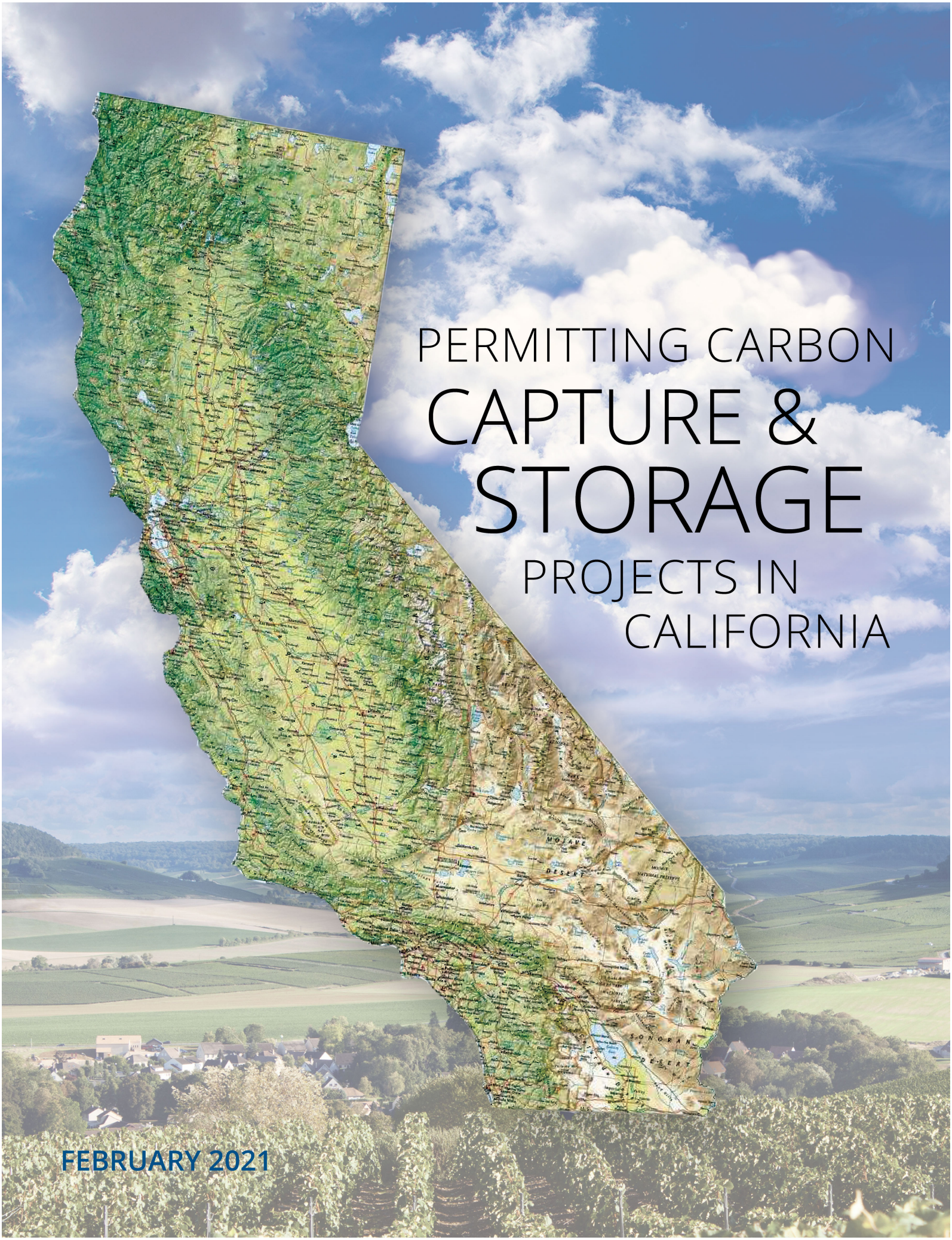

PERMITTING CARBON CAPTURE & STORAGE PROJECTS IN CALIFORNIA

FEBRUARY 2021

Author

George Peridas

Cite report as:

George Peridas, Permitting Carbon Capture & Storage Projects in California, February, 2021, Lawrence Livermore National Laboratory, LLNL-TR-817425.

Acknowledgements

This report was made possible through the support of the Livermore Lab Foundation. We are indebted to Sally Allen and Susan Houghton for their ongoing support and advice.

We are deeply grateful to all the individuals who devoted time and effort to provide input during the preparation of this document. The report was also greatly improved by reviewers from 17 organizations—members of academia, non-governmental organizations, industry, and government agencies—and independent subject matter experts. These individuals graciously provided their time and expertise to improve the accuracy and clarity of the work. Some are not listed in order to preserve anonymity. We extend our equal gratitude to all our reviewers, including the following (alphabetically):

Anne Canavati, *Energy Futures Initiative*

Myles Culhane and William Barrett, *Occidental Petroleum Corporation*

Maris Densmore and Brian Pellens, *California Resources Corporation*

Michael Gerrard, *Columbia University*

Barbara McBride and Kassandra Gough, *Calpine Corporation*

Ryan McCarthy, *Weideman Group*

John Miller, *JT Miller Group*

Deepika Nagabhushan, Jay Duffy and Bruce Hill, *Clean Air Task Force*

Douglas Pollak, *DP Land*

Mark Rigby and Bradley Gallant, *DTE Energy*

Sarah Saltzer, *Stanford Center for Carbon Storage*

Michael Wara, *Stanford Woods Institute for the Environment*

Robert Weisenmiller, former Chair, *California Energy Commission*

This report could not have been created without the design, editorial, and publication support of Katie Lindl and Jeannette Yusko of LLNL. We are deeply grateful for their insights, attention to detail, creativity, and teamwork. We also extend our special thanks to Kelly Johnson, Jennifer Macairan, Briana Schmidt, and Roger Aines of LLNL for their input, edits, and advice on the report.

LLNL-TR-817425

EXECUTIVE SUMMARY

To reach its ambitious goal of economy-wide carbon neutrality by 2045, California will have to capture, transport, and geologically store tens of millions of tons of carbon dioxide (CO_2) per year. This will come from the atmosphere and from large sources that have no other options for eliminating emissions. The needed technologies are available today and have been demonstrated at multiple U.S and international sites; California will need to host ten or more of these carbon capture and storage (CCS) projects to achieve its climate goals.

We studied the extensive regulatory framework – regulations and institutions – that applies to these CCS projects in California, and found it to be rigorous, robust, and capable of handling the permitting and review tasks while protecting Californians and their landscapes, ecosystems, and resources. However, this encompassing set of requirements, interactions, and the currently available resources and division of responsibilities may not allow sufficiently expeditious deployment of these projects to protect the rapidly worsening climate as quickly as needed. California can readily address the issues we have identified without any major overhaul. Specifically, the State could increase internal efficiency and coordination, secure adequate staffing and resources for the task, assign experienced process leads, expand its collaboration with relevant federal agencies, and adopt a small number of technical regulatory and legislative changes. Project developers should also recognize permitting complexity early, devote serious time and talent to obtaining necessary authorizations, and act in a transparent, timely, and competent manner to ensure that regulators have the information they need for efficient action.

BOX ES-1 Key Findings

- California has a robust and extensive array of regulations and institutions that are collectively sufficient to protect public health, safety, and the environment while CCS is being deployed.
- Permitting a sufficient number of sound CCS projects to achieve California's climate goals is unlikely due to scattered and/or poorly defined agency jurisdiction boundaries and responsibilities, inefficient and/or time-consuming processes, and inadequate staff resources.
- Environmental review, primarily under the California Environmental Quality Act and related litigation but also under the National Environmental Policy Act, will be a key determinant of project authorization timelines, which will likely span multiple years.
- The authorization process can be made more efficient while retaining its integrity and credibility with relatively few and straightforward operational and organizational fixes, and without major reforms.
- A small number of technical regulatory and statutory fixes would enable deployment of CCS technologies at the scale needed in the longer term.
- Project developers should anticipate and be equipped to handle a complex and technically involved authorization process.

Background

California has set itself ambitious mid-century climate goals. No state or nation can solve a large-scale global problem like climate change by itself, but California's goals aim to keep pace with the needed reduction of global greenhouse gas emissions. Specifically, Executive Order B-55-18 established a goal of achieving carbon neutrality no later than 2045 and ideally as soon as possible, and of achieving and maintaining net negative emissions thereafter. Multiple in-depth analyses have shown that, to achieve this goal, California must not only intensify efforts in emission reduction measures and technologies that are already under way but must also deploy technologies that dramatically reduce existing emissions from large sources such as industry, and also remove carbon from the atmosphere directly. Accordingly, the California Air Resources Board (CARB) has adopted a stance in line with these analyses.

Carbon Capture and Storage (CCS) refers to a family of technologies that remove CO_2 directly from large point sources or the atmosphere, transport it (commonly by pipeline, truck, rail, or barge), and then store it permanently and securely thousands of feet underground. This storage occurs in the same types of rock formations that held the carbon for millions of years in the form of fossil fuels, which have now been released to the atmosphere and are responsible for climate change. The technologies involved in CCS are not new, and a sizeable array of demonstration and early commercial-scale projects has emerged around the world over the past two or more decades. However, CCS projects are inherently complex and cross-cutting due to integrating three kinds of activity: CO_2 capture, transport, and storage. Any one of these phases is complex in itself and has significant regulatory and permitting needs that are managed by a large number of state and federal agencies. In addition, these projects will likely necessitate negotiations with private parties to ensure respect of existing surface and mineral ownership while obtaining authorization to site CO_2 pipelines and to inject CO_2 deep in the subsurface.

CCS projects can be permitted safely in California, but not at the pace dictated by climate goals

No CCS projects exist in California today. The state has a thorough and robust regulatory framework for screening and authorizing projects that may have environmental or public health impacts in general. In addition, extensive state and federal regulations have very recently been adopted specifically for geologic CO_2 storage, which take into account previous regulatory failings from the oil and gas sector and other gaps, and prescribe a preventative approach that screens out all but the best-designed and -executed projects. This report examines this regulatory framework in depth and outlines the majority of likely authorizations—regulatory or otherwise—that will be required for a CCS project in California. We conclude that, collectively, these authorization processes amount to a sufficiently high level of diligence to minimize risks to public health, safety, and the environment. However, this regulatory and permitting framework is also extensive and convoluted and was, for the most part, not devised with the complexity and cross-cutting nature of CCS in mind. Figure ES-1 below summarizes the likely permitting interactions for a typical CCS project.

In summary, a large number of private, local, state, tribal, and federal agencies be involved in processing authorization requests for CCS projects. Figure ES-2 below summarizes the nominal turnaround time, technical complexity, and political exposure involved in securing each of these permits or authorizations.

In addition, CCS projects will need to undergo environmental review under the California Environmental Quality Act (CEQA) and possibly the National Environmental Policy Act (NEPA). These review processes aim to evaluate whether a project may have significant effects on the environment and whether these effects can be avoided. CEQA review in particular is a significant undertaking and, unlike NEPA, can require mitigation measures. In practice, CEQA review, the completion of which must precede the issuance of most permits, is likely to be the primary determinant of projects' authorization timelines, along with possible related litigation.

Authorization related to:	Entity: Local Government	State Agency	Federal Agency	Tribal Government	Private Party
Local land use	✓				
Siting CO_2 pipelines	✓	✓	✓	✓	✓
Pore-space ownership & mineral rights	✓	✓	✓	✓	✓
Air permits		✓	✓		
CO_2 pipeline safety		✓	✓		
CO_2 injection permitting		✓	✓		
Discharges to water (including those of the State)		✓			
Discharge of dredge or fill materials into waters of U.S.			✓		
Endangered species		✓	✓		
Stream/river/lake alterations		✓			
Greenhouse gas reporting		✓	✓		
CO_2 crediting: the revenue stream		✓	✓		

Capture Transportation Storage

Figure ES-1. *Summary of main authorizations needed for a typical CCS project.*

Thus, we conclude that, given the complexity of this regulatory regime, the state cannot rely on the existing framework to process a significant enough number of CCS project applications to achieve its climate goals. In particular, factors that could compromise this endeavor include the following:

- Lengthy environmental review and permit application evaluation processes
- Lack of experience or established track record for state agencies leading the state environmental review process under CEQA for CCS projects specifically
- Poorly delineated regulatory authorities between agencies
- Need for cross-agency collaboration at local, state, and federal levels (sometimes several agencies need to review a permit application submitted to only one of them)
- Absence of an established and tested joint-review process for permit applications that involve multiple agencies

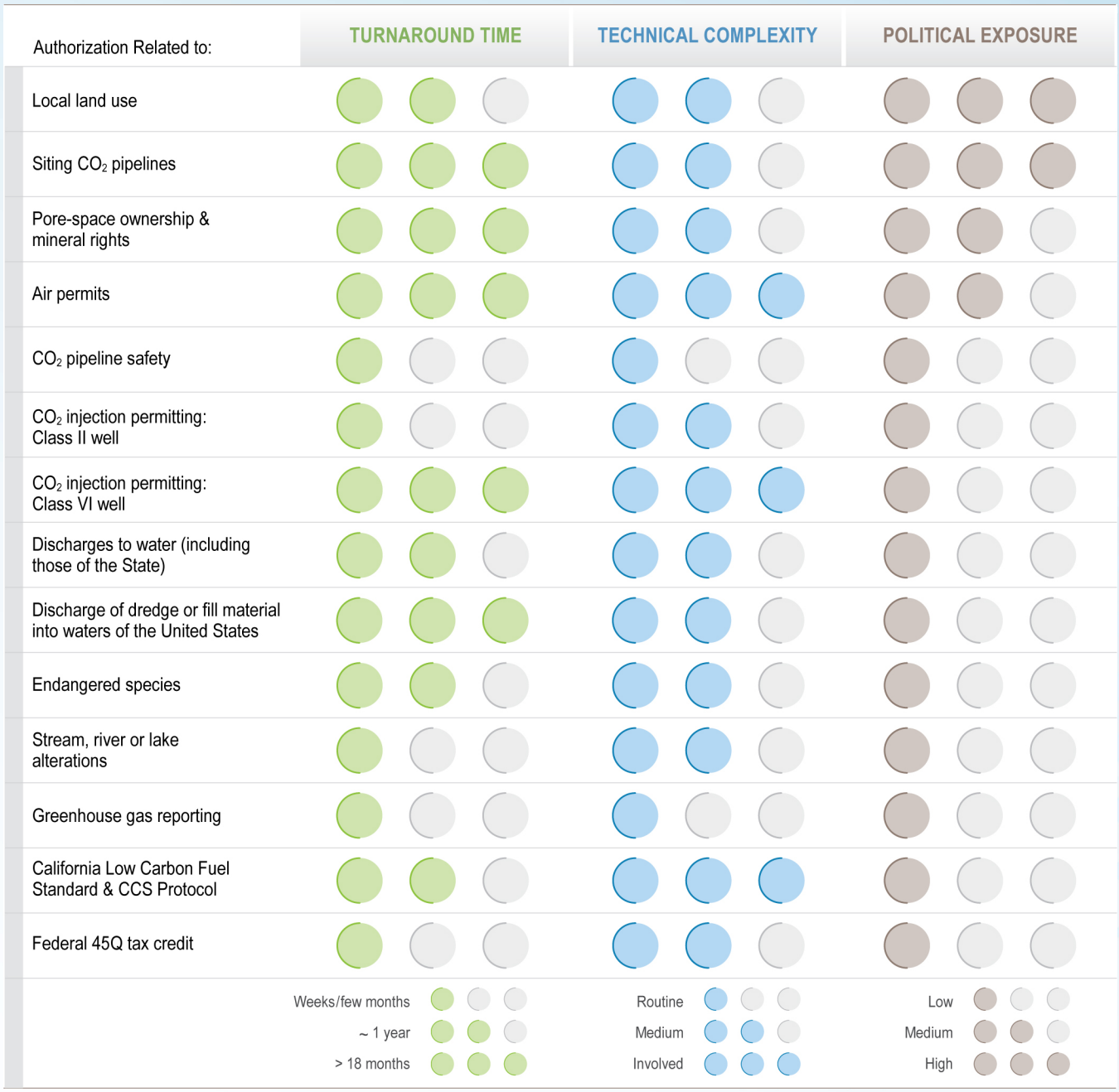

Figure ES-2. *Ranking of authorizations according to likely turnaround time, technical complexity, and political exposure.*

- Inadequate resources and staffing at regulatory agencies may not allow efficient handling of the anticipated high volume of applications spurred by recent CCS incentives
- Absence of statutory determinations and/or adjudication on the ownership of rock pore space where the CO_2 will be stored and its relation to mineral rights ownership

Fortunately, through some simple interventions to existing processes and structures, California can obtain faster and larger carbon emission reductions and removals while still maintaining robustness and rigor in its environmental review and permitting regime. Large reforms in the short- or medium-term are not necessary or even conducive to achieving these climate benefits, given the low level of public awareness

of CCS technologies. Rather, consideration of long-term measures to facilitate CCS deployment scale-up would be timelier after construction of the first wave of commercial-scale projects, which would inform a much more concrete discussion.

Options for state government

Options the State could utilize to ensure timely and efficient authorization of CCS projects to contribute to its climate goals while still safeguarding public health, safety, and the environment include the following:

Immediate (0-6 months)

- Assemble an interagency working group of state agencies likely to be involved in CCS project permitting
- Designate a staff contact for CCS permitting from each of these agencies to facilitate and expedite relevant conversations
- Through the working group, create an internally vetted list—to serve as a reference—of CCS permitting authorities and of the responsibilities of each agency
- Invite representatives from key federal and local agencies (such as key counties and air districts) to join the working group

Near-term (<2 years)

- Create a clear directive from the administration and/or legislature that unambiguously signals to state agencies the high-priority nature of CCS projects for the state and its climate goals and that calls for thoroughly and efficiently handling permit applications and environmental review
- Among the working group of relevant agencies, assign one agency to act as the central point of contact for CCS project permit applicants; this agency will function as coordinator, timekeeper, and manager for efficient permit processing, and will interact with developers and stakeholders
- Examine the desirability and legal feasibility of assigning a specific CEQA lead agency—from among those likely to have jurisdiction over most CCS projects—to assume this role and specialize in the CEQA process
- Assemble a flow chart with steps for state agencies to follow upon receiving a project application, including intended turnaround timelines for each step
- The U.S. Environmental Protection Agency, California Geologic Energy Management Division, California Air Resources Board, State Water Resources Control Board and regional water boards could perform a joint or coordinated review of the substantial and highly overlapping geologic information required for different regulatory or certification purposes.
- For all state agencies involved in CCS permitting, secure adequate staff and resources to ensure sufficient expertise, knowledge, and personnel availability to process what could be numerous and/or complex permit applications, and to navigate the CEQA process for multi-faceted projects
- Through California's administration and congressional delegation, convey the need for similar staffing and resources in Washington DC for federal agencies involved in permitting CCS projects in California
- To ensure timely processing of applications by federal agencies, pursue memoranda of understanding (MOUs) or informal agreements between state agencies and those federal agencies relevant to permitting CCS projects in California; also examine the potential for state and federal agencies to collaborate toward a common goal of CCS project deployment
- Make available the State's own land/mineral holdings for CO_2 pipelines or injection, where appropriate
- Through the Natural Resources Agency, review the relevance of certified programs under 14 CCR §§ 15250-15253 to CCS project permitting

- Weigh the desirability of California applying for primacy to administer EPA's Class VI injection well–permitting program
- Through the legislature, enact a minor technical amendment to the Elder Act, clarifying that the Act intends for the Office of the State Fire Marshal to also regulate intrastate CO_2 pipeline safety
- Through the legislature, clarify pore-space ownership, clearly vesting it with the surface owner, and possibly also clarify the relation of the surface estate with the mineral estate
- Through CARB, consider if (and which) changes to existing CCS Protocol provisions could meaningfully increase the array of projects in active development without materially compromising the Protocol's integrity or level of protection/precaution

Medium- and long-term (>2 years)

- Through state agencies and the legislature, consider more broadly the desirability of a parallel, certified process under CEQA with a specific agency as the lead
- Through the legislature, investigate the desirability of options for more efficient acquisition of rights-of-way for pipelines, and of pore space and mineral rights for injection, and then pursue the optimal option
- Construct a backbone of CO_2 trunklines with State involvement, such as a public-private partnership, that will link a large collection of CO_2 point sources to suitable storage
- Assemble a State-operated CO_2 transportation/storage utility to handle permanent subsurface storage

Considerations for project developers

In addition, project developers can follow a series of steps to stack the odds in favor of obtaining necessary authorizations efficiently.

CEQA considerations

- Developers should consider all aspects of a project, including location and stakeholders' disposition before choosing to proceed and should proactively engage in open conversations with stakeholders early; eliminating of disagreements at their root is easier said than done, of course, but an honest attempt to do so from the outset and shortlisting projects not on economic and technical merits alone ensures a smoother start
- From the outset, project developers need to thoroughly identify and mitigate impacts to the greatest extent feasible, and should also consider preparing a draft **initial study** preemptively to submit for the lead agency's consideration
- Project developers should identify and describe the preferred course of action, as well as the alternatives for both the project as a whole and its components
- Project developers can maximize the chances of a smooth CEQA process by seeking large and diverse coalitions of actors to coalesce towards a common objective

Permit application considerations

- As is customary and recommended, permit applicants should consider requesting **pre-application meetings** ("pre-app") with regulators to discuss the project and to learn which parameters the regulators consider critical
- Applicants should assemble and dedicate appropriate staff and/or consultant resources to permit applications, with as much skill and prior experience as possible
- Permit applicants should prioritize transparency, responsiveness and cooperation, and avoid a need-to-know policy with the regulators in permitting interactions