

### A. Agency

	What state agency is primarily responsible for overseeing drilling, operation, and plugging of geothermal wells?	What other state agencies have oversight or permitting responsibilities related to geothermal wells, use of the heat, or use of the water?
<b>Alaska</b>	Our agency, the Alaska Oil and Gas Conservation Commission, is responsible for oil & gas and geothermal wells in Alaska.	Alaska Department of Natural Resources
<b>Arkansas</b>	Oil and Gas Commission would be responsible provided current statutory authority is clarified to include geothermal wells.	None
<b>California</b>	California Geologic Energy Management Division (CalGEM).	<p>a. The Regional Water Quality Control Board (RWQCB) of the area where the geothermal well or project is located will permit the surface discharge of the geothermal well's brine if there is no injection of the brine. They will also be able to comment on injection project permits under application with CalGEM.</p> <p>b. The Air Pollution Control District (APCD) of the area where the geothermal well or project is located may be involved in the permitting of emissions related to the operation of equipment and other air emission sources related to the development of the geothermal resource.</p> <p>c. The California Energy Commission (CEC) permits any geothermal power project that will produce 50 MW of electric power or more. If less than 50 MW, the county permits the power project.</p> <p>d. Shallow geothermal heat-exchange wells including ground source heat pump wells are under the supervision of the Department of Water Resources (DWR).</p>
<b>Colorado</b>	Colorado Energy and Carbon Management Commission for deep geothermal wells.	Colorado Division of Water Resources (State Engineer) for shallow geothermal wells.
<b>Idaho</b>	Idaho Department of Water Resources (IDWR).	
<b>Indiana</b>	Indiana does not have a state agency responsible for geothermal wells.	Indiana does not have a state agency responsible for geothermal wells.
<b>Kansas</b>	KDHE-GWTU manages the drilling, construction, and plugging of geothermal wells in Kansas.	The KDHE Bureau of Waste Management oversees the disposal of heat transfer fluid. For certain applications needing water rights, it's advisable to
<b>Kentucky</b>	The Kentucky Division of Water oversees the drilling of geothermals well but not the operation of them.	

## I. Regulation

### A. Agency

	<b>What state agency is primarily responsible for overseeing drilling, operation, and plugging of geothermal wells?</b>	<b>What other state agencies have oversight or permitting responsibilities related to geothermal wells, use of the heat, or use of the water?</b>
<b>Louisiana</b>	Louisiana Department of Energy and Natural Resources - Injection and Mining Division.	Open system geothermal wells, water, and any extraction wells would fall under DENR. The Louisiana Public Service Commission may have some jurisdiction if the heat is used to generate electricity. I'm not sure if shallow closed loop systems require permitting.
<b>Maryland</b>	Unknown.	Unknown.
<b>Michigan</b>	Currently there is no state level statute for geothermal, some local health departments may be regulating aspects of closed loop geothermal, and EGLE is working on regulatory legislation with stakeholders and legislature in coming year.	Industry not regulated directly, currently.
<b>Mississippi</b>	Mississippi Department of Environmental Quality.	Mississippi Oil and Gas Board would permit the drilling of the well
<b>Missouri</b>	Missouri Geological Survey, Well Installation Section	Missouri Geological Survey, Water Resources Center, Missouri Department of Natural Resources, Division of Environmental Quality, Water Protection Program.
<b>Montana</b>	Board of Water Well Contractors.	Department of Natural Resource and Conservation (Water Division); Department of Environmental Quality.
<b>Nebraska</b>		
<b>Nevada</b>	Nevada Division of Minerals	Nevada Division of Environmental Protection
<b>New York</b>	New York State Department of Environmental Conservation (NYSDEC)	New York State Department of Public Service has authority to regulate the development and operation of Utility Thermal Energy Networks.
<b>North Carolina</b>	If we had any, it would be the Department of Environmental Quality / Division of Mineral, Energy, and Land Resources	Division of Water Quality
<b>Ohio</b>	Ohio Division of Oil and Gas Resources Management is responsible for wells for geothermal energy to produce electric power.	
<b>Oklahoma</b>	Oklahoma Department of Environmental Quality.	Oklahoma Department of Environmental Quality.

## I. Regulation

### A. Agency

	<b>What state agency is primarily responsible for overseeing drilling, operation, and plugging of geothermal wells?</b>	<b>What other state agencies have oversight or permitting responsibilities related to geothermal wells, use of the heat, or use of the water?</b>
<b>Pennsylvania</b>	There currently is no designated PA state agency overseeing all types of geothermal wells. However, geothermal wells that meet the definition of a "well" as defined in Title 58 of the Oil and Gas Act (58 Pa.C.S. Section 3203) would be regulated by the Pennsylvania Department of Environmental Protection (DEP), Office of Oil and Gas Management. Other state agencies such as DEP's Clean Water Program may be responsible for <u>incidental permitting</u> .	PA Public Utility Commission regulates electric transmission, PA Department of Conservation and Natural Resources oversees well registration, and local municipalities may have geothermal system ordinances. Pennsylvania does not have primacy for the underground injection control (UIC) program, so EPA Region III may regulate geothermal electric power wells as Class V UIC wells in.
<b>Texas</b>	Railroad Commission of Texas.	Public Utility Commission of Texas (power transmission).
<b>Utah</b>	Currently the Division of Water Rights within the Department of Natural Resources (DNR). This role covers conventional water geothermal wells. The DNR is evaluating moving this responsibility to a different division, or group of divisions, since new technology does not involve native water aquifers.	Utah Geological Survey; Utah Division of Oil, Gas, & Mining; Utah Office of Energy Development.
<b>Virginia</b>	Virginia Department of Energy	State Water Control Board
<b>Washington</b>	Washington Department of Natural Resources.	Washington Department of Ecology has jurisdiction on all water wells and geothermal injection wells.
<b>West Virginia</b>	West Virginia Department of Environmental Protection, Division of Water and Waste Management.	None.
<b>Wyoming</b>	Wyoming regulations are not clear or do not provide this authorization to any specific agency.	The Wyoming State Engineer's Office has the authority to appropriate water or steam that may be used in a geothermal project.

## I. Regulation

### B. Legal Citations

	What statutory code sections govern geothermal operations?	What regulatory code sections govern geothermal operations?
<b>Alaska</b>	Alaska Statutes AS 41.06.005-061.	Alaska Administrative Code 20 AAC Chapter 25 applies to geothermal wells in addition to oil and gas wells, except where 20 AAC 25.705-740 has some regulations specific to geothermal wells.
<b>Arkansas</b>	N/A	N/A
<b>California</b>	Statutory codes for geothermal operations are found in the California Public Resources Code, Division 3 Oil and Gas, Chapter 4 Geothermal Resources, sections 3700-3776. Some definitions pertinent to geothermal operations may also be found in Division 6, Chapter 3 Oil and Gas Mineral Leases, section 6903 and in Division 13 Environmental Quality, sections 21065.5, 21067 and 21090.1.	Regulatory codes pertaining to geothermal operations are found in Title 14 of the California Code of Regulations, Division 2, Chapter 2 Implementation of the California Environmental Quality Act of 1970, sections 1681-1685; Subchapter 4 State-wide Geothermal Regulations, sections 1900 – 1981.2, and Subchapter 5 Disclosure and Inspection of Public Records sections 1995-1998.2 .
<b>Colorado</b>	§ 37-90.5-101 through § 37-90.5-111.	2 CCR 404-1 for Deep Geothermal regulated by ECMC 2. CCR 402-10 for Shallow Geothermal regulated by DWR.
<b>Idaho</b>	Idaho Code § 42-4001.	IDAPA 37.03.04.
<b>Indiana</b>	N/A	N/A
<b>Kansas</b>	Article 30 Water Well Contractors License Water Well Construction.	N/A
<b>Kentucky</b>		
<b>Louisiana</b>	La R.S. 30:800-809.	LAC Title 43: XVII. Chapter 1 (Statewide Order No. 29-N-1).
<b>Maryland</b>	Unknown.	Unknown.
<b>Michigan</b>	None, currently.	None, currently.
<b>Mississippi</b>	Class V well.	MS would regulate as a Class V well 40CFR 144.
<b>Missouri</b>	Section 256.600-640, RSMo "Water Well Drillers' Act." Section 644, RSMo "Missouri Clean Water Law."	10 CSR 23 Chapters 1, 2, 3, and 5.10 CSR 20 Chapters 6.
<b>Montana</b>	37-43-100, MCA, Water Well Contractors.	ARM 36.21 BOARD OF WATER WELL CONTRACTORS.
<b>Nebraska</b>		
<b>Nevada</b>	NRS 534A and 445A.	NAC 534A and 445A.

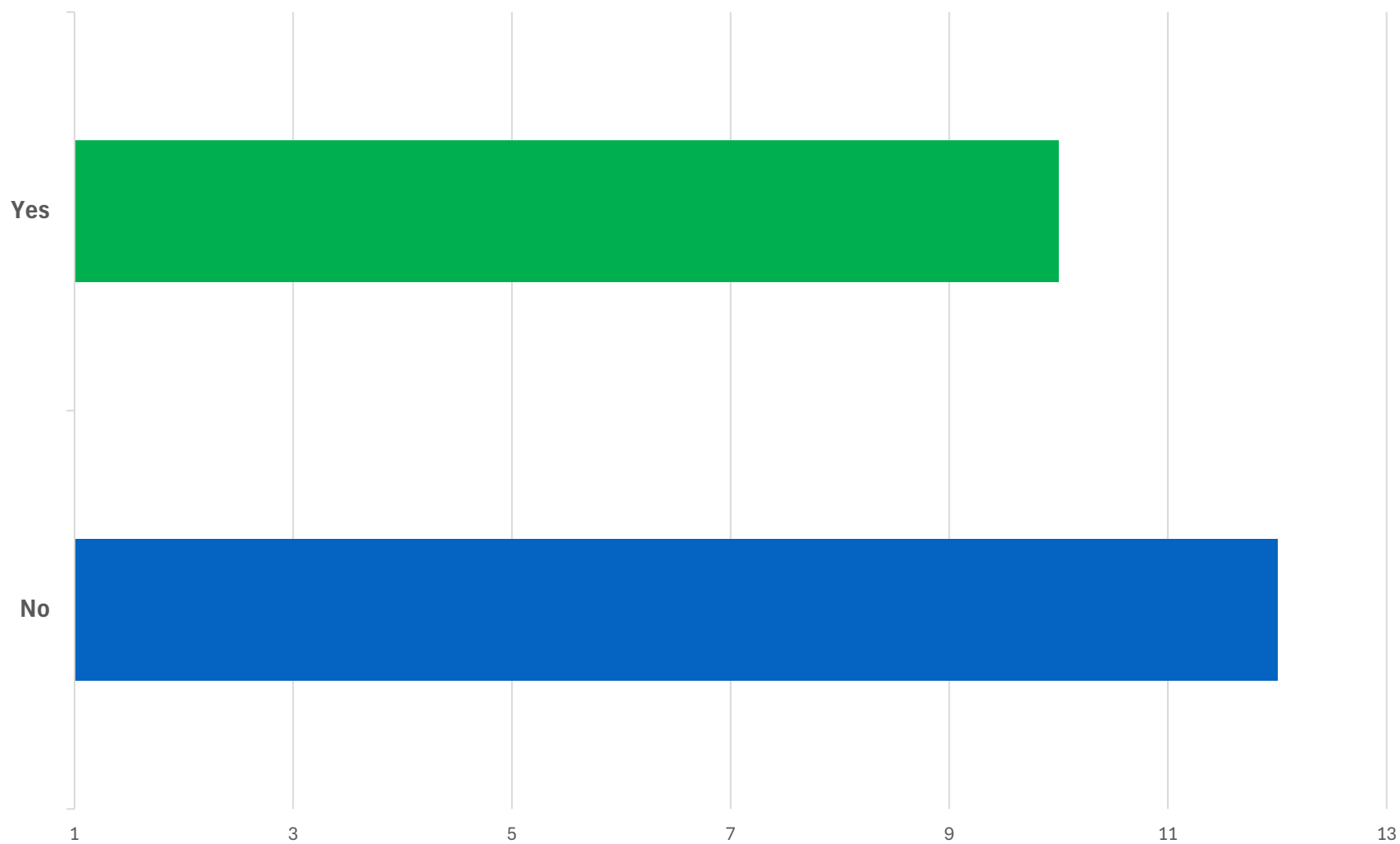
## I. Regulation

### B. Legal Citations

	What statutory code sections govern geothermal operations?	What regulatory code sections govern geothermal operations?
<b>New York</b>	Geothermal wells drilled deeper than 500 feet are regulated in accordance with Environmental Conservation Law (ECL) Article 23. Article 23-0305(14) applies to open loop and standing column geothermal wells deeper than 500 feet, while Article 23-0305(15) applies to closed loop geothermal boreholes deeper than 500 feet. Geothermal wells drilled shallower than 500 feet are regulated in accordance with ECL Article 15. Open loop geothermal wells, regardless of depth, may be subject to regulation under ECL Article 17, which covers State Pollution Discharge Elimination System Permits.	Open loop and standing column geothermal wells drilled deeper than 500 feet are regulated in accordance with 6 NYCRR Parts 550-559, similar to oil, natural gas and solution salt mining wells. NYSDEC is currently working on rule making specific to closed loop geothermal boreholes drilled deeper than 500 feet. This rulemaking will establish a new part in 6 NYCRR that is specific to closed loop geothermal boreholes. Open loop geothermal wells may be subject to the requirements of 6 NYCRR Part 750, if a State Pollution Discharge Elimination System Permit is required.
<b>North Carolina</b>	None in existence yet.	N/A
<b>Ohio</b>	Ohio Revised Code section 1509.221.	None.
<b>Oklahoma</b>	Please contact ODEQ.	Please contact ODEQ.
<b>Pennsylvania</b>	Pennsylvania has no comprehensive statutory code governing geothermal operations. The Alternative Energy Portfolio Standards Act (73 P.S. §§ 1648.1-1648.8, as amended by 66 Pa.C.S. § 2814,) provides requirements for electric distribution companies to provide alternative energy resources that may include geothermal.	52 Pa.Code Chapter 75 (relating to Alternative Energy Portfolio Standards) defines geothermal energy as an “alternative energy source” per 52 Pa.Code § 75.1.
<b>Texas</b>	Texas Natural Resources Code, Title 5, Chapter 141, (Geothermal Resources), Geothermal Resources Act of 1975. Also, references to geothermal resources in Chapters 89 and 91, Texas Natural Resources Code Texas Water Code, Chapter 27 (Injection Wells), Section 27.037, Jurisdiction over Closed-Loop Geothermal Injection Wells.	Currently, geothermal referenced in the rules in Title 16, Chapter 3. Shallow closed-loop geothermal operations are regulated under new Title 16, Chapter 6 of the Texas Administrative Code. We are currently drafting deep-geothermal regulations to address new technologies.
<b>Utah</b>	Utah Code 73.22.	Utah administrative rule R655-1.
<b>Virginia</b>	Title 45.2, Subtitle V, Chapter 20 §§ 45.2-2000 through 45.2-2008.	Title 4. Agency 25. Chapter 170. 4VAC25-170
<b>West Virginia</b>	For drilling and plugging of geothermal wells--WV Code § 22-6 applies and WV regulation 47-13.	For drilling and plugging of geothermal wells--WV Code § 22-6 applies and WV regulation 47-13.
<b>Washington</b>	RCW 78.60.	WAC 332-17.
<b>Wyoming</b>	Wyoming Statute Title 41, Chapter 3, Section 9. (W.S. 41-3-900).	

**Figure 2**

**Does your state have a trade group that represents geothermal energy operators?**





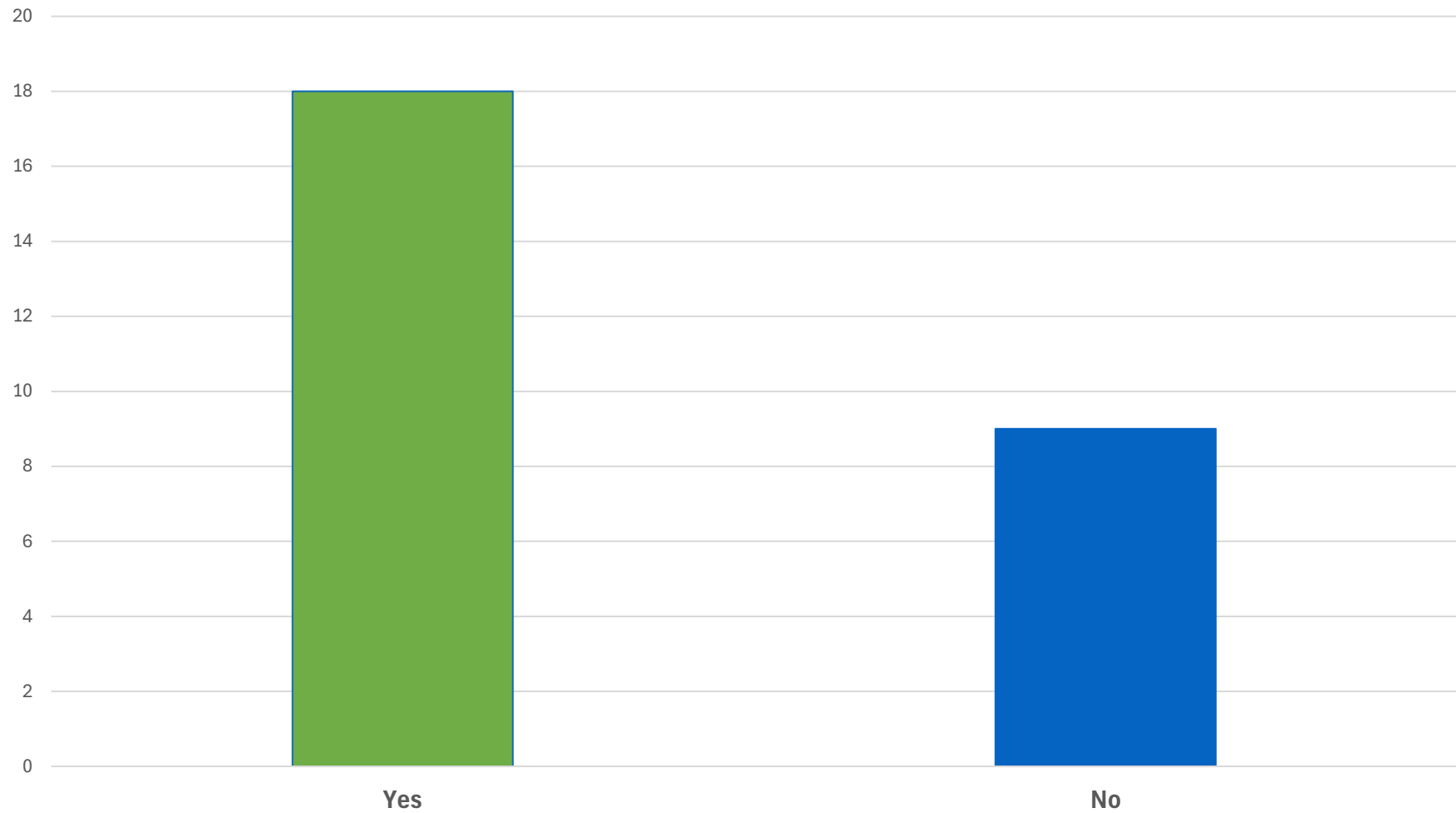
## II. Trade Groups

	Does your state have a trade group that represents geothermal?	Trade Group that represents geothermal energy operators. Please identify the trade group.
<b>Alaska</b>	No	
<b>Arkansas</b>		
<b>California</b>	Yes	To my knowledge, there is no equivalent state group similar to those that CalGEM interacts with in the oil and gas sector for oil and gas wells. However, CalGEM has been in communication with Geothermal Rising, a national geothermal advocacy group.
<b>Colorado</b>	Yes	Geothermal Rising is active in Colorado.
<b>Idaho</b>		
<b>Indiana</b>		
<b>Kansas</b>	No	
<b>Kentucky</b>	No	
<b>Louisiana</b>	No	
<b>Maryland</b>		
<b>Michigan</b>	No	It is uncertain whether there is an organized group.
<b>Mississippi</b>	No	
<b>Missouri</b>	Yes	Missouri Geothermal Association.
<b>Montana</b>		
<b>Nebraska</b>	No	
<b>Nevada</b>	Yes	Nevada Petroleum and Geothermal Society.
<b>New York</b>	Yes	New York Geothermal Energy Organization (NY-Geo).
<b>North Carolina</b>	Yes	NC Sustainable Energy Association.
<b>Ohio</b>	Yes	Unknown
<b>Oklahoma</b>		

## II. Trade Groups

	Does your state have a trade group that represents geothermal?	Trade Group that represents geothermal energy operators. Please identify the trade group.
<b>Pennsylvania</b>	Yes	The Pennsylvania Geothermal Heat Pump Association, Inc. (PA-Geo) is a nonprofit, member-driven, trade organization founded in 2019. PA-Geo's founding members are residential and commercial geothermal professionals and subject matter experts focused on the advancement of geothermal heat pump (GHP) technology in Pennsylvania. PA-Geo focuses on increasing the visibility and understanding of GHP systems by connecting consumers with local professionals and inspiring property owners and stakeholders to invest in GHP systems. PA-Geo also provides training and education to those who wish to broaden their knowledge of geothermal technology and its many environmental and economical benefits.
<b>Texas</b>	Yes	Texas Geothermal Energy Association (TxGea).
<b>Utah</b>	No	
<b>Virginia</b>	No	
<b>West Virginia</b>	No	
<b>Washington</b>	No	
<b>Wyoming</b>	No	

**Figure 3**  
**Do you currently have geothermal operations in your state?**



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### III. Geothermal Operations

#### A. Current

	Do you currently have geothermal operations in your state?	If yes, please describe the operations. Include in your description whether the operations are shallow closed loop, deep bedrock closed loop, deep bedrock open, or another type of geothermal operation.
<b>Alaska</b>	Yes	A large hydrothermal steam power production facility and wells are planned, with wells 2000 ft deep and 350+ deg F steam. The hydrothermal resource has been confirmed and the development project is under way. Another operation is a small-scale geothermal project powering a hot springs resort. There have been several exploratory geothermal temperature gradient and test wells drilled over the past few decades.
<b>Arkansas</b>	No	
<b>California</b>	Yes	Geothermal operations are mainly: a) Electric power generation from naturally-occurring hydrothermal or steam geothermal resources. The power plants are typical steam flash systems or binary-type. b) Direct-use for space heating and commercial spas.
<b>Colorado</b>	Yes	There are historic thermal energy network style shallow systems used in Pagosa Springs, and other municipalities. Colorado Mesa University in Grand Junction has an extensive and growing campus wide thermal energy network. Currently in the pre-drilling phase of permitting, there are two deep geothermal projects. 1) In the Denver-Julesburg Basin a project will drill a pair of wells into the Precambrian basement rock at approximately 20,000' TVD. The wells will meet at the toes, forming a deep bedrock closed loop system. 2) A conventional hydrothermal project is being planned in Chaffee County, near Buena Vista.
<b>Idaho</b>	Yes	
<b>Indiana</b>	Yes	I only know they exist in Indiana.
<b>Kansas</b>	Yes	Horizontal geothermal closed loop, vertical geothermal closed loop, injection of water-geothermal open loop, and surface discharge geothermal open loop.
<b>Kentucky</b>	Yes	

### III. Geothermal Operations

#### A. Current

	Do you currently have geothermal operations in your state?	If yes, please describe the operations. Include in your description whether the operations are shallow closed loop, deep bedrock closed loop, deep bedrock open, or another type of geothermal operation.
Louisiana	Yes	To my knowledge, the only existing systems are shallow closed loop, which don't require permitting from DENR since there's no underground injection activity.
Maryland	No	
Michigan	Yes	Michigan is a relatively cool basin with geothermal gradient. There is extensive shallow closed loop geothermal being installed, and also moderate amount of deeper (up to 1000') bedrock closed loop geothermal wells being installed.
Mississippi	No	
Missouri	Yes	Mostly shallow closed loop. Current regulations do not allow closed-loop systems greater than 500 feet. Deep bedrock open loop systems occur but are few.
Montana	No	
Nebraska	No	
Nevada	Yes	All of the above.
New York	Yes	Most geothermal wells throughout New York are closed loop wells drilled to less than 500 feet in depth. Approximately 150 geothermal wells deeper than 500 feet have been drilled in New York under the ECL Article 23 regulatory program since 1987. Of those, only one is a closed loop well, while the remainder are all standing column wells. Recent legislation changes (September 2023 and February 2024) exempted closed loop geothermal wells drilled deeper than 500 feet from regulation under the ECL Article 23 regulatory program until NYSDEC promulgates regulations specific to this well type. It is unknown to NYSDEC how many closed loop geothermal wells have been drilled deeper than 500 feet since the initial legislation change.
North Carolina	Yes	For heat pumps. Not generally enough heat for electricity production.
Ohio	No	The Division is not aware of any geothermal wells used for electricity production.
Oklahoma	Yes	Please contact ODEQ.

### III. Geothermal Operations

#### A. Current

	Do you currently have geothermal operations in your state?	If yes, please describe the operations. Include in your description whether the operations are shallow closed loop, deep bedrock closed loop, deep bedrock open, or another type of geothermal operation.
<b>Pennsylvania</b>	Yes	Shallow Geothermal wells for heating and cooling are common in Pennsylvania and there are already several large-scale heating and cooling district geothermal systems in the Commonwealth. These systems include wells typically at shallow depths of less than 500 feet. Besides highly efficient heating and cooling of buildings, these shallow systems include a wide range of applications such as food processing and pre-heating and drying in manufacturing.
<b>Texas</b>	Yes	Shallow Closed-loop geothermal (for heating and cooling).
<b>Utah</b>	Yes	Deep bedrock closed loop/enhanced geothermal. Deep rock is drilled, fractured, then connected to a nearby well developed in the same way. Fluid is then injected by one well, heated, and extracted by the adjacent well.
<b>Virginia</b>	No	
<b>West Virginia</b>	No	N/A
<b>Washington</b>	No	
<b>Wyoming</b>	Yes	There have been several wells drilled to test the potential for use of geothermal steam to heat buildings or campuses.

### III. Geothermal Operations

#### B. Anticipated

	Do you anticipate an increase in geothermal development activity in the next 2-5 years?	If yes, please describe the type of operations anticipated.
Alaska	Yes	Mostly exploration wells to test geothermal gradients and perform flow tests in areas near volcanoes where high temperatures are present close to surface. Hydrothermal production wells are also being planned for full scale energy generation. Also the US army is planning to drill exploratory geothermal temperature gradient wells to delineate the potential for alternative energy sources for their army base. There is potential for geothermal energy to provide energy needs for mining operations in remote parts of Alaska.
Arkansas		
California	Yes	Three new geothermal power plants with a total capacity of 357 net MWe in the Salton Sea geothermal field are currently undergoing licensing with the California Energy Commission. At least 50 new wells to support the plants will be drilled. This project will employ typical steam flash technologies. Some existing plants are being converted and expanded to binary-type power generation. There are also a number of projects in the exploration planning stage for potential EGS-type drilling/completion and similarly for geologic hydrogen.
Colorado	Yes	We expect several pilot deep geothermal projects to be tested, and scaled up over time.
Idaho	Yes	
Indiana	No	
Kansas	Yes	We expect to see a rise in vertical geothermal closed loop installations.
Kentucky	No	
Louisiana	Yes	Deep bedrock open. So far we've just received early inquiries. No real projects as of yet.
Maryland		
Michigan	Yes	Likely expansion of closed loop geothermal, and drilling of deeper closed loop type bedrock wells.
Mississippi	Yes	Geothermal wells for electric generation.
Missouri	No	
Montana		
Nebraska	No	

### III. Geothermal Operations

#### B. Anticipated

	Do you anticipate an increase in geothermal development activity in the next 2-5 years?	If yes, please describe the type of operations anticipated.
<b>Nevada</b>	Yes	There has been an increase in enhanced geothermal systems and in conventional industrial geothermal power generation.
<b>New York</b>	Yes	There is significant interest in closed loop geothermal wells drilled for residential, commercial and utility scale purposes. There is additional interest in deep open loop geothermal, as Cornell University has proposed an open loop geothermal system targeting the Pre-Cambrian basement.
<b>North Carolina</b>	Yes	More local heat pumps.
<b>Ohio</b>	No	
<b>Oklahoma</b>		
<b>Pennsylvania</b>	Yes	There has been an increased interest in low-temperature geothermal reservoir temperatures for electricity generation. There are several areas in Pennsylvania where an adequate geothermal gradient exists for successful binary cycle geothermal system implementation. PADEP applied for pilot-scale Enhanced Geothermal System (EGS) grant available under the Infrastructure Investment and Jobs Act on September 20, 2024 for a project proposing to generate electrical power and thermal energy for rural communities adjacent to legacy and current oil and gas development. The project plans to transfer heat from the subsurface strata to the surface, via gas/fluids in an EGS system where its thermal energy generates electricity for the local grid and provides thermal energy for nearby homes and businesses. The project uses existing oil and gas facilities so there is no additional land use for the renewable energy generation facilities.
<b>Texas</b>	Yes	Hydrothermal, geopressured, hot dry rock, EGS.
<b>Utah</b>	Yes	Production at the state's Milford location will increase to 400MW by 2028. An additional 2-3GW will be built out by 2034.
<b>Virginia</b>	Yes	There are several research grants currently available to determine geothermal opportunities in the state.
<b>West Virginia</b>	Yes	Type of operations: Deep direct-use; low-temperature conventional.
<b>Washington</b>	Yes	New exploration and potential development of sources (none proposed currently).



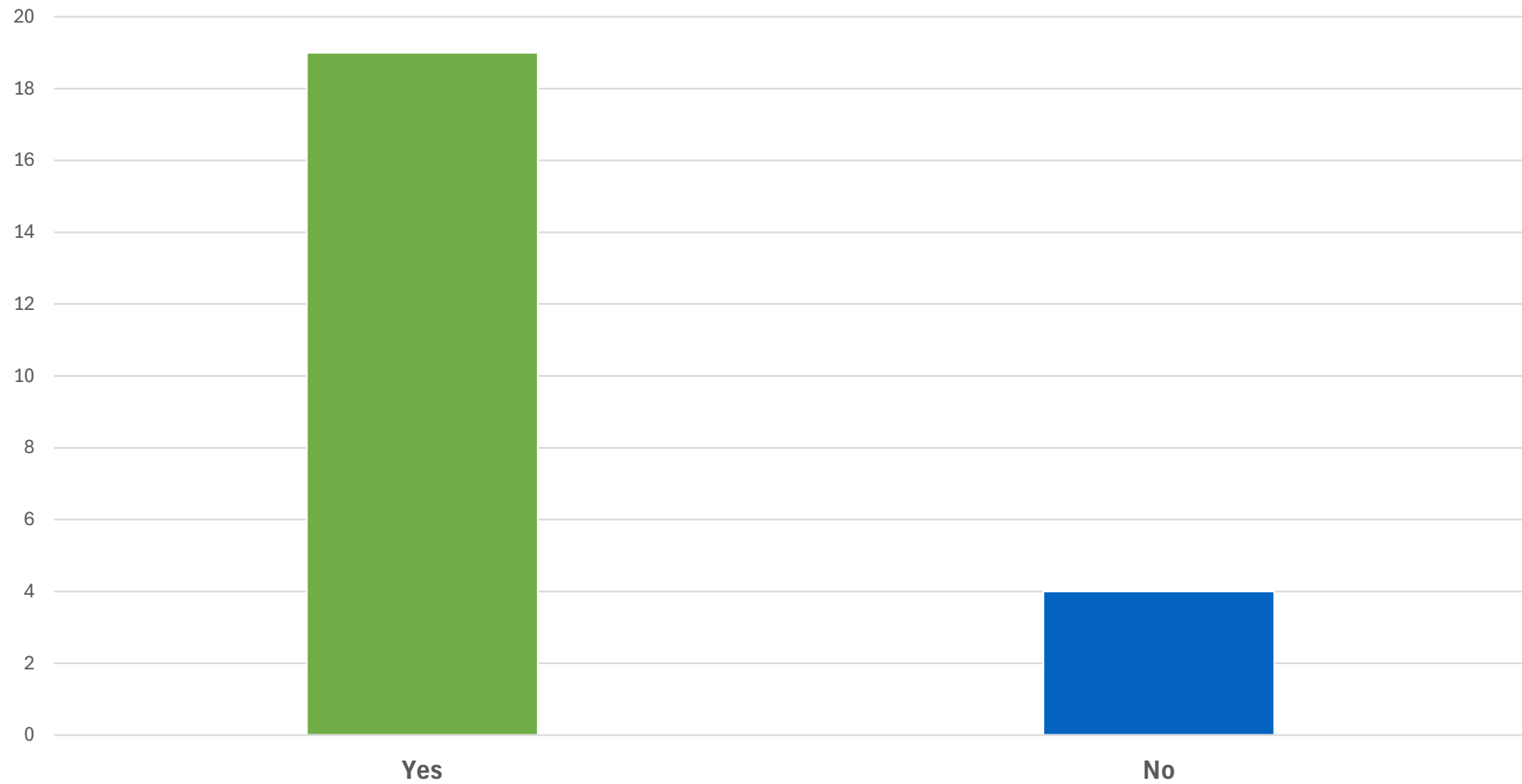
### III. Geothermal Operations

#### B. Anticipated

	<b>Do you anticipate an increase in geothermal development activity in the next 2-5 years?</b>	<b>If yes, please describe the type of operations anticipated.</b>
<b>Wyoming</b>	Yes	There have been numerous inquiries from interested companies related to authorization to drill geothermal wells for the purposes of testing the potential for geothermal.

**Figure 4**

**Do you anticipate an increase in geothermal development activity in the next 2-5 years?**



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#### IV. Technologies

	Please describe what types of geothermal technologies are being evaluated, such as variable technologies, shallow technologies like thermal energy networks, or deeper technologies like enhanced geothermal.	Do you have specific legal or regulatory strategies tailored to technology types? Depth?
<b>Alaska</b>	Mainly hydrothermal production, but there has been some prospecting to evaluate options for other geothermal power generation technologies.	No. Evaluated on a case-by-case basis. Variances and waivers from the standard oil and gas drilling regulations are considered upon the request of the operator.
<b>Arkansas</b>		
<b>California</b>	CalGEM does not regulate shallow heat-exchange systems such as ground source heat pump wells or thermal energy networks mentioned above. Deeper technologies like EGS type projects are being evaluated and are still in the exploratory planning stage.	Our regulatory framework is simply categorized into high temperature and low temperature geothermal wells, and by extension, the technology types suitable for such types of geothermal wells (i.e., high temperature wells for electricity generation, low-temperature wells for direct use). The regulations also require bonding and drilling fees based on whether the well is a high or low temperature well and the well depth.
<b>Colorado</b>	Thermal energy networks, deep sedimentary aquifer, deep hot dry rock, AGS, and EGS strategies are being investigated. Of note, co-producing geothermal heat from existing oil and gas projects is also being piloted.	Legal and regulatory strategies are currently focused on whether the water associated with geothermal resources is tributary or non-tributary to surface waters, as well as a depth delineation of 2500'.
<b>Idaho</b>		
<b>Indiana</b>	N/A	N/A
<b>Kansas</b>	N/A	N/A
<b>Kentucky</b>		
<b>Louisiana</b>	None by DENR.	No
<b>Maryland</b>		
<b>Michigan</b>		Not for geothermal.
<b>Mississippi</b>	Enhanced deep geothermal.	Would consider all types, but deep because of temperature required.
<b>Missouri</b>	Evaluation of new or enhanced geothermal technologies is minimal.	No. Deviations of current construction requirements require submission of a variance.
<b>Montana</b>		
<b>Nebraska</b>		
<b>Nevada</b>	Enhanced Geothermal Systems	Yes, the regulations were written for conventional geothermal development.

#### IV. Technologies

	Please describe what types of geothermal technologies are being evaluated, such as variable technologies, shallow technologies like thermal energy networks, or deeper technologies like enhanced geothermal.	Do you have specific legal or regulatory strategies tailored to technology types? Depth?
New York	Thermal energy networks and enhanced geothermal are both being evaluated, in addition to smaller scale closed loop geothermal wells.	For open-loop or standing column systems, ECL §15-1525 requires that the geothermal well driller be registered and all drilling activities be supervised by a person on-site who has taken and passed appropriate exams. For open loop or standing column wells drilled up to 500 feet deep, ECL §15-1525 requires that preliminary notice and well completion reports be filed with NYSDEC's Division of Water. For closed loop geothermal wells up to 500 feet, geothermal well driller registration, exams, and reporting are not required. Any open loop or standing column geothermal well drilled deeper than 500 feet requires an ECL Article 23 permit. The associated permit requires completion of an application including well location and construction information, a drilling plan, and Environmental Assessment Form, along with submission of a permit fee and financial security to guarantee the ultimate plugging and abandonment of the well at the end of its useful life. These wells must also be drilled by a driller registered with NYSDEC's Division of Mineral Resources. Closed loop geothermal wells deeper than 500 feet are currently exempt from regulation under ECL Article 25 until NYSDEC completes its current rulemaking process. The 500 foot depth threshold is set in the ECL and results from the fact that in many areas of New York State, a driller is more likely to encounter oil, natural gas, or brine in the subsurface when drilling deeper than 500 feet and therefore additional precautions and requirements are warranted.

#### IV. Technologies

	Please describe what types of geothermal technologies are being evaluated, such as variable technologies, shallow technologies like thermal energy networks, or deeper technologies like enhanced geothermal.	Do you have specific legal or regulatory strategies tailored to technology types? Depth?
<b>North Carolina</b>	Duke University, in Durham, NC, is currently drilling some test wells.	No.
<b>Ohio</b>		No.
<b>Oklahoma</b>	Please contact ODEQ.	Please contact ODEQ.
<b>Pennsylvania</b>	There has been an increased interest in low-temperature geothermal reservoir temperatures for electricity generation. There are several areas in Pennsylvania where an adequate geothermal gradient exists for successful binary cycle geothermal system implementation. PADEP applied for pilot-scale Enhanced Geothermal System (EGS) grant available under the Infrastructure Investment and Jobs Act on September 20, 2024 for a project proposing to generate electrical power and thermal energy for rural communities adjacent to legacy and current oil and gas development. The project plans to transfer heat from the subsurface strata to the surface, via gas/fluids in an EGS system where its thermal energy generates electricity for the local grid and provides thermal energy for nearby homes and businesses. The project uses existing oil and gas facilities so there is no additional land use for the renewable energy generation facilities.	Rules and regulations may focus on deeper closed and open loop geothermal systems and would not include rulemaking for shallow Geothermal wells used for heating and cooling. Some geothermal wells may be regulated by the US EPA UIC Program. Pennsylvania is considering applying for UIC primacy for geothermal wells depending on the level of increased activity in order to reduce the administrative burden on project developers.
<b>Texas</b>	Hydrothermal, geopressured, hot dry rock, ESG	Use as much of our current regulations as possible, tailoring for unique aspects of geothermal technologies.
<b>Utah</b>	Enhanced geothermal in dry rock.	We intend to use current oil and gas policy and methods to regulate these deep, enhanced geothermal wells. This includes pooling, royalty assignments, and safety measures for development and operation.
<b>Virginia</b>	No current projects.	Virginia has temperature (70F) and volumetric rate (100 gal/min) requirements for regulatory applicability.
<b>Washington</b>		The RCW that we regulate under specifies only two types of wells, core holes (<750' deep) and all other geothermal wells.

#### IV. Technologies

	<b>Please describe what types of geothermal technologies are being evaluated, such as variable technologies, shallow technologies like thermal energy networks, or deeper technologies like enhanced geothermal.</b>	<b>Do you have specific legal or regulatory strategies tailored to technology types? Depth?</b>
<b>West Virginia</b>	Technologies being evaluated: Enhanced geothermal; repurposing of legacy infrastructure for shallow thermal storage; beneficiation of associated brines for critical minerals.	N/A
<b>Wyoming</b>		

## V. Facilitating Development

	<b>Are there processes or incentives to facilitate development? Associated barriers?</b>	<b>Are there processes to address social variables, such as community engagement or education? Associated barriers?</b>
<b>Alaska</b>	There are no State incentives. The regulatory framework for drilling exists, but it is based on oil & gas regulations. One barrier is that oil and gas drilling regulations may be too onerous to promote economic geothermal prospects.	No
<b>Arkansas</b>		
<b>California</b>	<p>The state through the California Energy Commission's Geothermal Resources Development Account (GRDA) provide grants and financial assistance for the</p> <p>(a) Reduction of dependence on fossil fuels and stimulation of the state's economy through development of geothermal resources.</p> <p>(b) Mitigation of the adverse social, economic, and environmental impacts caused by geothermal development.</p> <p>(c) Financial assistance to cities, counties, and districts to offset the costs of providing public services and facilities necessitated by the development of geothermal resources within their jurisdictions.</p> <p>(d) Maintenance of the productivity of renewable resources through the investment of the proceeds of a depleting resource. Associated barriers typical to any development in the state is the rigorous and potentially lengthy environmental review of any project including geothermal exploration and development projects, as required by the California Environmental Quality Act (CEQA). CalGEM is mandated in statute to be the lead CEQA agency for geothermal exploration projects. In order to expand the potential roles in CEQA for local jurisdictions, AB 1359 was passed into law in 2024 to allow appropriate counties to be delegated by CalGEM to assume the lead CEQA role for geothermal exploration projects.</p>	<p>CalGEM, if it is the lead CEQA agency for a geothermal exploratory project, coordinates with the geothermal operator and the local land-use agencies, like the county where the geothermal project is located, in engaging parties to address social and community issues. For big power development projects 50 MW or more, like the ones undergoing licensing in the Salton Sea geothermal field, the California Energy Commission takes the lead. For smaller (less than 50 MW), the county takes the lead in addressing social variables such as community engagement.</p>
<b>Colorado</b>	The Colorado Energy Office administers two separate programs: a direct grant to incentivize geothermal development of all types, as well as a state income tax credit program to incentivize geothermal development of all types.	In Colorado, local governments have co-equal siting authority for deep geothermal projects. ECMC requires community engagement and planning for permitting of deep geothermal operations within 2000' of a disproportionately impacted community.
<b>Idaho</b>		
<b>Indiana</b>	N/A	N/A

## V. Facilitating Development

	Are there processes or incentives to facilitate development? Associated barriers?	Are there processes to address social variables, such as community engagement or education? Associated barriers?
<b>Kansas</b>	There are no State incentives. The regulatory framework for drilling and water rights exists based on water well construction/UIC well drilling.	N/A
<b>Kentucky</b>		
<b>Louisiana</b>	Not to my knowledge.	Not to my knowledge.
<b>Maryland</b>		
<b>Michigan</b>		
<b>Mississippi</b>		There have not been many conversations around geothermal at the community level. Wells are being installed without much interest, other than occasional news stories at high profile sites such as the capitol where they are installed.
<b>Missouri</b>	No	Before a permit could be issued, legal notice is required. If public interest is received, a public hearing would be held.
<b>Montana</b>	No	No
<b>Nebraska</b>		
<b>Nevada</b>	There are no incentives to development. The associated barriers include permitting backlogs and staffing shortages, which are delaying an overwhelmed UIC program.	On public land, the NEPA process required public input. Additionally, there are public outreach and education opportunities operated by several state agencies and universities.
<b>New York</b>	New York state offers tax credits, rebates and low-interest financing for geothermal systems. The New York State Energy Research and Development Authority's Clean Heat Program is best suited to provide detailed information regarding these incentives.	The rulemaking process for closed loop geothermal wells drilled deeper than 500 feet includes multiple opportunities for stakeholder input via public meetings, public hearings and written comment periods. The ECL Article 23 and ECL Article 17 permitting processes for open loop geothermal wells may provide opportunities for stakeholder input, in the form of public comment periods, on specific project applications received by NYSDEC.
<b>North Carolina</b>	Not to my knowledge.	Not to my knowledge.
<b>Oklahoma</b>		
<b>Ohio</b>	No known incentives. The barrier would be obtaining all necessary applicable property rights and obtaining a permit.	No.
<b>Pennsylvania</b>	Yes, federal grant opportunities as discussed in Section III.B above, to conduct pilot level demonstrations would facilitate development.	PADEP has established an Office of Environmental Justice. Community engagement would involve the EJ staff and EJ policy.



## V. Facilitating Development

	<b>Are there processes or incentives to facilitate development? Associated barriers?</b>	<b>Are there processes to address social variables, such as community engagement or education? Associated barriers?</b>
<b>Texas</b>	Provisions for use of abandoned oil or gas wells.	Not as yet. However, we have a new Office of Public Engagement, which would assist the Oil and Gas Division in performing public outreach and community engagement.
<b>Utah</b>	The Governor's office is providing ongoing funding for research and incentivizing development. The US Dept of Energy is also providing significant funding. So far approximately \$5M has been allotted, and an additional \$50M will be provided to alternative energy development in geothermal and small nuclear power generation. Barriers are establishing right of ways to get the power to the grid and fill demand. Tax structure is also being developed.	Community engagement is ongoing. Geothermal faces pressure on both sides. Environmentalist decry geothermal since it involves drilling, and is not solar or wind. On the other side oil, gas, and coal do not support as it competes with their position as the sole base load provider.
<b>Virginia</b>	Potential grant funds on the federal level.	Not at this time.
<b>Washington</b>	WA has a clean energy facility siting process that provides additional evaluation of environmental justice, and assists proponents through permitting process.	All geothermal wells drilled (not core holes) are required to conduct public meeting prior to issuance of permits. through the State Environmental Policy Act (SEPA) there is additional opportunity for public engagement.
<b>West Virginia</b>	N/A.	Unknow at this point.
<b>Wyoming</b>	No	No

## VI. Property Rights

	What property rights are involved in your state?
<b>Alaska</b>	Various.
<b>Arkansas</b>	
<b>California</b>	In California, surface and mineral rights can be owned by different entities, whether private, state or federal. CalGEM only regulates wells that are drilled and operated in private or state surface and minerals rights.
<b>Colorado</b>	Geothermal resources associated with non-tributary water are a property right belonging to the surface owner.
<b>Idaho</b>	
<b>Indiana</b>	N/A
<b>Kansas</b>	In Kansas, surface rights and subsurface rights can be owned by different parties.
<b>Kentucky</b>	
<b>Louisiana</b>	There's no public ownership of sources of heat so land ownership is the preeminent concern as far as I'm aware.
<b>Maryland</b>	
<b>Michigan</b>	Drilling of a geothermal well, particularly closed loop, is a surface right.
<b>Mississippi</b>	Not sure, but probably a lease from surface owner?
<b>Missouri</b>	Landowners have the right to access water. No permitting is required for the construction of closed loop systems. Permitting is required for open loop discharges to waters of the state including groundwater (UIC). The geothermal and water well drilling industry must be permitted to conduct the work.
<b>Montana</b>	
<b>Nebraska</b>	
<b>Nevada</b>	Over 80% of the state is federal land, where mineral rights are leasable. On private land, mineral rights must be acquired.
<b>New York</b>	Mineral rights and water extraction rights.
<b>North Carolina</b>	Surface rights and mineral rights can be separate.
<b>Ohio</b>	If a person seeks to drill a geothermal well, the person would have to have all applicable property rights.
<b>Oklahoma</b>	
<b>Pennsylvania</b>	Ownership of surface and subsurface rights in Pennsylvania are often severed. Ownership of geothermal resources has not been explicitly defined in Pennsylvania and would likely have to be clarified by statute.
<b>Texas</b>	Appears to be the surface estate.
<b>Utah</b>	Federal, tribal, state, local, and private ownership, as well as split estates.
<b>Virginia</b>	Ownership rights to a geothermal resource are in the owner of the surface property underlain by the geothermal resource unless such rights have been otherwise explicitly reserved or conveyed.
<b>West Virginia</b>	
<b>Washington</b>	Surface rights and mineral rights are involved in permitting, and can be severed.
<b>Wyoming</b>	Surface owner property rights and water rights.

## VII. Lessons Learned/Gaps Identified

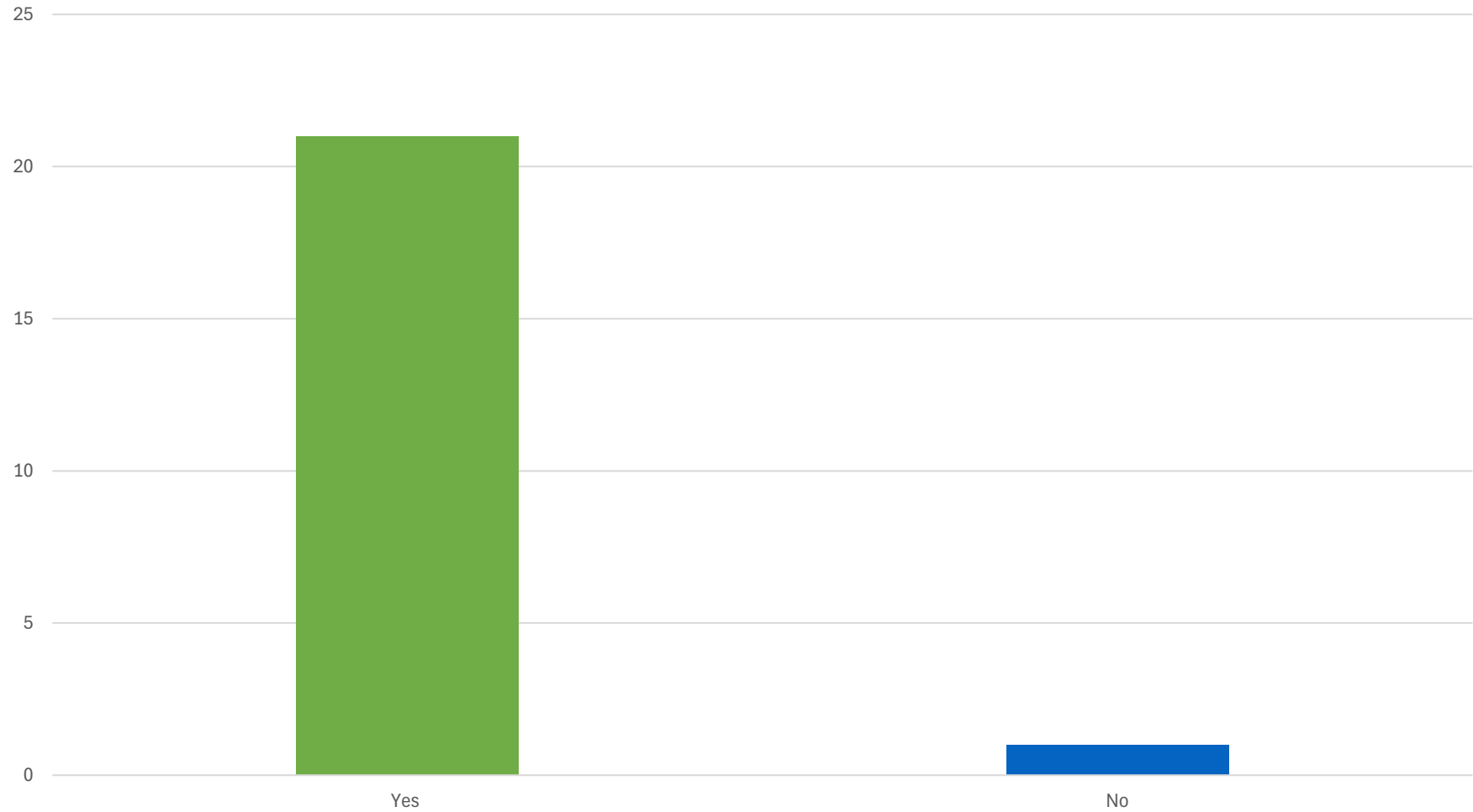
	What lessons has your state learned from existing or proposed operations?	What legal or regulatory gaps or concerns have been identified?
<b>Alaska</b>	We've learned that the costs of getting geothermal resources to a market are difficult since the resource is typically far from existing power needs. We've also learned that geothermal wells are often drilled in constructed differently than oil and gas wells and variances and waivers to our oil and gas regulations are often requested.	The oil and gas regulations are followed, but may not always be relevant or applicable to geothermal. We need to understand where drilling practices and risks are different from oil and gas operations and tailor the safeguards to geothermal operations, especially with respect to well control regulations and blowout prevention equipment.
<b>Arkansas</b>		
<b>California</b>	Facilitating the CEQA process is something that can be improved and AB 1359 was passed to partly address that. CalGEM is in the process to update its geothermal regulations to address gaps and provide clarification. There has been feedback from potential operators that the complex regulatory landscape where different state agencies are involved in the permitting process can be a challenge and a drawback.	CalGEM is in the process of updating its geothermal regulations. While the preliminary rulemaking process is ongoing, there are certain aspects in current regulations that have been identified for potential updating and clarification. These are in the aspects of regulatory definitions, well construction and abandonment, underground injection control, notification and reporting, seismic monitoring, subsidence monitoring.
<b>Colorado</b>	Permitting of geothermal projects is complicated, made more so by the newness of the technologies and strategies being contemplated and developed.	The most important concern identified is that all deep geothermal operations currently would require a DWR water use permit for all operational losses of geothermal fluids. ECMC, DWR, and the Department of Natural Resources have developed a strategy to alleviate this. Please see: Regulation of Geothermal Resources in Colorado, A Legislative Proposal, December 2024.
<b>Idaho</b>		
<b>Indiana</b>	N/A	
<b>Kansas</b>	We learned that some grout types do not set up well with brine.	Need to regulate the operations of geothermal wells.
<b>Kentucky</b>		
<b>Louisiana</b>	Since the existing operations aren't regulated by my office, we have few to no lessons learned so far.	DENR has statutory authority to oversee geothermal injection wells but the regulatory framework is incomplete.
<b>Maryland</b>		
<b>Michigan</b>		Michigan is exploring what a regulatory framework should look like. Currently there is not a statewide statute.
<b>Mississippi</b>	There have been instances where some regulation would have been good, particularly with regard to soil erosion and sedimentation control planning and management of sour cuttings.	

## VII. Lessons Learned/Gaps Identified

	What lessons has your state learned from existing or proposed operations?	What legal or regulatory gaps or concerns have been identified?
<b>Missouri</b>	MDEQ has received interest from one group and is reviewing the process, but no permit application has been received.	
<b>Montana</b>		Geothermal development could certainly overlap with oil and gas and there isn't really legislative direction to handle those situations.
<b>Nebraska</b>		
<b>Nevada</b>	Nevada's geothermal regulations were first enacted in 1985 and last revised in 2019. The state's regulations have been developed based on lessons learned.	There are no regulations specific to geothermal well stimulation.
<b>New York</b>		As a result of recent legislation changes, closed loop geothermal wells deeper than 500 feet are not currently regulated by NYSDEC until NYSDEC promulgates regulations specific to this well type.
<b>North Carolina</b>	That we need a varied energy portfolio.	To my knowledge, there isn't any regulation.
<b>Ohio</b>		There are no current rules governing geothermal wells for the generation of electricity.
<b>Oklahoma</b>		
<b>Pennsylvania</b>	N/A as geothermal development is still relatively limited in the Commonwealth.	Comprehensive rules and regulations are needed for surface and subsurface operations. Regulatory concerns similar to those with CCUS such as pore space ownership and financial assurance would be additional concerns.
<b>Texas</b>		
<b>Utah</b>	Research and rhetoric are abundant. The hard and pressing need is to develop policy geared toward geothermal growth. We also need to establish an infrastructure that transports the power generated to the customer.	Lack of solid regulatory framework with sufficient detail to help producers see success. There is also some ambiguity regarding who the lead agency will be since new technologies do not require a water right.
<b>Virginia</b>	Virginia currently doesn't have any regulated geothermal operations.	None at this time.
<b>Washington</b>	No operations have been proposed in WA.	Bonding amount, depth of exploratory holes, fracking (enhanced geothermal).
<b>West Virginia</b>		
<b>Wyoming</b>	Have not had significant operations at this time.	There is a lack of clear authorization to any agency to regulate the drilling, operation, and plugging of the wells, especially for deep geothermal operations. There are clear statutes on appropriation of steam or water.

Figure 5

Would your state want to participate in regular meetings with other state regulators?



Geothermal Operations: Exploring the Need for a State Regulatory Forum  
Survey Results

## VIII. Meetings with other States

	Would your state want to Participate in regular meetings with other state regulators. If so, how frequently?	What topics related to geothermal operations would you like these meetings to cover?
<b>Alaska</b>	Twice per year.	Well control and blowout prevention equipment. Well Kill techniques for geothermal wells. Steam blowout case histories. Understanding of well control risks and uncertainty. Well casing and cementing design. Underbalanced drilling operations.
<b>Arkansas</b>		
<b>California</b>	As capacity allows, perhaps quarterly.	1) New technologies and best practices in regulations or monitoring of operations 2) Repurposing O&G wells into geothermal wells – what’s the experience from other states 3) Other states’ experience in funding regulatory programs for geothermal.
<b>Colorado</b>	Quarterly at the most frequent.	Projects/strategies being permitted. Regulatory strategies.
<b>Idaho</b>		
<b>Indiana</b>		
<b>Kansas</b>	Quarterly	Grout, regulations, groundwater protection, geothermal technologies/systems, safety, and efficacy of geothermal systems.
<b>Kentucky</b>		
<b>Louisiana</b>	No more than quarterly.	Fitting geothermal operations into the framework of an Underground Injection Control program.
<b>Maryland</b>		
<b>Michigan</b>	Semi-annual (annual minimum).	Sharing of information (state regulatory statutes and how they work, don’t work, areas for improvement), lessons learned regarding any challenges (spills, migration, abandonment, etc.).
<b>Mississippi</b>	Would be determined after an initial meeting.	Technical issues.
<b>Missouri</b>	Quarterly.	Construction alternatives including grout materials and exchange fluids.
<b>Montana</b>		
<b>Nebraska</b>		
<b>Nevada</b>	Quarterly virtual meetings, with the possibility of one or two in-person meeting per year.	There is nothing specific. Nevada has had geothermal regulations for nearly 40 years.
<b>New York</b>	Quarterly.	Groundwater protection, geothermal technologies, enhanced geothermal systems, life cycle analysis, and environmental impact
<b>North Carolina</b>	Annual.	

## VIII. Meetings with other States

	<b>Would your state want to Participate in regular meetings with other state regulators. If so, how frequently?</b>	<b>What topics related to geothermal operations would you like these meetings to cover?</b>
<b>Ohio</b>	No, because the geology in Ohio is not conducive to the generation of electricity via geothermal wells, it is unlikely that Ohio would participate in meetings.	
<b>Oklahoma</b>		
<b>Pennsylvania</b>	Quarterly.	PADEP would be interested in a coordinated discussion around geothermal issues with a particular emphasis on how those facilities interact with oil and gas exploration and production.
<b>Texas</b>	Once every two months or quarterly.	How to address the differences in the different geothermal technologies and their unique problems without restricting future new technology.
<b>Utah</b>	Monthly.	Regulatory development. Overcoming barriers in delivering power to customers, including right of ways, grid assessment, and infrastructure buildout.
<b>Virginia</b>		Lessons learned from other states.
<b>Washington</b>	Bi-annual or quarterly.	
<b>West Virginia</b>	Yes.	Once per six month or may be Quarterly.
<b>Wyoming</b>	No preference on frequency.	Overlapping regulatory requirements between water rights, UIC, drilling/plugging.