

Washington Geothermal Energy Status and Roadmap

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Appendix A: Excerpts from Final Programmatic Environmental Impact Statement, U.S. Bureau of Land Management and U.S. Forest Service

Introduction

Washington has a wide variety of renewable resources including wind, solar, bioenergy, ocean wave, tidal, and geothermal. Geothermal energy can be used for:

- Power production, including clean heat and power (CHP)
- District energy
- Direct uses such as greenhouses
- Ground source heat pumps (GSHP)

Development and use of geothermal energy has been very difficult in Washington, especially for power production/CHP.

Biopower and geothermal are baseload renewable power sources, and as such are especially prized. In the Northwest, they offset natural gas on peak-load conditions and coal at base-load conditions.¹

One megawatt of baseload renewable power or energy efficiency offsets over one million metric tons carbon dioxide equivalent (MMTCO₂e) of coal greenhouse gases.² District energy, direct uses, and ground source heat pumps (GSHPs) can also offset fossil fuel energy.

A state government geothermal consultation was held December 12, 2008, hosted by the Washington State University Extension Energy Program. Staff from the Department of Natural Resources, the Geology and Earth Sciences Division of the Washington Geological Survey, the Department of Community, Trade and Economic Development Energy Policy Division, and the Snohomish County Public Utility District were participants. This meeting provided the organizational and informational basis to develop the current second draft of this document.

For a link to an overview map of Washington geothermal resources, go to www.energy.wsu.edu/projects/renewables/geothermal.cfm.

¹ *Marginal Carbon Dioxide Production Rates of the Northwest Power System* (Northwest Power and Conservation Council, June 2008), www.nwcouncil.org/library/2008/2008-08.pdf

² Page 4, *Carbon Dioxide Emissions from the Generation of Electric Power in the United States* (U.S. Department of Energy and U.S. Environmental Protection Agency, July 2000), www.eia.doe.gov/cneaf/electricity/page/co2_report/co2emiss.pdf

Why Develop a Geothermal Roadmap for Washington?

A number of events have occurred in recent years to give added impetus to geothermal development, including:

- The final federal Programmatic Environmental Impact Statement (EIS) for geothermal was released in October 2008, followed by the signed Record of Decision.³
- Washington Initiative Measure 937 (approved in 2006) requires utilities to develop renewable energy, and geothermal is a baseload renewable energy source. See RCW 19.285.⁴
- Snohomish County PUD is actively pursuing geothermal power development through their Integrated Resource Plan:
<http://www.snopud.com/renewables/Geothermal.ashx?p=3913>.
- There is a growing need to reduce greenhouse gases, and implement climate action plans.⁵
- Technologies such as binary (two stages) and organic rankine cycle (which boosts and uses lower temperature geothermal) have recently been more fully commercialized. Washington has an abundance of low- to mid-temperature geothermal energy.⁶
- Recent higher prices of oil, propane and natural gas have improved the prospects for use of ground source heat pumps and other direct uses.
- Other Northwest states are moving forward with geothermal development. Idaho has its Raft River geothermal field producing power, and Oregon has development projects moving forward.

³ Federal Programmatic Environmental Impact Statement:
www.blm.gov/wo/st/en/prog/energy/geothermal/geothermal_nationwide.html

⁴ RCW 19.285: apps.leg.wa.gov/RCW/default.aspx?cite=19.285

⁵ See *Leading the Way: Implementing Practical Solutions to the Climate Change Challenge* (November 2008): www.ecy.wa.gov/climatechange/2008CATdocs/ltw_app_v2.pdf

⁶ See Washington Geothermal Resources map: www.energy.wsu.edu/documents/renewables/wa.pdf

Scope of Geothermal Roadmap

This geothermal roadmap covers a full range of temperatures and technologies including:

Ambient Temperature (normal ground temperature)

Ambient temperature geothermal can be used with GSHPs for large residential, commercial, and institutional applications. For example, Lake Washington School District's high school uses a GSHP with savings on the order of \$66,000 per year. These systems function best with moist ground contact and are a natural application for schools west of the Cascades. Commercial applications and campus facilities can also use this system.⁷

Low to Moderate Temperature (generally below 212 degrees F)

Low and moderate temperature geothermal has a wide variety of uses including district heating,⁸ direct uses in agriculture (crop and food drying and greenhouses)⁹, and power generation often using a binary and organic rankine cycle (ORC) technologies. Chena Hot Springs, Alaska, uses a binary ORC CHP system to produce 400kW of power using 165 degree F water.¹⁰

Moderate to high temperature (above boiling point)

Moderate to high temperature geothermal uses are also varied, including power production, CHP, district heating and direct use. For example, Empire Energy's Nevada CHP system produces power and dehydrates onions and garlic.¹¹

⁷ *Commercial Geothermal Heat Pumps*, Washington State University Extension Energy Program, 1999: www.energy.wsu.edu/documents/renewables/geo_heat_pumps.pdf

⁸ Geothermal case studies: www.energy.wsu.edu/pubs/default.cfm#geothermal_casestudies

⁹ Geothermal aquaculture operations in Idaho: energy.idaho.gov/renewableenergy/aquaculture.shtml

¹⁰ Chena Hot Springs project: www.chenahotsprings.com/index.php?id=90#c610

¹¹ Empire Energy project: www.energy.wsu.edu/documents/renewables/2GeoHeat%20Bulletin_July04.pdf

Status of Geothermal Energy in Washington

For the past 30 years there have been strong efforts to advance geothermal use and development. A number of very good steps have been taken in recent years, including:

- Renewal of the state's geothermal policy, RCW 43.140.010.¹² It is due for sunset again in 2011.
- Renewal of state government geothermal responsibilities and the state geothermal account (allocation of state share of federal geothermal leases), RCW 43.140.010. This also sunsets in 2011.
- Updating RCW 78.60 to close loopholes in submission to the Washington Department of Natural Resources (DNR) of data from well drilling.¹³
- Restoring the database of Washington geothermal data from very old software.
- District heating and cooling legislation is in place.
- The federal Programmatic EIS for geothermal energy included Mount Baker National Forest. Vulcan Power has pending leases that can now move forward (www.vulcanpower.com).
- The Northwest CHP Application Center (www.chpcenternw.org), a five-state group led by the WSU Extension Energy Program, has a solid understanding of emerging technologies such as ORC.
- In 2005 the Department of Ecology worked with a GSHP stakeholder group to resolve permit issues.
- Making geothermal data available via the "Washington State Geological Information Portal" (Department of Natural Resources, Division of Geology and Earth Resources), www.dnr.wa.gov/ResearchScience/Topics/GeosciencesData/Pages/geology_portal.aspx.
- Updating *Bibliography and Index of Geothermal Resources and Development in Washington State* (Department of Natural Resources, Division of Geology and Earth Resources, March 2009), www.dnr.wa.gov/Publications/ger_ofr2009-2_geothermal_bib.pdf.

¹² RCW 43.140.010: apps.leg.wa.gov/RCW/default.aspx?cite=43.140.010

¹³ See RCW 78.60.200: apps.leg.wa.gov/RCW/default.aspx?cite=78.60.200

Washington Incentives for Geothermal

Washington has no tax incentives for geothermal energy development (power generation or ground source heat pumps). However, a number of utilities have incentives. See Database of State Incentives for Renewables & Efficiency (www.dsireusa.org/index.cfm) and search by technology.

Washington Ground Source Heat Pumps

Washington has a growing ground source heat pump market and an abundance of low temperature geothermal energy (especially in the Columbia Basin). As shown in Table 1, shipments of geothermal heat pumps to Washington State grew by 35% from 2006 to 2007 (as measured by rated capacity in tons):

Table 1. Geothermal Heat Pump Shipments to Washington State*

Year	Rated capacity in tons
2006	2,203
2007	2,980

*From *Geothermal Heat Pump Manufacturing Activities 2007*, Energy Information Administration's annual report¹⁴

Guidance in permitting ground source heat pumps is provided in the report *A Regulatory Guide to Low Temperature Geothermal Development in Washington*¹⁵ (WSU Extension Energy Program, April 2009).

¹⁴ www.eia.doe.gov/cneaf/solar.renewables/page/ghpsurvey/geothermalrpt.pdf

¹⁵ www.energy.wsu.edu/documents/renewables/WA_Regulatory-Guide-for-Low-Temp-Geothermal.pdf

Electrical Power Generation and Capacity for Washington

Washington has had minimal exploration of its geothermal power production potential. Therefore, projected geothermal electrical output is best classified as *educated estimates*. In addition to information provided in the programmatic environmental impact statement (PEIS) discussed below, the Western Governors' Association's *Clean and Diversified Energy Initiative, Geothermal Task Force Report*¹⁶ estimates five sites producing a near-term projection of 50 MW (page 6), with long-term projections of 600 MW for sites at Mount Baker and Wind River (Gifford Pinchot National Forest) in the Cascade Range (page 64). The U.S. Geological Survey (USGS) report *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States*¹⁷ estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Washington during the next 30 years at 23 MW, with a total low-high range of 7 MW to 47 MW (page 4).

Most but not all of the suspected geothermal power generation potential in Washington is found on U.S. Forest Service lands (Mount Baker and Gifford Pinchot National Forests). Both national forests had geothermal exploration leases in the 1970s and early 1980s.

Federal Law

The federal Public Law 109-58, Energy Policy Act of 2005, section 225, Coordination of Geothermal Leasing on Federal Lands, includes the following language:

- (a) IN GENERAL.—Not later than 180 days after the date of enactment of this section, the Secretary of the Interior and the Secretary of Agriculture shall enter into and submit to Congress a memorandum of understanding in accordance with this section, the Geothermal Steam Act of 1970 (as amended by this Act), and other applicable laws, regarding coordination of leasing and permitting for geothermal development of public lands and National Forest System lands under their respective jurisdictions.
- (b) LEASE AND PERMIT APPLICATIONS.—The memorandum of understanding shall—
 - (1) establish an administrative procedure for processing geothermal lease applications, including lines of authority, steps in application processing, and time limits for application procession;
 - (2) establish a 5-year program for geothermal leasing of lands in the National Forest System, and a process for updating that program every 5 years; and
- (3) establish a program for reducing the backlog of geothermal lease application pending on January 1, 2005, by 90 percent within the 5-year period beginning on the date of

¹⁶ www.westgov.org/wga/initiatives/cdeac/Geothermal-full.pdf

¹⁷ pubs.usgs.gov/fs/2008/3082/pdf/fs2008-3082.pdf

enactment of this Act, including, as necessary, by issuing leases, rejecting lease applications for failure to comply with the provisions of the regulations under which they were filed, or determining that an original applicant (or the applicant's assigns, heirs, or estate) is no longer interested in pursuing the lease application.

(c) DATA RETRIEVAL SYSTEM.—The memorandum of understanding shall establish a joint data retrieval system that is capable of tracking lease and permit applications and providing to the applicant information as to their status within the Departments of the Interior and Agriculture, including an estimate of the time required for administrative action.

For additional amendments to the geothermal steam act of 2005 see sections 221 through 237 at www.energy.wsu.edu/ftp-ep/pubs/library/EnergyPolicyAct-PublicLaw109-58.pdf

BLM/USFS Programmatic EIS

The U.S. Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) jointly cooperated to develop a Programmatic Environmental Impact Statement (PEIS) to analyze and expedite the leasing of BLM- and USFS-administered lands with high potential for renewable geothermal resources in 11 Western states and Alaska.

The final PEIS¹⁸ includes information pertinent to the status of geothermal energy in Washington State. The PEIS was followed by a Record of Decision¹⁹ signed by the Bureau of Land Management.

Key information from the PEIS and for Washington is included in Appendix A.

The following tables are extracted from tables in the PEIS Volume One.

Table 2. BLM Public Lands in Washington with Geothermal Potential and Proposed Acreage Closed to Leasing*

District or Field Office	Acres within Planning Area	Proposed Acres Closed	% Remaining Open
Mount Baker	435,461	44,309	89.82%
Wenatchee	152,054	5,976	96.07%

* From PEIS Volume One, Table 2-1

¹⁸ Final PEIS, October 2008, www.blm.gov/wo/st/en/prog/energy/geothermal/geothermal_nationwide/Documents/Final_PEIS.html

¹⁹ Record of Decision, December 2008, www.blm.gov/pgdata/etc/medialib/blm/wo/MINERALS_REALTY_AND_RESOURCE_PROTECTION/_energy/geothermal_eis/final_programmatic.Par.90935.File.dat/ROD_Geothermal_12-17-08.pdf

Table 3. National Forest System Lands in Washington with Geothermal Potential and Areas Legally Closed to Geothermal Leasing*

Location	Acres within Planning Area	Proposed Acres Closed	% Remaining Open
Mt Baker-Snoqualmie National Forest	1,982,319	867,833	56.22%
Gifford Pinchot National Forest	1,420,495	300,565	78.84%

* From PEIS Volume One, Table 2-2

Table 4. Estimated Future Geothermal Electrical Generation Development in Washington*

Location	Estimated Development by 2015 Commercial (MW)	Estimated Development by 2025 Commercial (MW)
Mt Baker-Snoqualmie National Forest	50	100
Gifford Pinchot, Mt. Baker-Snoqualmie, Okanogan-Wenatchee		500

* From PEIS Volume One, Table 2-6

Table 5. Acreage and Percentage of Federally Managed Lands in Washington State as of FY2006*

Total State Acreage	Federal Land Acreage	Percent Land Federally Managed
43,064,000	16,825,000	39.07%

* From PEIS Volume One, Table 3-2

Federal Leasing of U.S. Forest Service Lands

The Record of Decision signed by the Bureau of Land Management in December 2008²⁰ does not apply to U.S. Forest Service (USFS) lands. The USFS can decide to:

- a) Issue a Letter of Consent Decision, or
- b) Issue its own Record of Decision

As of this date (5/25/09), the choice has not been made. The decision rests at the national office level with two units: 1) Minerals and Geology Management; and 2) Ecosystem Management Coordination. At the regional level (Region 6), contact Bob Fujimoto at (503) 808-2430. No USFS lands in Washington State will be available for geothermal leases until action is taken at the national level by the USFS.

²⁰ www.blm.gov/pgdata/etc/medialib/blm/wo/MINERALS_REALTY_AND_RESOURCE_PROTECTION/energy/geothermal_eis/final_programmatic.Par.90935.File.dat/ROD_Geothermal_12-17-08.pdf

Washington State Utility Interest

Washington State's larger utilities are subject to the renewable portfolio standard of Initiative Measure No. 937, and the state requires Integrated Resource Plans (IRP).

The most active utility in the state regarding geothermal energy is Snohomish County PUD.²¹ In Snohomish County PUD's IRP²² the preferred resource plan (table 1-1) includes 30 MW of geothermal in 2016 and 90 in 2020. Action Plan goal number 5 (page 128-129) is as follows:

- 5. Actively pursue development of geothermal power resources in or near Snohomish County with a target commercial operation date of 2014 for the first power plant.**

The Preferred Plan relies heavily on power production from geothermal energy in Snohomish County. Staff will move expeditiously to explore this potential and, assuming promising sites are confirmed, move to project development. The first step will involve obtaining permits and land rights and drilling exploratory wells. Both hydrothermal and EGS technologies will be pursued. A target date of 2014 for commercial operation of the first plant will give the PUD enough lead-time to adjust plans if geothermal resource development brings unexpected challenges.

Snohomish County PUD is pursuing two separate efforts:

1. Work with GeothermEx²³ to develop and implement an exploration plan for developing a hydrothermal resource in Snohomish County. Several sites have been identified. Snohomish County PUD is currently evaluating the best path to obtaining resource rights. They received \$475,750 from the federal 2009 omnibus Appropriations Act to support the exploration activities for this project.
2. They are pursuing development of enhanced geothermal systems (EGS) with AltaRock Energy²⁴. A 2007-2008 study has been conducted to identify sites with high EGS favorability. They are currently seeking funding to move forward.

State Laws and Regulations

Washington classifies geothermal resources capable of generating electricity (no specific temperature is defined) as *sui generis*, meaning it is its own distinct thing (not a mineral

²¹ Snohomish County PUD, www.snopud.com/

²² Snohomish County PUD 2008 IRP: www.snopud.com/Content/External/Documents/IRP808.pdf

²³ www.geothermex.com/

²⁴ www.altarockenergy.com/index.html

or water right). RCW 78.60.040²⁵. Developers must secure ownership or geothermal lease rights. Environmental review is required under Washington's State Environmental Policy Act.

All direct-use geothermal resources are considered to be ground water and regulated as such. The state Department of Ecology is responsible for issuing water rights, well construction permits, and geothermal fluid disposal plans, including underground injections. Ground source heat pump borings (both open and closed) require a Department of Ecology permit. Contact Bill Lum at 360.407.6648 or e-mail at blum461@ecy.wa.gov. Developers must also secure their water right from the Department of Ecology. For further, detail see *A Regulatory Guide to Geothermal Direct Use Development*.²⁶

Roadmap of Next Steps

Following is a topical list of initial next steps to develop geothermal energy, with notations of responsible parties in italics²⁷:

Explore and Characterize Geothermal Geology (entire temperature range)

Geothermal exploration and characterization is one of the top needs for developing geothermal energy in Washington. Exploratory drilling is expensive and risky. Little focused work has been done. However, upgrading data from existing wells and hot springs can be improved for modest cost.

- Support and seek funding (from federal sources - USGS and DOE) for geothermal exploration, especially in our youngest rhyolitic (silicic) intrusive rock - *DNR*
- Improve data and its availability from existing wells/water systems, update hot springs data, sample fluids analysis, and obtain data from the Department of Ecology (low cost) per RCW 78.60.200 and 210 – *DNR, Ecology*
- Develop a fault map of Washington that will guide exploration for geothermal energy - *DNR*
- Encourage utility and private sector geothermal exploration – *DNR, WSU Extension Energy Program and CTED Energy Policy Division*
- Further develop and expand the state's geothermal database in an accessible GIS package – *DNR*
- Further understand seismicity concerns in relation to geothermal energy - *DNR*

²⁵ apps.leg.wa.gov/RCW/default.aspx?cite=78.60.040

²⁶ www.energy.wsu.edu/documents/renewables/WA_Regulatory-Guide-_for_Low_Temp_Geothermal.pdf

²⁷ Washington state agencies/utilities and their acronyms include: Department of Natural Resources (DNR), Department of Ecology (Ecology), Department of Community, Trade and Economic Development (CTED), Washington State University Extension Energy Program (WSU Energy Program), Snohomish County PUD (SnoPUD).

- Complete a state lands geothermal programmatic EIS. This EIS will gateway the issuance of geothermal leases on state lands as required in RCW 79.13.530²⁸ – *DNR, SnoPUD, WSU Extension Energy Program, CTED*

Geothermal Leases and Permitting

- Encourage and support the issuance of federal geothermal exploration leases – *WSU Extension Energy Program, DNR, CTED, SnoPUD, geothermal developers*
- Washington Geothermal Account – Ensure the state share of federal geothermal lease funds are deposited into this account. See RCW 43.140²⁹ – *WSU Extension Energy Program in cooperation with the State Treasurer*
- Create an improved permitting process for geothermal well exploration per RCW 78.60³⁰ – *DNR, SnoPUD, WSU Extension Energy Program, Washington Office of Regulatory Assistance*
- Further understand the relationship of geothermal energy “borrowing and then returning to the ground” the water in contrast to the consumptive use embedded in water rights

Geothermal Economics (organized by technology)

- Develop cost comparisons between the range of geothermal technologies, and with other energy technologies – *WSU Extension Energy Program*

Geothermal Program Development

- Seek long-term program funding opportunities – *All*
- Encourage universities, colleges, state and local governments to use geothermal energy in buildings – *CTED, WSU, SnoPUD, DNR*
- Actively support and provide technical assistance to utilities that wish to develop geothermal energy - *All*
- Upgrade the geothermal resources of the WSU Energy Program Library – *WSU Extension Energy Program*

Geothermal Policy

- Develop a Geothermal Vision document (a short document presenting the opportunities) – *WSU Extension Energy Program, DNR, CTED*
- Develop a “Washington Geothermal Energy Status and Roadmap” – *WSU Extension Energy Program, DNR, CTED, SnoPUD, stakeholders*

²⁸ apps.leg.wa.gov/RCW/default.aspx?cite=79.13.530

²⁹ apps.leg.wa.gov/RCW/default.aspx?cite=43.140

³⁰ apps.leg.wa.gov/RCW/default.aspx?cite=78.60

- Identify existing geothermal tax incentives (state and federal). Examine if other incentives should be established. – *CTED, SnoPUD, WSU Extension Energy Program, DNR*
- Include geothermal energy in the transition team Energy and Climate Report to Peter Goldmark, Commissioner of Public Lands – *WSU Extension Energy Program – Completed January 2009*
- Support passage of SSB 5149 Geothermal Resources – *All*

Legal, Institutional and Regulatory

- Develop a comprehensive report of Washington state geothermal laws and regulations – *WSU Extension Energy Program, DNR*
- Update *Regulatory Guide to Low Temperature Geothermal Development in Washington* – *WSU Extension Energy Program — Completed April 2009*

Washington Geothermal Team and Collaborative

- Develop a state/university geothermal work group with regular meetings to maintain momentum. This team would engage in policy, program and technical issues and support – *WSU Extension Energy Program, DNR, CTED, Ecology, SnoPUD*
- Develop a broader Washington Geothermal Collaborative to include a broad range of stakeholders – *Washington Geothermal Team supports.*

Trade Associations and National Collaboratives

- Re-establish relationships with the DOE Geothermal Program and national trade associations, including the Geothermal Energy association (GEA), Geothermal Resources Council (GRC) and the International Ground Source Heat Pump Association (IGSHPA) – *WSU Extension Energy Program*

Conclusion

Geothermal energy development and use needs to move forward in the state of Washington. This roadmap outlines a number of steps that can and should be made. Some steps are of relatively low cost and others such as exploration drilling are much more expensive.

Washington does not have a mature understanding of its geothermal resource base. Other states have a much better understanding of their geology, which enables them to develop their geothermal resources. As a consequence, decisions can be made without realizing the impact on geothermal opportunities.

Appendix A

Excerpts from Final Programmatic Environmental Impact
Statement
U.S. Bureau of Land Management and
U.S. Forest Service

Executive Summary, page ES-1

The BLM has the delegated authority to issue geothermal leases on federal mineral estate, such as that underlying lands administered by the FS. A geothermal lease is for the earth's heat resource where there is federal mineral estate. The BLM currently (at the end of fiscal year 2007) administers approximately 480 geothermal leases that covered over 700,000 acres. Of those, 57 are producing geothermal energy, 54 are for electrical generation and three for direct use (BLM 2008b). Leasing geothermal resources by the BLM vests with the lessee a non-exclusive right to future exploration and an exclusive right to produce and use the geothermal resources within the lease area subject to existing laws, regulations, formal orders, and the terms, conditions, and stipulations in or attached to the lease form or included as conditions of approval in permits. Lease issuance alone does not authorize any ground disturbing activities to explore for or develop geothermal resources without site specific approval for the intended operation. Such approval could include additional environmental reviews and permits.

Executive Summary, page ES-2

To achieve this, the BLM and FS are proposing to do the following:

1. Identify public and NFS lands with geothermal potential as being legally open or closed to leasing.
2. Issue or deny geothermal lease applications pending as of January 1, 2005.

Under the proposal, the BLM would also do the following:

3. Identify public lands that are administratively closed or open to leasing, and under what conditions.
4. Develop a comprehensive list of stipulations, best management practices, and procedures to serve as consistent guidance for future geothermal leasing and development on public and NFS lands.
5. Amend BLM land use plans to adopt the resource allocations, stipulations, best management practices, and procedures.

Executive Summary, pages ES-3 and ES-4 (underlining added for emphasis)

The project area is defined as the 12 western states, including Alaska. The planning area is defined as the 530 million acres within the 12 western states that have the potential for geothermal resources. The planning area includes BLM- and FS-administered surface lands with minerals under federal ownership that have geothermal potential and the subsurface federal geothermal mineral estate on other lands. Surface lands administered by other federal agencies, such as the National Park Service and US DOI, Fish and Wildlife Service (USFWS), and state agencies are not assessed in this document unless their administrative boundaries overlap with public or NFS lands. If these lands have subsurface

federal geothermal mineral estate, the BLM would apply the management direction provided in this PEIS, with the surface management agency's consent, for lease nominations or applications. Lands that are not administered by the BLM or FS, or that are closed to geothermal leasing by statute are not part of the analysis, including National Park System lands.

Executive Summary, pages ES-2 and ES-3

The purpose of the proposed action is threefold:

1. To complete processing active pending geothermal lease applications and nominations by deciding whether, and under what stipulations, to issue geothermal leases on NFS and BLM administered lands.
2. To amend BLM land use plans to allocate BLM-administered lands with geothermal resource potential as closed, open, or open with major or moderate constraints to geothermal leasing. This includes establishing a projected new level of potential geothermal development with existing planning level decisions, termed reasonably foreseeable development (RFD) scenario, and identifying appropriate stipulations, best management practices, and procedures to protect other resource values and uses while providing sufficient pre-leasing analysis to enable the BLM to make future competitive geothermal leasing availability decisions.
3. To provide suitability information to the FS to facilitate its subsequent consent decision to the BLM for leasing on NFS lands. Provide environmental analysis to assist future NFS land use decisions by providing possible land use allocations and stipulations for geothermal leasing.

Executive Summary, page ES-5

Alternative B: Proposed Action (Preferred Alternative)

Approximately 117 million acres of BLM administered public land would be allocated as open and 75 million acres of NSF land would be legally open to geothermal leasing for direct and indirect use subject to existing laws, regulations, formal orders, stipulations attached to the lease form, and the terms and conditions of the standard lease form. The authorized officer retains the discretion to issue leases with stipulations that impose moderate to major constraints on use of surface of any leases in order to mitigate the impacts to other land uses or resources objectives as defined in the guiding resource management plan. The 118 million acres of public land and 79 million acres of NFS land that would be open to geothermal leasing under the Proposed Action represent about 80 percent of public lands and NFS lands within the planning area. The remaining 25 million acres of BLM administered public land and 24 million acres of NFS lands in the planning area would be closed to geothermal leasing. The closed areas encompass non-discretionary and discretionary (BLM only) determinations, including the statutorily closed Island Park Geothermal Area. Island Park encompasses over 470,000 acres of NFS and public lands around the west and southwest boundary

of Yellowstone National Park for the explicit purpose of protecting the geothermal features of the Park. The BLM would amend 122 land use plans to adopt the allocations, RFDs, and specific stipulations, best management practices, and procedures. Based on the analysis contained in the PEIS and public comments on the Draft PEIS, the BLM has selected Alternative B as the Preferred Alternative.

Executive Summary, page E-6

REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

An RFD for commercial electrical generation and direct use was developed to serve as a basis for analyzing environmental impacts resulting from future leasing and development of federal geothermal resources within the western US over the next 20 years. It is estimated that within the planning area there are 5,540 megawatts (MW) of geothermal potential considered viable for commercial electrical generation by 2015, with a further 6,660 to 6,670 MW being forecast by 2025. This capacity is expected to be realized through approximately 110 additional power plants by 2015, and a further 132 more power plants by 2025. Using these values, it is estimated that the average viable capacity at any particular site is 50 MW by 2025. Most of the development would likely occur in northern Nevada, California, and Idaho, with the least amount in Wyoming and Montana.

Chapter 1, page 1-1

1.1 INTRODUCTION

The goal of this project is to make geothermal leasing decisions on pending lease applications submitted prior to January 1, 2005 and to facilitate geothermal leasing decisions on other existing and future lease applications and nominations. Geothermal resources are abundant in the western United States (US) and have high potential for providing reliable base demand electrical generation and “direct use” heating applications. ...

Chapter 1, page 1-2

Under the proposal, the BLM and FS would do the following:

- (1) Identify public and NFS lands with geothermal potential as being legally open or closed to leasing.
- (2) Issue or deny geothermal lease applications pending as of January 1, 2005.

Under the proposal, the BLM would also do the following:

- (3) Identify public lands that are administratively closed or open, and under what conditions.

- (4) Develop a comprehensive list of stipulations, best management practices, and procedures to serve as consistent guidance for future geothermal leasing and development on public and NFS lands.
- (5) Amend BLM land use plans to adopt the resource allocations, stipulations, best management practices, and procedures.

Chapter 1, page 1-2

PURPOSE OF THE ACTION

The purpose of the proposed action is threefold:

1. To complete processing active pending geothermal lease applications and nominations by deciding whether, and under what stipulations, to issue geothermal leases on NFS and public lands.
2. To amend BLM land use plans to allocate BLM-administered lands with geothermal resource potential as closed, open, or open with major or moderate constraints to geothermal leasing. This includes establishing a projected new level of potential geothermal development with existing planning level decisions (termed reasonably foreseeable development scenario), and identifying appropriate stipulations, best management practices, and procedures to protect other resource values and uses while providing sufficient pre-leasing analysis to enable the BLM to make future competitive geothermal leasing availability decisions.
3. To provide suitable information to the FS to facilitate its subsequent consent decision to the BLM for leasing on NFS lands. Provide environmental analysis to assist future National Forest land use decisions by providing possible land use allocations and stipulations for geothermal leasing.

Chapter 1, page 1-3

NEED FOR THE ACTION

There are three needs for the Federal action:

1. To issue decisions on pending lease applications in accordance with the EAct of 2005. Specifically, Section 225 requires that the Secretary of Interior and Secretary of Agriculture establish a program for reducing by 90 percent the backlog of geothermal lease applications that were pending as of January 1, 2005. The EAct of 2005 mandates that action be taken by August 8, 2010.
2. To address other provisions of the EAct of 2005 (Sections 211 and 222[d][1]); respond to other policy directives calling for clean and renewable energy (see Section 1.8 Renewable Energy Policies); and to meet the increasing energy demands of the nation while reducing reliance on foreign energy imports, reducing greenhouse gas emissions, and improving national security.

3. To facilitate geothermal resource leasing in an environmentally responsible manner to help meet the increasing interest in geothermal energy development on public and NFS lands in the western US (EPA Act Section 211).

Chapter 2, page 2-1

INTRODUCTION

This chapter provides the details of the proposed action, alternatives to the proposed action, a discussion of alternatives considered but eliminated from detailed analysis, and an overview of the reasonably foreseeable development (RFD) scenario for geothermal resources in the western US.

Chapter 2, page 2-1 and pages 2-6 – 2-7

2.2 PROPOSED ACTION

The BLM and FS are proposing to facilitate geothermal leasing on BLM administered public lands and NFS lands that have geothermal potential in the twelve western states, including Alaska. This would be accomplished by the following four specific actions:

- Identify public and NFS lands with geothermal potential as being open or closed to leasing;
- Provide a comprehensive list of stipulations, best management practices, and procedures to serve as consistent guidance for future geothermal leasing and development;
- Amend BLM Resource Management Plans (RMPs) to adopt the RFDs, resource allocations and list of stipulations, best management practices, and procedures; and
- Make decisions to issue or deny geothermal lease applications on BLM and NFS lands pending as of January 1, 2005.

2.2.1 Identify Lands for Leasing

Under this proposed action, all lands in the 12 western states with geothermal potential and administered by the BLM and FS would be identified as being open to geothermal leasing with possible moderate to major constraints or closed to leasing. In the Record of Decision the BLM would amend the appropriate RMPs for these allocations. Figures 2-1 and 2-2 show the BLM Field Office boundaries within the geothermal potential area and Figures 2-3 and 2-4 show National Forests.

The BLM and FS have determined that certain lands within the planning area are excluded from geothermal leasing on the basis of existing laws, regulations (see 43 CFR 3201.11), and Executive Orders. These non-discretionary closures include the following lands administered by the BLM and FS:

- National Monuments.
- National Conservation Areas (NCA) and similar designations with the exception of King Range NCA and Steese NCA.
- Wilderness Areas and National Wilderness Areas.
- Wilderness Study Areas.
- Lands within areas allocated for wilderness or further planning in Executive Communication 1504, Ninety-Sixth Congress (House Document 96-119), unless such lands are allocated to uses other than wilderness by a land and resource management plan or are released to uses other than wilderness by an act of Congress.
- National Recreation Areas.
- Designated Wild Rivers under the Wild and Scenic River Act.
- The Island Park Geothermal Area (includes NFS lands in Idaho and Montana).
- Withdrawn lands under Section 17(d)(1) of the Alaska Native Claims Settlement Act.¹

As discussed in Chapter 1, there are other lands administered by other Federal agencies that are closed to leasing, including lands managed as part of the National Wildlife Refuge System (16 USC 668 [dd]) and lands within units of the National Park System. Prior to making a leasing decision on lands in proximity to a National Park System unit, the BLM or FS must determine if there would be any impacts to thermal or hydrological features within the unit, in accordance with the Geothermal Steam Act Amendments (30 USC Section 1026).

In addition to non-discretionary closures, the BLM and FS have the administrative authority to issue discretionary closures to protect special resource values. BLM and FS have had a great deal more experience managing lands for development of oil and gas resources, and many more management plans address these resources. Development of oil and gas resources result in many of the same kinds of impacts as development of geothermal resources (e.g., surface disturbance resulting from the footprints of facilities, wells, pads and pipelines, as described in Section 2.5, Reasonably Foreseeable Development Scenario); therefore, BLM and FS have determined that it is appropriate to take an approach to development of geothermal resources similar to that taken to development of oil and gas resources. Areas that require protection from the effects of development of fluid resources are more likely to require protection from the similar effects of development of geothermal resources. Because of this, the BLM has

determined that, for ACEC's the management approach to development of oil and gas resources may appropriately serve as a surrogate for development of geothermal resources, absent more explicit geothermal-specific treatment. The following areas are proposed BLM discretionary closures for geothermal leasing; the Forest Service is not proposing to amend any land use plans to make such administrative decisions as part of the Proposed Action (see Section 1.11.1 Decisions on the Programmatic Analysis).