Geothermal Permitting and NEPA Timelines

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ABSTRACT

In identifying the barriers to geothermal development, geothermal industry stakeholders list high up-front capital costs, perceived risk profiles, overall project timelines, and the need for a more streamlined permitting process (Blue Ribbon Panel, 2011; Islandsbanki Report, 2011). Because 90% of the geothermal resources in the United States are on federally managed lands (BLM, 2005) and multiple National Environmental Policy Act of 1969 (NEPA) analyses are commonly required for the development of utility-scale geothermal projects, NEPA considerations are a major factor in present and future geothermal development projects. Thus, the time required for the NEPA process itself and the potential for delays in permitting attributable to the NEPA process can be a major barrier in present and future geothermal development projects.

In this paper, we outline the types of NEPA-related analyses and approvals (e.g., environmental assessment), and we provide examples of geothermal development activities (e.g., well drilling) that might require each type of approval, including an overview and discussion of the specific permits.

We conducted an in-depth analysis of timelines specific to each NEPA analysis type, and we analyzed a sample of geothermal projects to identify factors that increased NEPA review timelines. Based on that analysis, we identified proven and potential strategies that can assist geothermal projects by lowering the time necessary to navigate the NEPA process, while maintaining the efficacy of the federal environmental review intact. We also identified areas of potential improvement in NEPA efficiency within each phase of geothermal development. Shortening project timelines can effectively decrease the perceived risk profiles of geothermal development projects.

[Complete list of acronyms available at end of document.]

Introduction

The National Environmental Policy Act of 1969 (NEPA) requires federal agencies to review the potential environmental impacts of proposed actions in order to determine whether the proposed actions will "significantly affect the quality of the human environment." (NEPA, Sec. 102). The NEPA process integrates natural and social sciences, environmental design arts, agency cooperation, and public comment and opinion in order to achieve the Act's stated goals (NEPA, Sec. 102). NEPA's purpose is to outline a balanced approach in order to improve and coordinate federal plans in a way that allows for the United States to use the environment in a beneficial way, preserve historic and cultural resources, maintain safe and aesthetically pleasing surroundings, achieve resource use for an increasing population, and enhance the quality of renewable resources while approaching the maximum attainable recycling of depletable resources (NEPA, Sec. 101).

The NEPA process is triggered whenever the federal government grants approval for an activity that may impact the human or natural environment. For purposes of geothermal development, NEPA is commonly trigged because either the proposed project is on federally managed lands or federal funds are contributed to the project. Because 90% of the geothermal resources in the United States are on federally managed lands (BLM, 2005) and multiple NEPA analyses are commonly required for the development of utility-scale geothermal projects, NEPA considerations are a major factor in present and future geothermal development projects.

In identifying the barriers to geothermal development, geothermal industry stakeholders list high up-front capital costs, perceived risk profiles, long project timelines, and the need for a more streamlined permitting process (Blue Ribbon Panel, 2011). Perceived risk profiles are problematic because the profiles reflect investor uncertainty; perceived project risk during early stages of geothermal development is much higher than the actual project risk (Islandsbanki Report, 2011). Because the NEPA process is almost always necessary in some form for geothermal projects, NEPA affects the certainty in permitting timelines, overall project timelines, and perceived risk profiles.

While all federal projects must go through the sometimes-lengthy NEPA process, geothermal projects are unique. Each phase of development may require the NEPA process: a single location could conceivably trigger the NEPA process six separate times (Figure 1). The fragmentation exists because project developers may be unwilling to apply a more time-consuming NEPA process (e.g., an Environmental Assessment (EA) or an Environmental Impact Statement (EIS)) to early, prospective project phases that may require a less-intense analysis (e.g., a Categorical Exclusion (CX)). In addition, data from one phase of development is often used and relied upon to inform activity decisions in subsequent phases.

Reducing the overall project time directly attributable to NEPA, whether by reducing the time of individual NEPA analyses or reducing the frequency of NEPA analysis for a particular project, can alleviate some of the major barriers to geothermal development. Reducing NEPA timelines directly decreases overall project timelines, which indirectly decreases the perceived risk profile– lowering three of the four barriers to geothermal development identified by industry. Lowering these barriers is in line with one of NEPA's stated goals: to "enhance the quality of renewable resources."

In 2012, the United States Government Accountability Office (GAO) was asked by the House of Representatives Chairman of the Committee on Natural Resources to review the status of renewable energy permitting on federal land, which included the time frames for permit processing since enactment of the Energy Policy Act of 2005 (EPAct) as well as steps that the agencies have taken to expedite renewable energy development on federally managed lands.

The resulting report (GAO, 2013), issued in January 2013, found that for the period following the enactment EPAct through May 2012, Bureau of Land Management (BLM) received 29 new applications for developing geothermal power in Nevada, including Notices of Intent (NOIs) to Conduct Exploration, Geothermal Drilling Permits (GDPs), and Plans of Utilization (POUs). The approval time for completing NEPA analysis and obtaining geothermal permits ranged from 1 to 4 years, and depended largely on the type of NEPA analysis (e.g., CX, EA, EIS) that was required (this is a subset of the timeframe described in Figure 1).

In this paper, we provide an overview of the different types of NEPA analyses, and of the permitting process for geothermal development and its relation to the NEPA-related environmental review processes. The discussion is focused on projects developed on BLM and U.S. Forest Service (USFS) lands. We then present an analysis of project timelines by comparing the amount of time required for the specific NEPA processes for each phase of development of various past geothermal projects and outline specific factors within a sample of 39 geothermal projects shown to individually or cumulatively increase NEPA project timelines. Based on the timeline data analysis, we identify proven and potential strategies that could lower the time necessary to complete the NEPA process for individual geothermal projects, while still keeping the efficacy of the federal environmental review intact.

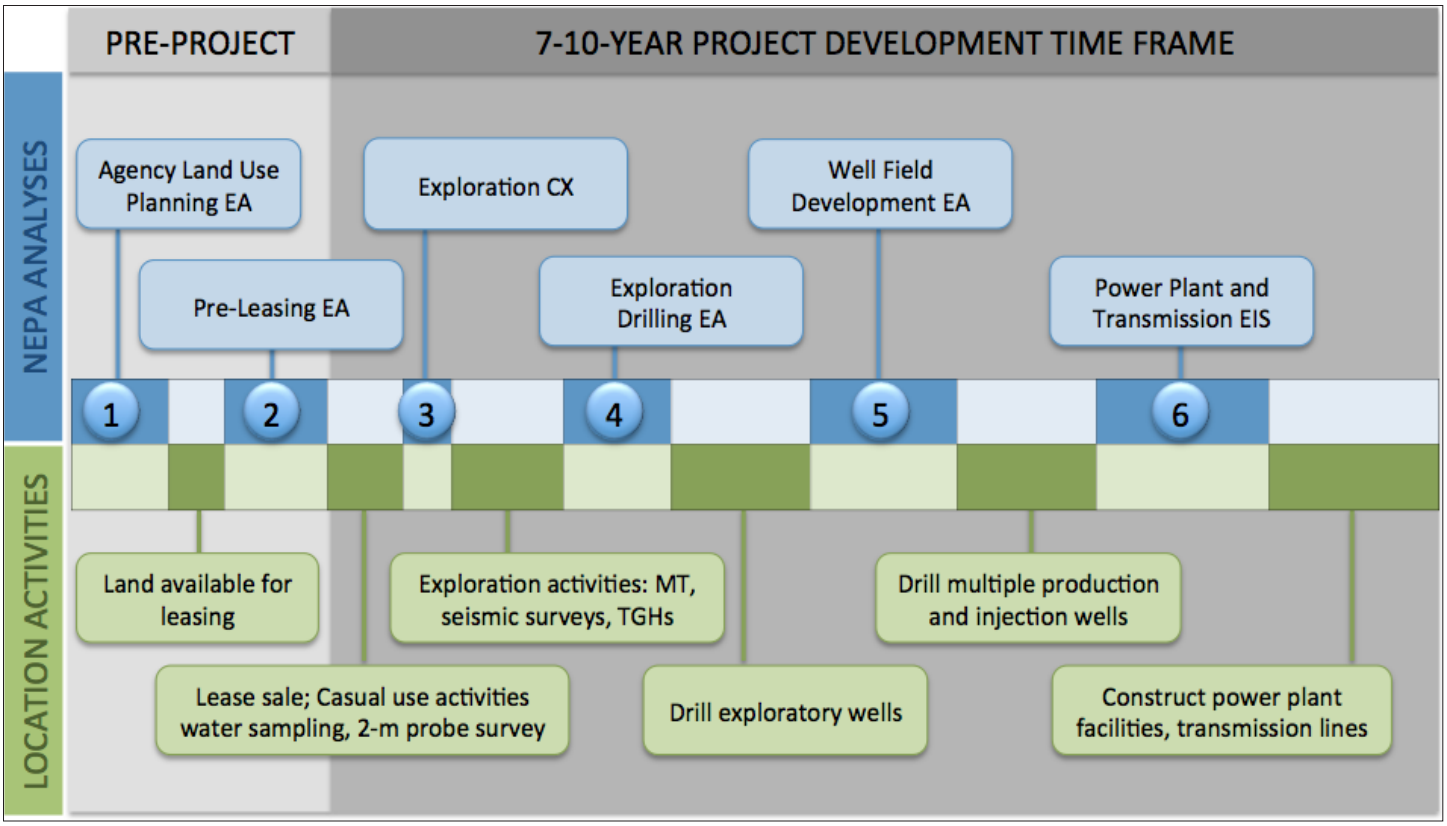

Figure 1. Example timeline of a geothermal location on federal lands illustrating that a single location could conceivably trigger NEPA analysis six separate times. Often data from each activity will provide the required information for the next permit application (e.g., exploration activities will help to target exploration well locations).

The NEPA Process

When project applications are submitted to the federal permitting authority (e.g., BLM), a review is completed to assess the level of NEPA analysis needed, if any. There are five potential determination outcomes: Casual Use (CU), Categorical Exclusion (CX), Determination of NEPA Adequacy (DNA), Environmental Assessment (EA), and Environmental Impact Statement (EIS) (Table 1), as described below. Of these outcomes, only the EIS is defined in NEPA, although the EA is described in the regulations promulgated by the Council on Environmental Quality (CEQ), the agency formed based on language in NEPA and tasked with interpreting general requirements under the Act. For this reason, we use the term "NEPA-related reviews" to describe all five potential outcomes we discuss, since they relate to NEPA – even if they are not specifically described within the act.

Note that the BLM manages all subsurface geothermal resource on federal lands, regardless of the federal agency (e.g., USFS) that manages the surface estate. If the BLM issues an active geothermal lease, regardless of whether the surface estate is managed by itself, another agency, or is privately owned, the BLM is the approving authority for federal geothermal permitting. The operator submits the applications to the BLM, which is the lead agency for processing the applications and coordinating the NEPA process with the surface owner.

Table 1. Types of Environmental Reviews.

Federal Action Description	Resulting Environmental Review	Approximate Time frames	Comments
Action would not ordinarily result in significant disturbance[1] to federal lands, resources, or improvements.	Casual Use (CU)	<1 month	A CU does not require any NEPA analysis and usually results from the review of a NOI for geothermal surface exploration.
Action that has been adequately analyzed under an existing NEPA document(s) and is in conformance with the land use plan.	Determination of NEPA Adequacy (DNA)	1 month	Not all new proposed actions will require new NEPA analysis. In some instances, an existing EA or EIS may be relied upon in its entirety, and new NEPA analysis is unnecessary.
Action that the agency or Congress has determined does not have a significant effect[1] on the quality of the human environment[2] (individually or cumulatively) and for which neither an EA nor an EIS is required.	Categorical Exclusion (CX)	2 months	A CX does not require extensive NEPA analysis. A CX is used for activities that have been determined not to have a significant effect on the environment.
Action that may significantly impact the environment	Environmental Assessment (EA)	10 months	EAs are conducted to determine whether action would significantly affect the environment. The EA process results in either a Finding of No Significant Impact (FONSI) or the preparation of an Environmental Impact Statement (EIS).
Major federal action that significantly affects the environment	Environmental Impact Statement (EIS)	25 months	The EIS process requires public participation for all federal agencies. The EIS requires more intense analysis, data collection, and public participation.

[1]Definition of "effects" is provided in CFR 1508.8
[2]Definition of "human environment" is provided in CFR 1508.14

Casual Use

Casual use activities are those "activities that ordinarily lead to no significant disturbance of federal lands, resources, or improvements" as defined in 43 CFR § 3200.1. While casual use activities do not require a permit and are not covered by BLM regulations (43 CFR § 3250), it is common practice for a geothermal developer to submit a Notice of Intent (NOI) for geophysical operations that would otherwise be covered by the casual use definition. The NOI informs BLM the operator will be conducting exploration operations and provides the basis for justification of diligence in developing the lease and meeting the required annual financial expenditures to hold the lease past its primary term. BLM reviews the NOI, responds to the applicant in a letter verifying that the exploration activities are casual use, and may request that the applicant notify BLM when the activity commences and when it has been completed.

Typical geothermal activities that would be considered casual use include the use of all-terrain vehicles (ATVs) in off-road vehicle areas, two-meter probe surveys, magnetotelluric (MT) surveys, gravity surveys, geochemical surveys, archaeological surveys, and water sampling.

Categorical Exclusion

A CX is a "category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a Federal agency … and for which, therefore, neither an environmental assessment nor an environmental impact statement is required" (40 CFR 1508.4).

The BLM has one CX listed in its rules available for geothermal exploration projects that allows an NOI to be approved under a CX when no new or temporary road construction is proposed, no drill pad construction is proposed for the drilling of a thermal gradient hole (TGH), and no extraordinary circumstances (43 CFR 46.215) are identified during the screening (DOI 516 DM 11.9, B.6; 43 CFR 3250; BLM Instruction Memorandum 2009-044, 2009).

Geothermal exploration permits are approved using a CX determination when the operations could have significant effects to federal lands, resources, or improvements, but after review under NEPA it is found that there are no extraordinary circumstances and there would be no significant effects. When the BLM applies a CX, the plan area and exploration operations are screened for the presence of extraordinary circumstances. If extraordinary circumstances are present, specific operational limits will be required within the approved permit to avoid any potential disturbance. Alternatively, disturbance could be avoided by relocating the plan area away from resource concerns.

Typical geothermal activities that are "categorically excluded" include seismic surveys, electromagnetic surveys, and TGHs with no new well pad or access road construction.

Determination of NEPA Adequacy

A DNA is a process in which a federal agency relies on existing NEPA analysis to document the rationale for approving a permit. DNAs avoid additional NEPA analysis by "tiering" the environmental review for a proposed activity to existing NEPA analysis (DOI 516 DM). The proposed activity must meet NEPA adequacy criteria (DOI 516 DM 11.6) and be in conformance with an existing agency land use plan or tiered to an EA or EIS. To meet NEPA adequacy criteria the reviewing agency must conclude there will be no *new* significant environmental impact that would require a new environmental assessment or environmental impact statement.

Typical geothermal activities that would be considered under DNAs include drilling new wells and constructing new well pads, constructing new access roads, and building a pipeline.

Environmental Assessment

An EA is a "concise public document for which a federal agency is responsible that serves to:

1. Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact.
2. Aid an agency's compliance with [NEPA] when no environmental impact statement is necessary.
3. Facilitate preparation of a statement when one is necessary."

(40 CFR 1508.9)

Typical geothermal activities requiring an EA include some NOI approvals where the exploration project requires new access roads or TGHs requiring new well pads, geothermal drilling permit application (GDP) approvals, construction of pipelines or other infrastructure, and plans of utilization (POUs for commercial development of the geothermal resource.

Environmental Impact Statement

An EIS is a detailed statement by the responsible official required of "all major federal actions significantly affecting the quality of the human environment" (NEPA, Sec. 201(C)). The document must include:

1. "the environmental impact of the proposed action;
2. any adverse environmental effects which cannot be avoided should the proposal be implemented;
3. alternatives to the proposed action;
4. the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and
5. any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."

(NEPA Sec. 102(2)(C))

Typical geothermal activities that would require an EIS include drilling large well fields, POUs, or controversial activities such as a proposed project location in an environmentally sensitive area.

NEPA and the Geothermal Development Process

NEPA review is often conducted multiple times at a given geothermal development project location, including during the agency's land use planning and leasing analysis phases, and during a developer's exploration, drilling, power plant, and transmission project phases. These phases are described in more detail below.

Table 2 lists the phases of a typical geothermal project, common activities, likely permits, and the potentially required NEPA-related review. Table 2 illustrates that it is not always clear which type of NEPA-related analysis might be required; the decision is made on a project-by-project basis by BLM staff and may change throughout the environmental review process. However, the selected environmental review must be completed prior to issuance of the permit.

Table 2. Common activities in the development of geothermal projects that may require NEPA analyses. The table lists the activities and their respective potential permits and NEPA requirements.

Phase	Common Activities	Likely Permit(s) Needed	BLM Authority	Potentially Required NEPA-Related Review[1]
Land Use Planning[1]	N/A	None	43 CFR Part 1600 43 CFR Subpart 1610	EA, EIS
Leasing	N/A	None	43 CFR Part 3200	EA, DNA
Exploration	Water sampling	Notice of Intent to Conduct Geothermal Exploration (NOI)		CU
	Seismic surveys, Temperature Gradient Holes	Notice of Intent to Conduct Geothermal Exploration (NOI)	43 CFR Subpart 3250 43 CFR Subpart 3251 43 CFR Subpart 3252	CX, DNA, or EA
Drilling	Drilling of slim holes, full-diameter wells for confirmation of a resource	Geothermal Drilling Permit (GDP) + Plan of Operations (POO), and/or Sundry Notice	43 CFR Subpart 3260 43 CFR Subpart 3261	DNA or EA, EIS
Utilization	Construction of power plant, transmission lines, ancillary facilities, production wells, injection wells, pipelines, etc.	Plan of Utilization (POU), Construction Permit, Site License, Commercial Use Permit (CUP), and GDP (if necessary)	43 CFR Subpart 3270 43 CFR Subpart 3271 43 CFR Subpart 3272 43 CFR Subpart 3273 43 CFR Subpart 3274	EA, EIS, or DNA (only for GDP)

[1]Activity conducted by the agency prior to development. If geothermal development is not included in the land use plan, the plan must be amended prior to leasing.

While two or more of the phases listed above could be permitted and their respective NEPA processes completed concurrently, the phases and processes are often submitted and processed sequentially, so that data from one phase can be used to inform activity decisions in subsequent phases.

Land Use Planning

Prior to a developer's involvement in an area, a federal agency commonly takes several steps to prepare for geothermal development. The first step, as listed in Table 2, is Land Use Planning. A Land Use Plan (a.k.a. Resource Management Plan[1]) is the agency's final decision determining the allocation of resources on federal lands; it is the decision document by which an agency allows geothermal development (among other uses) on specific federal lands. Land use plans (LUPs) are developed at the field office level, and generally cover a 10- to 20-year planning period. The planning process is time consuming and costly and as such, not all LUPs are up-to-date; many were prepared over 20 years ago (BLM Resource Management Plan Map, 2013). However, amendments are common and key to keeping these plans current. A LUP might be amended if, for example, unforeseen uses (such as geothermal development) require authorization of permits that are not consistent with, or addressed in, the plan (BLM Land Use Planning Handbook, 2010). Any time an LUP is developed, amended, or revised, an environmental review is conducted at the level of an EA or EIS. The focus of this review is to analyze potential impacts, determine mitigation, and decide whether geothermal development is allowable.

Leasing

A NEPA analysis is also typically conducted during the leasing phase. Ordinarily, an environmental review is required prior to making federal land available for geothermal leasing. The focus of the review at this stage is for the agency to determine what lands are open for leasing, what leasing stipulations will be required and/or recommended, and what resources might be impacted.

In 2008, federal land management agencies completed a Programmatic Geothermal Leasing EIS (PGEIS). The PGEIS amended 114 BLM Resource Management Plans (RMPs) for geothermal leasing by adopting the PGEIS Record of Decision (ROD) to open the land under the RMPs for geothermal leasing, along with adopting stipulations and best management practices (BMPs). After completion of the PGEIS, leasing nominations on federal land opened by the PGEIS for geothermal leasing are now cleared by way of a DNA tiered to the environmental review for the RMP. However, not all RMPs contain allocations of geothermal resources for development. If geothermal leasing is not already made available by the relevant RMP, an area can be formally nominated for geothermal leasing and approval will be subject to an environmental review at the level of an EA or EIS.

Exploration

An NOI is used to request permission for exploration activities on federal lands. As noted in Table 2, the type of environmental review required for this stage in the process depends on the activities proposed. Multiple NOIs may be submitted for subsequent activities, to allow less-impactful activities to proceed without requiring intensive environmental review. Alternatively, the activities may be listed in a single NOI and activities requiring only CU may be approved prior to the activities requiring more intensive environmental review. The NOI can be approved based on CU, CX, DNA (tiered off the leasing NEPA analysis or any previous NEPA analysis in the area including the PGEIS), or in some cases, an EA.

Drilling

A GDP application is used to request permission for drilling activities on federal lands (43 CFR § 3261). The type of environmental review required for this stage of development could be a DNA, EA, or EIS. It is often helpful in the long run to submit an EA or EIS for more GDPs than the project initially requires. If subsequent drilling permits become necessary, and the additional and cumulative impacts were fully contemplated in the original EA or EIS – the permits can be approved based on a DNA. Otherwise, an additional EA or EIS is necessary for subsequent GDPs to address the additional and cumulative environmental impacts.

Power Plant & Associated Transmission Construction

A POU is required to outline how the developer plans to get the geothermal resource from the bottom of a well all the way to the electric grid (43 CFR §§ 3270-74). Utilization might include drilling production and injection wells, and constructing power plants, transmission lines, and support facilities or ancillary equipment. Utilization might require a Construction Permit, Site License, Commercial Use Permit (CUP), and GDPs (for production/injection wells). A Site License is not required if the site facilities are not located on federal land.

The construction of power plants and transmission lines will always trigger an EA at a minimum and, given the amount of industrial activity inherent in the operation, a requirement to complete an EIS is not uncommon. In certain limited circumstances the GDPs for utilization may be approved with a DNA as it is possible that an earlier EA or EIS accounted for production and/or injection wells.

Timelines for Geothermal Permits

In 2013, the Department of Energy's Geothermal Technologies Office (GTO) funded the collection of metadata and documents from previously conducted geothermal NEPA analyses, which were cataloged in a Geothermal NEPA Database (Young and Levine, 2014). Additional timeline information was collected in 2014 and added to the database. The data were used in this analysis to review timelines for various types of NEPA analyses (e.g., CXs, EAs, EISs), and to review projects where DNAs were used to tier environmental reviews for additional activities to previous NEPA analyses.

Data in Table 3 were assembled from the NEPA Database cataloging the number of permit applications for each activity and the resulting NEPA-related review conducted for permit approvals. Not all of the records are complete; documents are often missing key dates (e.g., was there a pre-application meeting? If so when did it occur? Was the application accepted as complete when initially submitted, or was the application resubmitted and accepted as complete on a later date?). These uncertainties reduced the number of records suitable for analysis from the total amount cataloged in the database.

Table 3. NEPA Database Open Energy Information Geothermal Permit Applications[1].

	Permit Applications[2]												
	Notice of Intent to Conduct Exploration				Geothermal Drilling Permit[3]			Plan of Operations/Plan of Development[3]			Plan of Utilization[3]		Total
Activity	CU	CX	DNA	EA	CX	DNA	EA	DNA	EA	EIS	EA	EIS	
Surface Exploration													
Water Sampling	2												2
2-Meter Probe	2	1											3
TGH		9	5	3			1		1				19
Geophysical Exploration													
Electrical/MT/ Gravity	20	11									1		32
Seismic	1	11											12
Unknown (NOI Unavailable)		13											13
Drilling													
Exploration Drilling (excluding TGH)				1		2	3		10				16
Development Drilling					1	15	4						20
Well Field Development						1		1	7				9
Power Plant													
Power Plant											7	3	10
Totals	25	45	5	4	1	18	8	1	18		8	3	136

[1] Documents in NEPA Database adequate for analysis

[2] NEPA Analysis: CU-Casual Use, CX-Categorical Exclusion, DNA-Determination of NEPA Adequacy, EA-Environmental Assessment, EIS-Environmental Impact Statement

[3] Some GDP, POO, POD, and POU EAs included in the above table overlapped and are represented for each category to which they applied.

Exploration Permit (NOIs) NEPA Timelines

Table 3 illustrates that most of the geothermal exploration permit applications, including TGHs, were permitted using a CU or CX determination. We look at each type of exploration activity individually. For thirteen NOIs, the applications were not available for review in determining the proposed activity, and thus those NOIs are not treated in this discussion. These NOIs are listed as "NOI Unavailable" in Table 3.

Surface Exploration

Two applications for 2-m probe surveys and two applications for water sampling were permitted as casual use. Shallow probe and water sampling are routinely permitted as casual use because these activities typically do not significantly disturb federal lands or resources. However, one application was permitted using a CX after the developer explicitly requested the BLM apply a CX when permitting the proposed 2-m probe surveys. A more thorough environmental review can function as a measure to increase the legitimacy of an agency's approval and add certainty to the development process.

Applications for TGHs cataloged in our database were handled in many different ways, including CUs, CXs, DNAs, and EAs. The type of determination required depended on the terms of the geothermal lease in question, the impact of the proposed action, or the terms of existing authorizations based on the findings of a prior assessment of the affected area.

Nine TGH applications were categorically excluded from further NEPA review because no temporary or new road construction or well pads were proposed (DOI 516 DM 11.9, B.6; 43 CFR 3250; BLM Instruction Memorandum 2009-044). The five TGH permit applications that required only DNAs were either sited in areas that had previously been approved for surface disturbance via the construction of well pads or cross-country roads, or involved the relocation of TGH sites within the area surveyed during a prior EA. One of those five cases was closed without action due to failure of the developer to submit the required bonding documents. Finally, three applications for TGHs required EAs and concluded with a FONSI. In all cases, the applications for TGHs were included within larger permit applications that required EAs for the construction of well pads, access roads, and/or the drilling of observation or exploratory wells; the TGHs that were allowed under CXs or DNAs could proceed prior to the completion of the EA for the remaining proposed activities.

Geophysical Exploration

Electrical, Magnetotelluric and Gravity Surveys were considered to be CU 65% of the time (20/31 permits), and required CXs 35% of the time (11/31 permits). The records indicate that the BLM used CU designations when it determined the operations would have no significant disturbance on lands, resources, or improvements. Permits that were categorically excluded from further NEPA review (under DOI 516 DM 11.9, B.6; 43 CFR 3250) were those that could create a significant disturbance due to, for example, the necessity of vehicle travel through an area containing cultural resources or protected species. In these instances, the BLM screened for extraordinary circumstances and approved permits after including required "operational measures" to avoid impact on resources.

Exploration permits for seismic surveys were granted using a CX 91% of the time in our database. The BLM applied CXs when it determined the proposed activity would not cause significant disturbance to federal lands. These surveys are expressly categorically excluded by BLM rulemaking (DOI 516 DM 11.9, B.6; 43 CFR 3250). Project areas were screened for extraordinary circumstances and permits were approved with required operational measures to avoid impact on resources. A single seismic survey was authorized as CU under the authority of 43 CFR 3209. The reason that this

survey was authorized as CU was unclear, although it might relate to the survey's use of a unique seismic source that would result in minimal disturbance of the surrounding environment.

Drilling Permits (GDPs)

GDPs are typically approved through either an EA or DNA, but Table 3 reflects a few exceptions.

A single GDP application for 10 TGHs required an EA, and it was approved through a FONSI. The time from application to decision was 158 days (5 months). The scope of the EA provided for expanding the wells upon discovery of productive geothermal resource without having to do a sundry notice.

One GDP for well drilling was approved using only a CX in conformance with 516 DM 11.9. This GDP only required a CX because it involved the re-drilling of a previously authorized geothermal well to greater depth for the purposes of electric power generation. No new well pad or roads were needed.

For the eighteen DNA-approved GDPs, the permits are often tiered to an existing EA approving a Plan of Development (POD) or Sundry Notice.

The remaining seven GDPs in our database required EAs, and all resulted in a FONSI.

Specialized Plans

Plans of Operation (POOs), Plans of Development (PODs), and Plans of Utilization (POUs) are usually approved using an EA, while in rare circumstances, an EIS will be prepared. Application approval will require an EIS if the reviewing agency determines the adverse environmental impacts cannot be mitigated through any proposed measures or measures established by the agency.

Plan of Development (POD)

A POD is required whenever a federal unit is established by way of a unit agreement. A unit agreement consolidates land or geothermal deposits with different ownership into a cumulative unit for purposes of effective development. The unit operator must submit a POD to the BLM defining how the operator will diligently pursue exploration and development on the unit to meet initial and subsequent unit development and public interest obligations (43 CFR 3280.2). All of the PODs reviewed required an EA, except one that was covered under a previous NEPA analysis.

Plan of Operations (POO)

A POO is a report outlining the location of wells, access roads and authorized water supply, among other details. POOs are often submitted simultaneously with GDPs (43 CFR 3262.4). All of the POOs reviewed required an EA.

Plan of Utilization (POU)

A POU outlines the subsequent drilling and infrastructure requirements in order to deliver the resource to a power plant, including the generating facilities if they will be located on federally managed lands. Developers may submit proposed POUs simultaneously with proposed POOs (and GDPs). POUs must identify proposed measures for environmental protection and mitigation. Eight of the reviewed POUs required an EA and three required an EIS. More thorough environmental review was required in these three instances because the project areas were located within or adjacent to areas with exceptional characteristics for recreation or preservation, or populated areas. For this reason, public comment and review was extensive and adverse impacts could not be sufficiently mitigated to allow for less comprehensive review with an EA.

Geothermal NEPA Processing Times

Time frames for a geothermal developer to receive approval of each of the necessary permits can vary widely, largely because of differences in:

- The resources (e.g., cultural, flora and fauna, etc.) present at the proposed locations;
- The complexity of the operation;
- Delay of developer hiring an environmental consulting firm for NEPA document preparation;
- Staff/budget availability at the lead agency office; and
- Whether the proposed activity is considered controversial.

Below, we review the NEPA timelines for NEPA-related analyses collected in the NEPA database.

Analysis of Timelines in the NEPA Database

A statistical analysis of the NEPA document processing times is illustrated in Table 4. The time is calculated from the date the permit application (NOI, Sundry Notice, GDP, POO, POD, or POU) was submitted to the date the permit was approved.

Table 4. NEPA Processing Time Statistics.

Statistical Parameter (days)	Permitting Analysis Documents				
	CU	DNA	CX	EA	EIS
Mean	26.1	43.4	97.4	337.1	824.3
Median	21.0	27.0	64.0	302.0	749.0
Standard Deviation	24.4	46.8	98.6	218.7	596.6
Skewness	2.9	2.1	2.1	1.0	0.6
Range	124.0	193.0	525.0	943.0	1186.0
Minimum	1.0	0.0	0.0	3.0	269.0
Maximum	125.0	193.0	525.0	946.0	1455.0
Sum	652.0	1086.0	4384.0	12474.0	2473.0
Count (# of database entries)	25.0	25.0	45.0	37.0	3.0

The time for BLM to make a CU determination varied from 1 day to 125 days, with a median of 21 days with a positively skewed distribution. Records show that the time from application to decision for electrical, MT, and gravity geophysical surveys approved as CU activities ranged from 1 day to 43 days, with most applications requiring 28 days or less to be approved. The seismic survey authorized as CU (under the authority of 43 CFR 3209) required 41 days to gain approval from application to decision.

The Median CX review took 64 days with a range of 0 to 525 days. Over 90 percent of the CXs were approved within 213 days (7 months) with a positively skewed distribution. The time from application to decision for electrical, MT, and gravity surveys approved by CX under 43 CFR 3250 ranged from 23 to

213 days, with more than half of the applications requiring 182 days or more to be approved.

For DNA reviews analyzed for the approval of GDPs that were tiered to an EA prepared for a POO or POD, the median processing time was 27 days with a range of 0 to 193 days and a positively skewed distribution.

The Median EA processing time was 302 days with a range of 3 to 946 days. The one GDP application for TGHs that required an EA required 158 days (5 months) from application to decision to gain approval, however no documentation was available for inclusion in the NEPA database that describes the reason that necessitated an EA for the drilling of these TGHs.

Processing times for EISs are positively skewed with the mean processing time greater than the median processing time, but may not be representative because only three EISs are present in the database and were written for the approval of a POU for the commercial development of the geothermal resources. The processing time ranged from 269 to 1455 days with a median of 749 days, or about 25 months. Generally, the minimum time for the completion of an EIS is approximately 18 to 24 months, due to the public notice and participation process requirements (CEQ NEPA Task Force Report, 2003).

In summary, median timelines for processing activities as CU, CXs and DNAs (1-2 months) are significantly shorter than median time frames for EAs (10 months) and EISs (25 months). Finding ways to process geothermal permits using these shorter reviews will help to reduce project time frames. One way to increase the potential application of CXs is to develop geothermal-specific CXs—either administratively or statutorily (Levine and Young, 2014). Another is to increase the use of DNAs by expanding the scope of project EAs (as described in more detail below).

NEPA Project Timelines

The large spread in the time frame data in the last section raises the question, "Why?" Why is there such variance in NEPA-related analysis timelines? Why do some projects take so long? For projects for which we had sufficient data, we broke down the timelines to see which step or steps in the process create delays. Thereafter, we review the documents to identify potential causes of these delays.

An environmental assessment has several distinct phases that make up a project's timeline (Figure 2):

1. Application;
2. Scoping, consultation, studies, formulation of alternatives, and writing the environmental review document;
3. Preliminary EA;
4. Public review if required and revisions, if necessary; and
5. Final EA and decision record/finding of no significant impact.

For several projects in our database, we were able to collect sufficient information to assemble detailed project timelines (Figure 2). These timelines illustrate that the scoping/consultation/study period appears to be the most time consuming portion of these analyses. These activities can take long periods of time—due to applicant and agency variables, project variables, or both.

Applicant/Agency Variables

In meetings with industry and agency personnel (Young and Witherbee, 2012) the following causes for applicant/agency delays were highlighted as potential issues:

- Developers changing project plans after the initial application
- Waiting on developers to provide additional information
- Agency personnel on vacation with no back-ups in place
- Agency personnel with competing priorities
- Agency personnel without sufficient budget to process EAs
- Untrained agency personnel
- Lack of inter-agency coordination

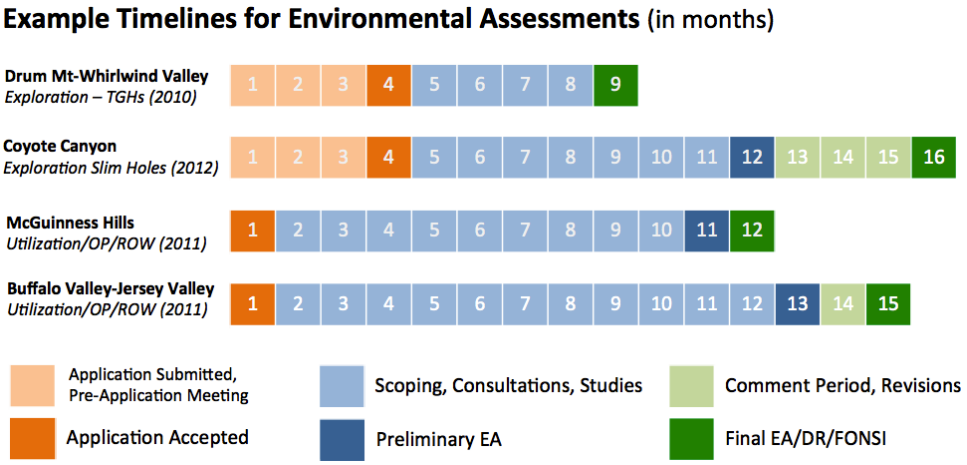

Figure 2. Example Timelines for Environmental Assessments (in months).

Table 5. Summary of Median Time Frames for EAs for Variables that Potentially Increase Time Frames. Thirty-nine EAs reviewed for this analysis.

Variable	# of Yes (of 39 EAs)	Average # of Days			Median # of Days		
		Yes	No	Difference	Yes	No	Difference
Native American Concerns?	25	368.8	307.3	61.5	337	256.5	80.5
Significant Tribal Comment?	9	400.9	330.4	70.5	354	297	57
Significant Public Comment?	5	428.8	317.8	111.0	456	309.5	146.5
ESA Species present?	3	404.7	341.9	62.8	380	311.5	68.5
Migratory Birds Present?	36	364.8	119.0	245.8	331.5	155	176.5
BLMSSS Present?	33	388.1	119.0	269.1	337	113	224
Exceptional Concern for Ambient Environment?	10	361.0	341.8	19.2	331.5	296	35.5
Overlapping Jurisdictions of Federal Agencies?	11	390.0	329.7	390.0	302.0	327.0	-25.0

Note that detailed project information (e.g., notes, emails, calendars) were not available for any of the projects in our database, and therefore, it is not possible to know which, if any, of the above factors played a role in the project timelines.

Project Variables

Some (but not all) details about project variables were available for review and analysis. For 39 EAs in our database, we reviewed several factors that have been cited as potentially contributing to extended environmental review time frames (Table 5).

The presence of migratory birds and BLM Special Status Species (BLMSSS) were common, occurring in almost every instance we reviewed, and therefore, do not appear to be a good indicators, by themselves, for increased timelines.

Native American concerns were present slightly less often (25/39) and appear to cause an increase in NEPA timelines.

NEPA timelines increased further, however, when tribes or the larger public actively commented throughout the process. Assessment timelines also increased when the project area contained wildlife protected under the Endangered Species Act (ESA) and when there were overlapping jurisdictions of federal agencies.

There did not appear to be any correlation between project size and permitting time frame (Figure 3a) or between amount of new surface disturbance and permitting time frame Figure 3b).

Reducing Individual NEPA Timelines

Reducing NEPA timelines would help to reduce project financing costs and project risk. It is important, however, to first understand in detail what these timelines look like.

A step towards reducing applicant and agency delays in NEPA timelines would be to track project schedules and metrics in more detail, thereby increasing overall accountability and transparency, as well as providing the needed information to identify causes of delays.

Additionally, actively engaging with tribes and the public may help to reduce delays, and avoiding areas containing wildlife protected under the ESA, when possible, may also help to reduce timelines.

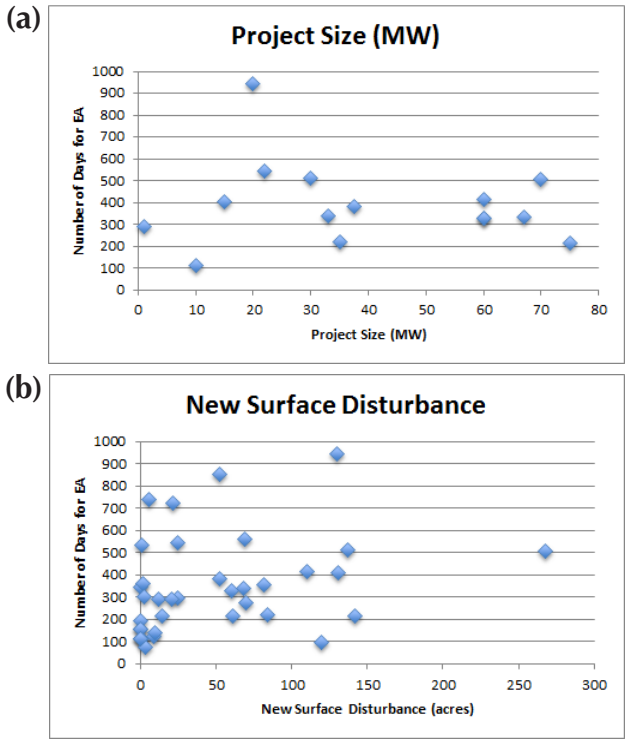

Figure 3. Graphs showing relationship between (a) project size and (b) new surface disturbance on a project's EA review timeline.

Combined and Tiered NEPA Analyses

Another way to reduce project timelines is to reduce the number of times a project goes through the NEPA review process. As previously mentioned, one of the reasons the NEPA process time requirements can be a barrier to geothermal development is due to the number of activities and permits that require NEPA analysis throughout a geothermal project. Because each NEPA process takes time and introduces uncertainty into the geothermal project, agencies and developers have looked at ways of reducing the timelines and risk by conducting fewer analyses. The strategy is to conduct a larger NEPA analysis (EA or EIS) that includes analysis of the potential impact of more project activities, along with subsequent smaller analyses (e.g., DNAs). We look at four examples of this concept in more detail below.

1. Combining Land Use and Pre-Leasing (Figure 1, NEPA Analyses #1 and #2)
2. Combining Pre-Leasing and Exploration Drilling (Figure 1, NEPA Analyses #2 and #4)
3. Combining Exploration Drilling and Development Drilling (Figure 1, NEPA Analyses #4 and #5)
4. Tiering NEPA Analyses - relying on existing NEPA analysis for use in subsequent analysis (Figure 1, multiple combinations)

Combining Land Use Planning and Pre-Leasing Analyses

The Energy Policy Act of 2005 changed the BLM's geothermal leasing program from essentially a noncompetitive leasing system to an all-competitive leasing system. The geothermal leasing regulations (43 CFR 3200) issued by BLM in June 2007 require that BLM first offer all geothermal leases for utility-scale electrical production through a competitive auction.

Lands for competitive geothermal leasing are formally nominated by the public. If the lands are available for leasing, BLM will conduct a leasing analysis, typically an EA, to determine what lands will be made available for leasing, and which site-specific stipulations will be attached to the lease. BLM is required to hold an auction, at a minimum of every two years when lease parcels are available.

Prior to completion of the PGEIS, an EA was typically prepared prior to offering a geothermal lease to an applicant or for competitive sale. Currently, lease nominations are cleared for leasing through a DNA tiered to the LUP. For Example, 295 of 375 geothermal lease parcels were cleared for leasing using the DNA process by tiering to the amended RMP, which was tiered to the PGEIS (Table 6). This was a major improvement for geothermal development, in that the BLM was able to offer geothermal leases with the shorter DNA process, instead of having to prepare an EA.

Table 6. Geothermal Leases –Post PGEIS[1].

State	Leases Offered	Additional Documents	
		DNA	**EA**
CA	15	12	3
CO	3	1	2
ID	12	12	0
NV	267	246	21
OR	11	11	
UT	68	13	55
Totals	376	295	81

[1] Sales through 11/19/2013
Data source: LR2000; BLM Geothermal Lease Sale Results.

Including Exploration Drilling in Pre-Lease EAs

There have been discussions and recommendations among stakeholders recommending that a geothermal lease be conditioned so that geothermal exploration drilling (TGH or slim holes) can be permitted without having to conduct an additional EA. The major drawback is that an EA will be required prior to offering a lease parcel for competitive sale. One of the major industry concerns prior to the PGEIS was the time from lease nomination to being offered for sale. However, having a geothermal lease that would allow the lessee to access the lease for exploration drilling would eliminate the additional time required to conduct a post-lease NEPA analysis and the additional expense to the lessee. There is some concern that an agency would incur the expense of the pre-lease exploration drilling EA, and that the lease would not be sold, and therefore, the costs would not be recouped. Nevertheless, such a lease may be more valuable to potential bidders at a competitive lease sale, which could offset the additional BLM costs for the pre-leasing NEPA analysis.

Alternatively, geothermal stakeholders have suggested that a programmatic EIS for exploration drilling be conducted, similar to the programmatic EIS for leasing. This would reduce the burden on individual field offices to complete the exploration EA before lease sales.

One of the reasons this option is getting so much attention from industry relates to project risk. Until a resource is proven with exploration and confirmation drilling, a geothermal project has higher risks and more expensive financing options when compared to financing for projects at the development phase, and may have difficulties in finding financing at all (Speer, et al). Reducing permitting risk and time frames in the early phases of the project (NEPA analyses #3 and #4 in Figure 1) has the potential to increase potential value for geothermal developments.

Combining Exploration and Development Drilling NEPA Analysis

Some geothermal developers have submitted combined exploration and drilling plans for review in a single environmental analysis. Combined NEPA analysis requires the developer to submit both permit application to the BLM including an NOI for drilling TGHs and a Sundry Notice or GDP for drilling slim holes and development wells as a POD or POO. An initial review of these combined NEPA documents indicates that the processing time is greatly reduced compared to the practice of submitting two separate permits that requires two EAs.

For example, the New York Canyon Geothermal Project (Figure 4), combined its exploration and drilling into a single EA and was able to complete permitting for the entire project in about four years.

This project's timeline includes three separate NOIs for geophysical exploration that were evaluated by BLM and determined to have met the CU criteria. The next phase of permitting included the preparation of an EA for NOIs for TGH and GDPs for exploration development drilling. The final phase of permitting included the preparation of a subsequent EA to approve a POU for additional development of the geothermal reservoir and construction of a power plant with associated transmission lines.

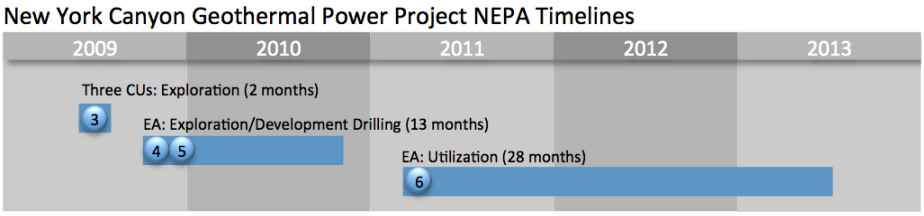

Figure 4. NEPA timelines for New York Canyon Geothermal Development Project showing a shortened time frame for NEPA analyses by combining exploration drilling and development drilling into a single EA. The numbers in the figure correspond to the numbered NEPA analyses in Figure 1.

An additional example is the Drum Mountain-Whirlwind Valley Project (Figure 2), for which the developer submitted a single combined application with an NOI for exploration wells and a POO for development wells. For the Leach Hot Springs Geothermal Exploration Project, the developer submitted a single, combined permit application. For these applications, the BLM combined the NEPA analysis in one document. And, each combined analysis accommodated construction of exploration well pads and up to one temperature gradient well, one observation well, and one production well on each site.

Had the example projects conducted each permitting action and NEPA analysis individually, the time before development drilling would have been delayed until the completion of a second EA.

Tiering NEPA Analyses

Geothermal developers have also used the approach of developing comprehensive EAs or EISs early on in the project and then later having additional exploration or production wells approved through a DNA. Table 6 provides a list of DNAs completed for the EAs and EISs in the Geothermal NEPA Database. As shown in the table, the majority of DNAs (12/18) took less than a month for approval, with only one taking greater than two months. The median approval time for a tiered DNA was 27 days – significantly shorter than the median approval time of 302 days for an EA (Table 4).

Conclusion

The information and data presented and analysis conducted for this study illustrate six main points.

Table 7. Tiered Determinations of NEPA Adequacy.

Geothermal Area	NEPA Tiered Document Name/ Number	EA		DNA	
		Days to Approve	Date of FONSI / ROD	Application Date	Days to Approve
Salt Wells Geothermal Area	Salt Wells Geothermal Energy Projects Final Environmental Impact Statement Final DOI-BLM-NV-CC-ES-11-10-1793	749	9/30/11	12/6/11	51
				12/6/11	51
				12/31/11	27
Gabbs Valley Geothermal Area	Environmental Assessment Gabbs Valley and Dead Horse Wells Geothermal Exploration Projects - DOI-BLM-NV-C010-2010-0006-EA	363	11/13/10	5/20/11	26
				1/31/12	16
				10/11/12	14
				1/4/13	27
McCoy II Geothermal Area	McCoy II Geothermal Exploration Project DOI-BLM-NV-C010-2010-0514-EA	560	10/18/11	10/18/11	1
Dixie Meadows Geothermal Area	Dixie Meadows Geothermal Exploration Project DOI-BLM-NV-C010-2011-0516-EA	510	1/17/12	6/29/12	154
				1/11/13	34
Dead Horse Wells Geothermal Area	Wild Rose Geothermal Exploration Project DOI-BLM-NV-C010-2012-0050-EA	245	10/5/12	5/22/13	1
Coyote Canyon Geothermal Area	Coyote Canyon South Exploration DOI-BLM-NV-C010-2012-0051-EA	336	12/18/12	12/18/12	21
				1/14/13	56
Tungsten Mountain Geothermal Area	Tungsten Mountain Geothermal Exploration Environmental Assessment DOI-BLM-NV-C010-0029-EA	407	3/28/12	4/2/12	14
				7/31/12	31
				8/13/12	44
Gerlach Geothermal Area	Gerlach Geothermal Exploration Project NV-020-06-EA-12	14	NA	18/26/08	14

First, the NEPA process can add significant time to the development of geothermal projects. Finding ways to both adequately comply with the NEPA process and decrease the time associated with compliance can greatly reduce the degree to which NEPA reviews prolong geothermal development. Streamlining the NEPA permitting process could have the dual effects of reducing overall project timelines and lowering the perceived risk profiles of geothermal development projects, while still ensuring adequate environmental review.

Second, CUs, CXs, and DNAs take less time to complete than EAs and EISs. Finding ways to utilize these types of environmental reviews more often can lead to reduced timelines. One such way to accomplish this is through development of geothermal-specific categorical exclusions, where applicable.

Third, there may be potential to reduce NEPA timelines by tracking timelines and identifying applicant or agency delays, which will increase overall accountability and transparency. Data about such delays are critical to identifying issues and targeting additional potential for improvement in project timelines.

Fourth, recent policy changes provide a glimpse of the BLM's ability to help facilitate the goal of lowering the NEPA permitting timelines. The 2008 PGEIS cleared 78% of geothermal parcels for lease using a DNA, eliminating the need to conduct 295 EAs and effectively reducing the overall project timelines. Expanding on this policy idea, a programmatic EIS could be conducted for exploration drilling, or alternatively, individual field offices could conduct pre-lease EAs for exploration drilling. Either option would further streamline the permitting process during the critical high-risk, low-financing-option early phases of geothermal development.

Fifth, NEPA process timelines can be reduced by combining the environmental analyses for exploration and development drilling through comprehensive POOs or PODs that may only require one EA as opposed to two or more. While the possibility exists for (1) potentially longer up-front analysis, delaying initial exploration efforts and (2) potentially unnecessary expenditures on analyses for prospective GDPs that are never used due to negative exploration results, those time and cost expenditures could be more than offset by the time saved in projects that do indicate positive exploration results.

Finally, NEPA permitting timelines can be reduced by developing EAs or EISs that are more comprehensive than necessary. When a project may only require a defined number of drilling permits initially, developers that compile NEPA documents contemplating additional drilling permits (that may or may not be needed) have been able to realize approval for those additional permits by tiering a DNA of the initial EA or EIS. This practice could also be used for utilization activities, by contemplating more impacts than seemingly necessary in the POU. At a minimum, the data show that the median approval time for a tiered DNA was just less than 30 days, whereas the median approval time for an EA was 302 days.

In conclusion, there are multiple strategies the BLM and developers may incorporate into their geothermal development management and practices that could help to lower NEPA permitting timelines and foster growth in the geothermal industry. Ultimately, developers need to find the best way to balance up-front project capital costs with a contingency-laden timeline. Focusing on improving NEPA efficiencies is one way to achieve this balance.

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Acronyms Used

ATV	All-terrain Vehicle
BLM	Bureau of Land Management
BLMSSS	BLM Special Status Species
BMPs	Best Management Practices
CEQ	Council on Environmental Quality
CU	Casual Use
CUP	Commercial Use Permit
CX	Categorical Exclusion
DNA	Determination of NEPA Adequacy
DOE	Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
GDP	Geothermal Drilling Permit
GTO	Geothermal Technologies Office
LRMP	Land and Resource Management Plan
LUP	Land Use Plan
MT	Magnetotelluric
NEPA	National Environmental Policy Act of 1969
NOI	Notice of Intent
NREL	National Renewable Energy Laboratory
PGEIS	Programmatic Geothermal Leasing EIS
POD	Plan of Development
POO	Plan of Operations
POU	Plan of Utilization
RMP	Resource Management Plan
ROD	Record of Decision
TGH	Thermal Gradient Hole
USFS	United States Forest Service

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43 C.F.R. Subpart 1610 - Resource Management Planning.

43 C.F.R. § 46.215 - Categorical exclusions: Extraordinary circumstances.

43 C.F.R. Part 3200 - Geothermal Resource Leasing.

43 C.F.R. Subparts 3250-52 - "Geothermal Exploration Operations"

43 C.F.R. Subparts 3260-62 - "Geothermal Drilling Operations"

43 C.F.R. Subparts 3270-74 - "Geothermal Utilization Operations"

43 C.F.R. Part 3280 - Geothermal Resources Unit Agreements: Unproven Areas.

[1] A Land Use Plan is a generic term for federal agency planning documents, though specific agencies may have different terms for these plans. The BLM uses the term "Resource Management Plan" or RMP. The USFS uses the term "Land and Resource Management Plan" or LRMP, or "Forest Plan."