Non-Technical Barriers to Geothermal Development in California and Nevada

Aaron Levine, Esq.

Senior Legal and Regulatory Analyst

May 24, 2023

DOE Geothermal Technologies Office Lab Call

GTO issued a funding opportunity (national lab call) for project proposals on state and local environmental management issues.

From this lab call GTO selected three projects to investigate state and local environmental management issues, including regulatory and permitting issues.

The National Renewable Energy Laboratory, Pacific Northwest National Laboratory, and Idaho National Laboratory were the three awardees.

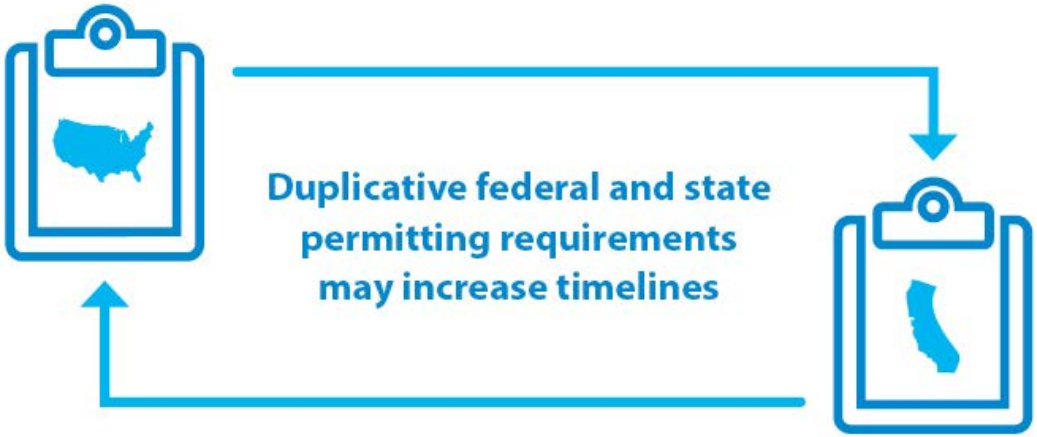
These national labs worked together to conduct qualitative interviews with federal, state, and local agencies as well as project developers.

The following presentations will summarize some of our key findings.

Federal, State, Local and Tribal Regulatory Matrix in California and Nevada

Streamlining and consolidating agency processes and increasing coordination and communication between federal, state, tribal and/or local authorities may decrease project development delays and lower costs and risks.

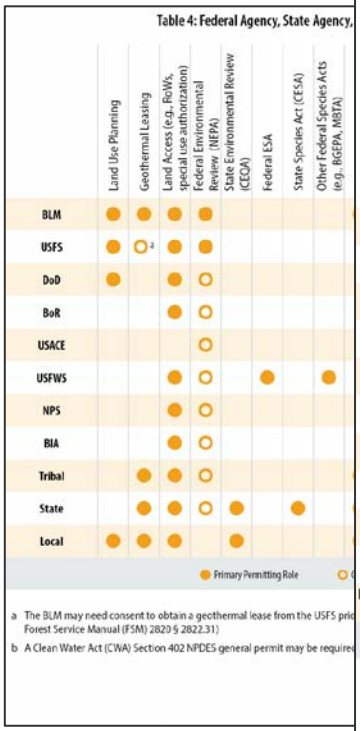
Federal, State, Local and Tribal Regulatory Matrix in California and Nevada

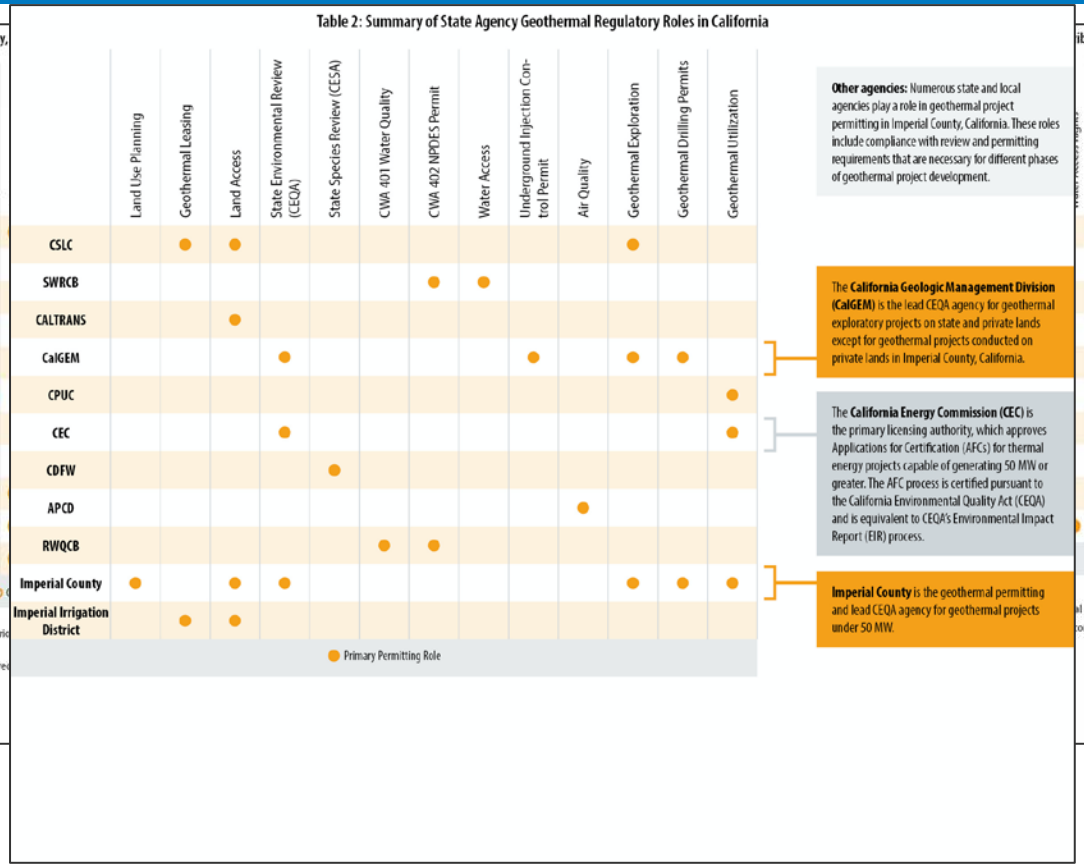


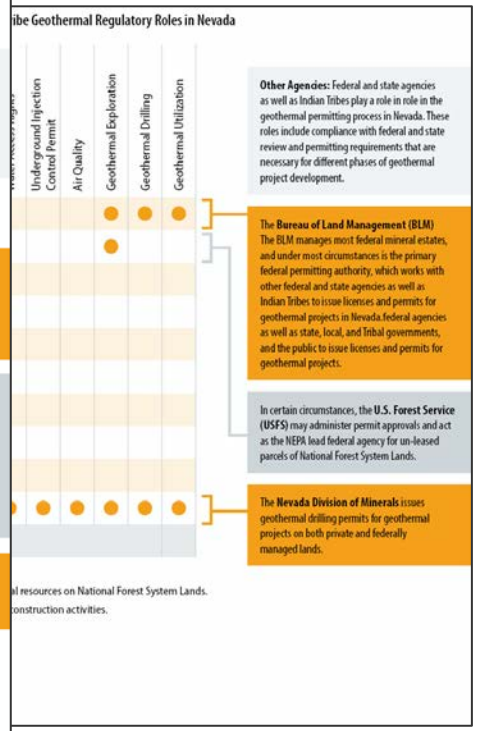
×2

Dual federal and state permitting and environmental review requirements in California and Nevada may increase project permitting timelines through lengthy, duplicative, and/or compartmentalized processes.

Federal, State, Local and Tribal Regulatory Matrix in California and Nevada





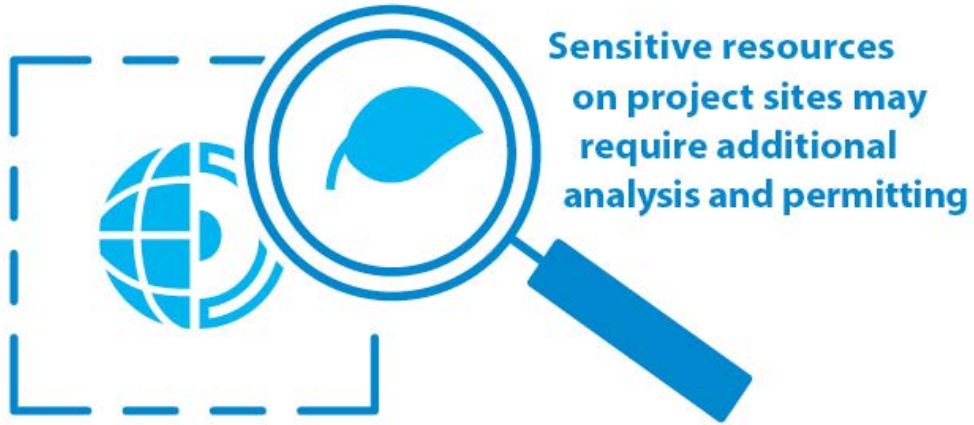


Federal, State, Tribal, and Local Agency Coordination

Key Takeaways:

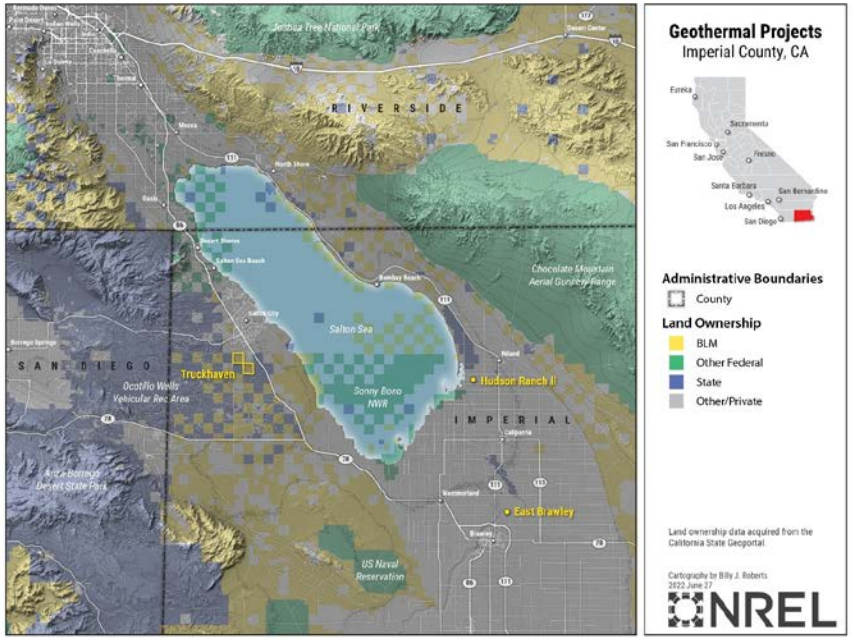
- Numerous federal, state, tribal, and local agencies/authorities are involved in the permitting and regulation of geothermal development.
- Need for coordination across these agencies/authorities via various mechanisms including:
  - Memorandum of Understanding
  - National Renewable Energy Coordination Office
  - Informal working groups
  - Comprehensive siting process (e.g., CEC Application for Certification process)

Key Environmental and Resource Issues in California and Nevada



Geothermal projects in California and Nevada may face site-specific challenges due to the presence of sensitive resources, which may cause permitting and project development delays and increase project costs and risks.

Key Environmental and Resource Issues in California (Imperial County)

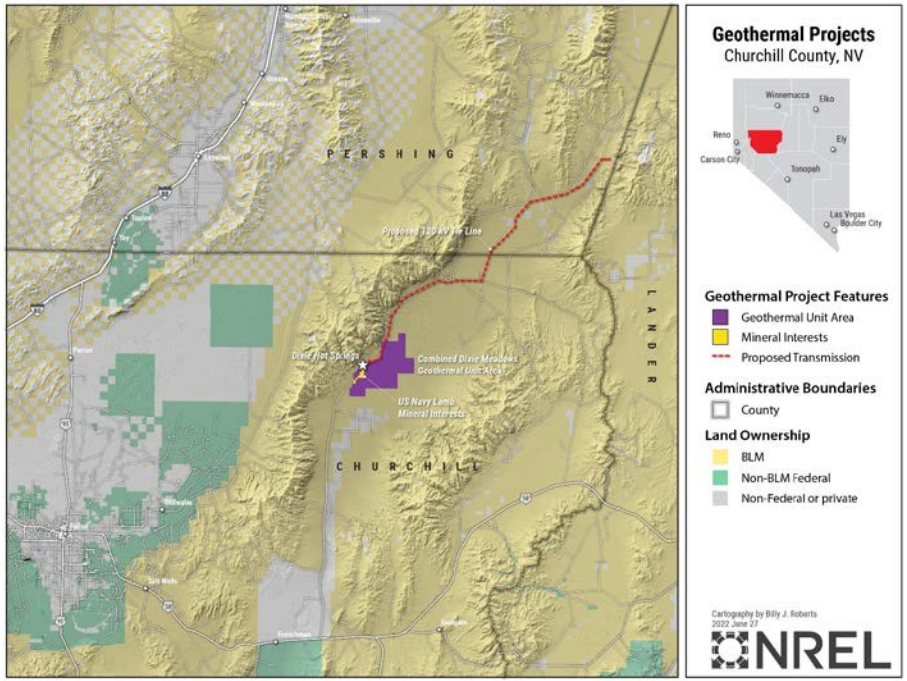


Key Environmental/Cultural Issues:

- WOTUS Jurisdictional Determinations
- Water quality analysis
- Biological species, particularly in the Sonny Bono NWR
- Cultural/Tribal resource impacts

❖ NEPA/CEQA processing timelines play a significant role in documenting these issues.

Key Environmental and Resource Issues in Nevada (Dixie Meadows)



Key Environmental/Cultural Issues:

- Biological species, particularly in the Dixie Valley Toad (currently subject of FWS emergency listing under the ESA)
- Cultural/Tribal resource impacts, including Dixie Hotsprings

❖ NEPA processing timelines play a significant role in documenting these issues.

Programmatic Environmental and Decision Analysis

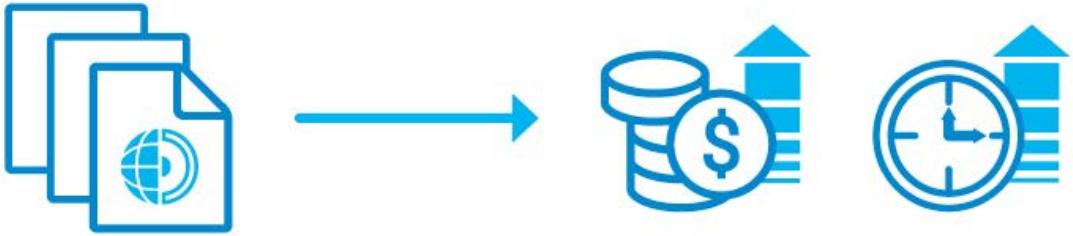
Key Takeaways:

- Comprehensive environmental review documents (i.e., NEPA, CEQA) and associated landscape level surveys (e.g., cultural, biological) can increase certainty around development potential and associated natural and cultural resource conflicts.
  - Could cover large geographical areas and then tier off of these documents.
  - Could potentially have coordination with NEPA-CEQA in California to align federal and state resource concerns (as feasible).
  - Could be technology specific (i.e., geothermal PEIS) or cover multiple technologies.

- WOTUS determinations for Salton Sea
  - Comprehensive analysis could increase certainty and reduce time spent on individual WOTUS determinations on a case-by-case basis.
  - Current process requires USACE WOTUS determination, State 401 review, and then USACE 404 permit.

Economic Impact of Geothermal Development Timelines

Regulatory and permitting requirements may create non-technical barriers to geothermal development



Project development delays resulting from regulatory requirements and acquisition of necessary permits may drive up geothermal project costs and increase economic uncertainty.

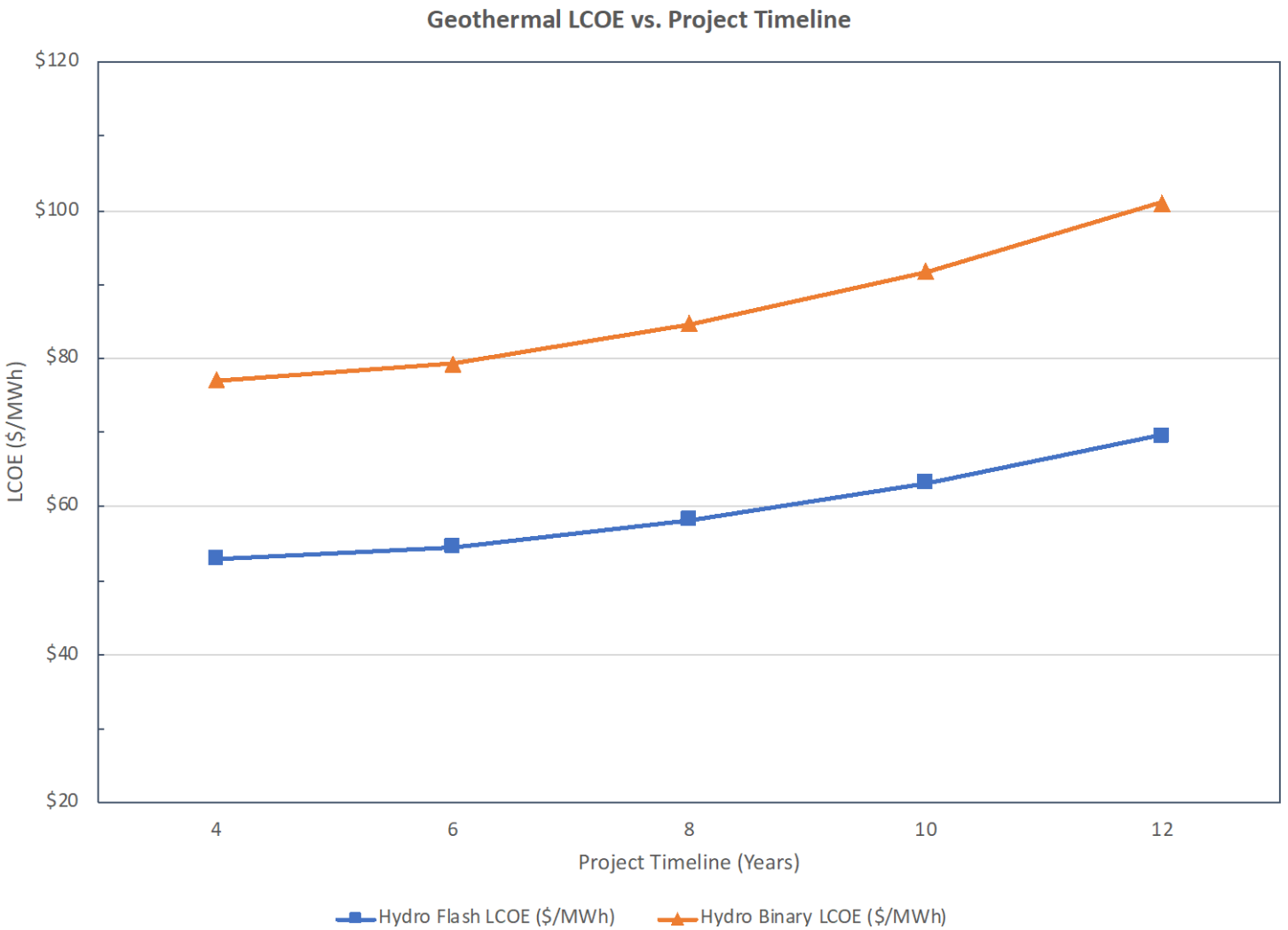
Timeline Financial Inputs

Construction Length: (Years)	Capital Fraction				
	4	6	8 (ATB)	10	12
0	30%	30%	30%	30%	30%
1	22%	22%	22%	22%	22%
2	26%	26%	26%	26%	26%
3	22%	10%	0%	0%	0%
4		2%	0%	0%	0%
5		10%	10%	0%	0%
6			2%	0%	0%
7			10%	10%	0%
8				2%	0%
9				10%	10%
10					2%
11					10%

TEA Results

		Project Timeline (yrs)				
		4	6	8 (ATB)	10	12
Hydro Flash	Construction Finance Factor	1.289	1.347	1.481	1.659	1.894
	CAPEX ($/kW)	$5,800	$6,059	$6,662	$7,461	$8,517
	Construction Financing Cost ($/kW)	$1,302	$1,561	$2,165	$2,963	$4,019
	LCOE ($/MWh)	$53	$55	$58	$63	$70
Hydro Binary	Construction Finance Factor	1.289	1.347	1.481	1.659	1.894
	CAPEX ($/kW)	$7,427	$7,759	$8,532	$9,555	$10,907
	Construction Financing Cost ($/kW)	$1,667	$1,999	$2,772	$3,795	$5,147
	LCOE ($/MWh)	$77	$79	$85	$92	$101

TEA Results


Geothermal LCOE vs. Project Timeline
$120
$100
$80
$60
$40
$20
LCOE ($/MWh)
4
6
8
10
12
Project Timeline (Years)
Hydro Flash LCOE ($/MWh)
Hydro Binary LCOE ($/MWh)

Thank You!

www.nrel.gov

Aaron Levine, Esq.

NREL/PR-6A20-86307

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Geothermal Technologies Office. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.