Memo on Permits for Geothermal District Heating Project

Before we start the permitting process at the state or local level during Phase 2, it will be important for us to begin discussing our projects at a local level to educate the public on the project and more broadly on geothermal energy, geothermal district heating, and how these compare/contrast to geothermal heat pump applications and oil and gas production. Marian Higgins' PhD research (TAMU, December 2015) in Matagorda County, Texas, observed that geothermal energy development was received more favorably if the local community understood the expectations and had an opportunity to ask questions and discuss concerns (Figure 1). There are currently only geothermal heat pumps in use in New York, Pennsylvania and West Virginia. These three States do not yet have established laws on the geothermal mineral right for larger projects such as geothermal district heating or electrical generation from a geothermal reservoir that utilizes former and gas fields. Therefore, an effort to establish and lead grassroots discussions to educate the public about higher temperature geothermal consumption, and include the concerns about drilling, injection, building codes, etc. will be necessary in order to alleviate the potential for negative campaigns as is occurring related to hydraulic fracturing. This effort will be part of the effort of the Phase 2 permitting team's time and expenses.

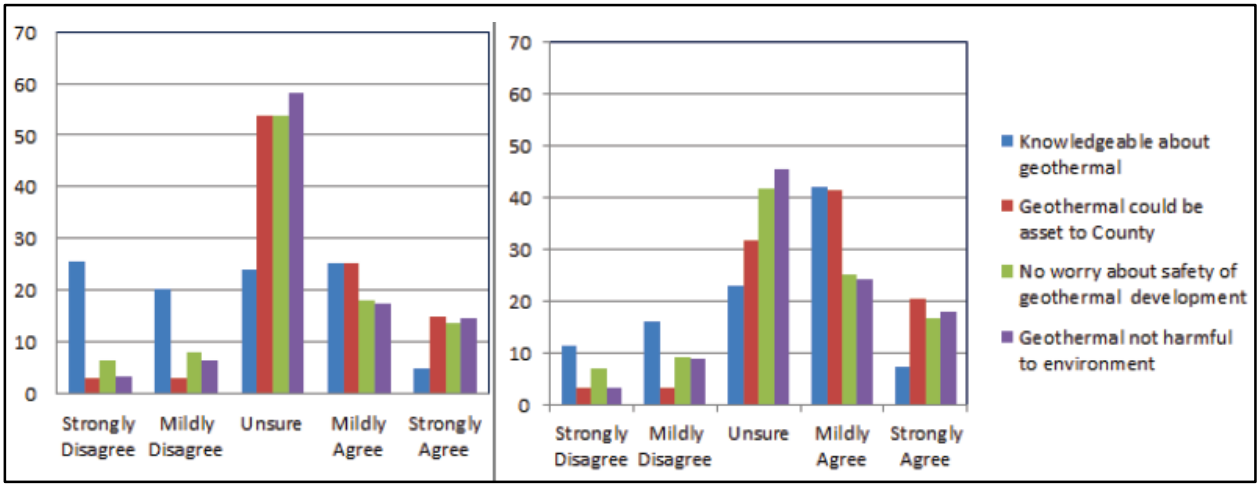

Figure 1. Charts showing the opinions of citizens in Matagorda County, Texas at *beginning* and *end* of grassroots effort to educate them on possible geothermal projects (Higgins, SMU Power Plays Conference, 2015).

During Phase 2 of this project, a combination of Federal, State and Local permits will be required for any new wells we plan to drill. Permits are also required for performing tests of an existing well. Local contractors with existing permits for entering an oil/gas well will be hired to perform these tests, thus reducing the permitting timeline, and reducing out-of-pocket expenses for permits.

Additional permits will be necessary during Phase 3 of the project. When we are working on a site to convert it over to geothermal district heating, there will be building and plumbing permits required. The

owner of the property will most likely be the entity who applies for these related permits. Being aware of all the permits required from start to end of a project, regardless of who is responsible for their submission, will be important to keep the development on a tight timeline for us to complete it within the timeframe of the DOE allocations.

This memo reviews the permitting process starting with the Federal Government permits and then outlines the permits for each of the three States. There are many overlapping requirements between the Federal and State permits. Considerable work will be needed to keep track of all the different forms and requirements, along with the timelines and fees associated with each permit.

Federal Permits

Geothermal projects may be subject to the following Federal Laws:

- National Environmental Policy Act (NEPA)
- Clean Air Act of 1970
- Clean Water Act of 1987
- Endangered Species Act
- National Historic Preservation Act.

We are expecting to have to hire a specialist to complete reconnaissance of the National Environmental Policy Act (NEPA) documentation. Other Federal policies to be reviewed are the Clean Water Act of 1987, Endangered Species Act, and National Historic Preservation Act.

Pursuant to the Geothermal Steam Act of 1970 (Title 30 U.S.C. Chapter 23), as amended, the Bureau of Land Management (BLM), an agency of the U.S. Department of the Interior, leases federal lands and reviews permit applications for geothermal development on those lands. The U.S. Forest Service, an agency of the U.S. Department of Agriculture, manages federal public lands in national forests and grasslands. Allegany National Forest in PA and the Monongahela National Forest in WV fall within our study area but these are not expected to have the required heat demand for a project in the near future. The Federally owned land within the NY, PA, and WV Appalachian Basin vicinity are typically related to military bases (Figure 2). There are many of them, but the total land holdings by the federal government is small.

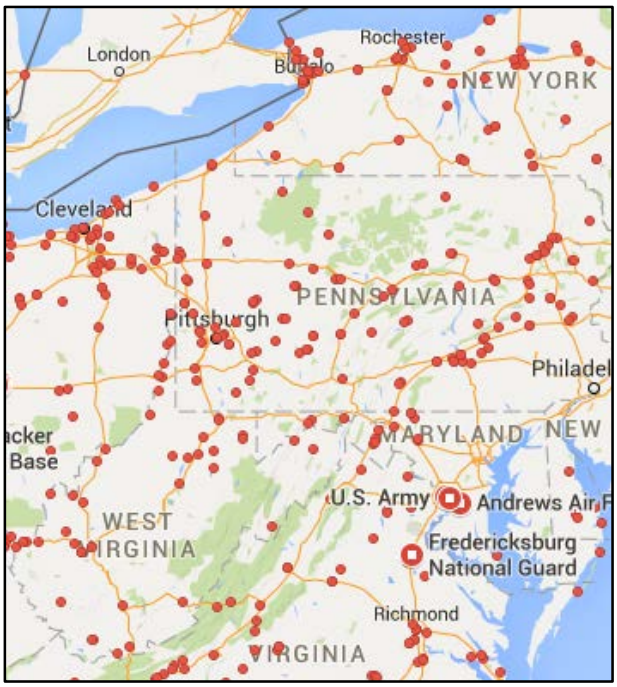

Figure 2. The US Federal Land sites for military facilities in New York, Pennsylvania and West Virginia shown as red dots.

Federal law, however, does not preempt state water laws and even on Federal land, all state laws must be met. The exact steps that are required to permit a geothermal resource vary depending upon where it is located and the land use at the time of development. Generally the steps can be summarized as follows:

- Gain access to lands.
- Contact local and state agencies to determine the requirements for local land use laws including zoning, land use, and building permits.
- Contact federal agencies, if required.
- Secure water rights, if applicable.
- Secure mineral rights as needed.
- Prepare environmental review as required by the National Environmental Policy Act or state environmental laws.
- Obtain well construction permit.
- Drill exploration wells.
- Identify the composition of the resource, which may affect the level of environmental impacts, waste disposal, etc.
- Determine fluid disposal plan and obtain permits for underground injection or surface disposal.
- Contact state agricultural department or state fish and wildlife agency if developing an aquaculture project.
- Drill production and injection wells.
- Drill monitoring wells if required.

As geothermal projects involve many notification forms, permits, and licenses to be submitted, the process can take months to a year to get all approvals required. There is the OpenEI website for some

Western US States that is helpful for us to understand the potential Federal requirements for geothermal sites in the Appalachian Basin (http://en.openei.org/wiki/RAPID/Geothermal).

There are fees for Federal Land Permits. According to the 2012 documentation by Witherbee et al. (2013) the fees will be approximately $1500 (Table 1).

According to the Flowchart for the Geothermal Development Process completed in 2012 by the Regulatory Roadmap Committee, it can take three to five years for all the exploration and permitting processes to be completed. The goal of this project is to speed up this timeline by working with private individual/corporation/federal sites where they own both land surface and mineral rights and are capable of using the produced heated fluids.

Table 1. BLM Fees for Processing Geothermal and Oil and Gas Documents and Applications on BLM and USFS lands as of 2012 (Witherbee et al., 2013).

Geothermal and Oil and Gas Application / Document[2]	FY 13
Geothermal Drilling Permit (GDP) – *Geothermal only*	$0
Application for Permit to Drill (APD) – *Oil and Gas only*	$6,500
Noncompetitive lease application (From #)	$390
Competitive lease application	$150
Assignment and transfer of record title or operating right	$85
Name change, corporate merger or transfer to heir/devisee	$205
Lease consolidation	$430
Lease reinstatement	$75
Nomination of land – *Geothermal only*	$110
Plus per acre nomination fee – *Geothermal only*	$0.11
Site license application – *Geothermal only*	$60
Assignment or transfer of site license – *Geothermal only*	$60

[1] 43 CFR § 3200.12

[2] Note: with the exception of drilling permit fees, most other fees are the same for geothermal as for oil and gas.

Native American Lands

As Sovereign Nations, tribes have inherent authority over their land. Their approval must be obtained to use or lease tribal resources, e.g., land, water, and minerals. Tribes are not subject to state regulation; they can negotiate with state and local governmental agencies. Permitting for a project on Indian land may take different paths and will be through the Tribal Agency and the Department of Interior.

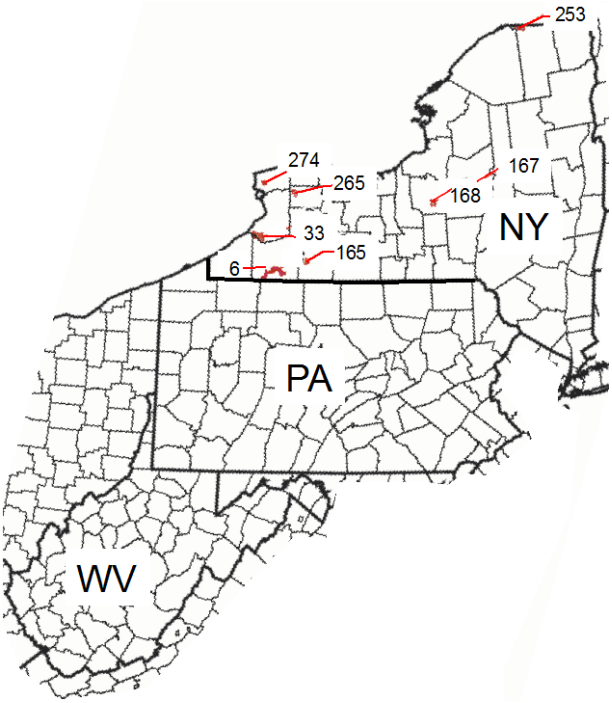

Figure 3. Map of Native American reservations in the study area and adjacent states, also showing county boundaries. New York has 8 federally recognized reservations, whereas West Virginia and Pennsylvania have none. Tribal lands codes: 6 – Allegany; 33 – Cattaraugus; 165 – Oil Springs; 167 – Oneida; 168 – Onondaga; 253 – St. Regis; 265 –Tonawando; 274 – Tuscarora.

State Permits and Licenses

The following are examples of types of permits and licenses a geothermal developer may have to obtain from the state:

- Conditional use
- Exploration
- Well construction and drilling
- Water rights
- Air emissions
- Fluid disposal
- Building construction
- Power facility
- Hazardous waste disposal
- License for direct uses
- Endangered species.

Permits for Geothermal in Local Communities

In addition to state agencies, a developer must also contact local and county agencies to determine the licenses and permits they may require. Relevant local and county agencies include:

- Local land use boards
- Local planning commissions
- Zoning boards
- County boards of commissioners

- Local sewer and water districts
- Regional boards, e.g., air pollution and water control districts.

New York Geothermal Permitting

In New York State, geothermal wells deeper than 500 feet are permitted in the same manner as oil and gas wells. There are required permits for water withdrawal for sites producing more than 100,000 gpd. There is also a permit for brine injection wells following the US EPA regulations.

The permitting authority is the New York Division of Mineral Resources within the Department of Environmental Conservation.

NYSDEC
Division of Mineral Resources
625 Broadway
3rd Floor
Albany NY 12233-6500
518-402-8056
oilgas@dec.ny.gov

The DEC website is very helpful. The main site for oil and gas is http://www.dec.ny.gov/energy/205.html

There are links from there to all the other information and forms required.

Drilling Permit

Application for drilling can be made through an onsite paper form or online submission if outside the area. The application consists of the following steps:

1) Oil and Gas Organization Report - to be notarized, submitted and approved before the permit application is submitted.
    a. This report includes: contact information, person(s) responsible for correspondence, and type of well drilled (geothermal is listed as a choice).

2) Financial Security documents – there is a worksheet to calculate the amount. You can chose between A. Bond, B. Cash, C. Escrow account, D. Irrevocable letter of credit, E. Certificate of Deposit

3) Drilling Permit application form and the following:
    - three copies of a plat (i.e. a survey map)
    - three copies of a map of the proposed spacing unit (for geothermal there will be at least two wells)
    - Affirmation of Acreage Control and Rights in Target Formation
    - the proposed drilling program (note there are casing requirements)
    - fee: examples 4000 ft = $1620, 6000 ft = $2380, 8000 ft = $3140
    - Division of Mineral Resources' well permitting Environmental Assessment Form

- Includes information about the physical setting of the proposed project, the general character of the land and land use, the size of the area disturbed and the length of time the drilling rig will be on the site. The applicant must also describe the procedures that will be used to construct the access road, supply water for drilling, contain and dispose of wastes and how to reclaim the site.
- Note: Drilling must be performed by a drilling contractor registered with the NY Division of Mineral Resources.
- Note: The operations must be commenced within the 180 day permit period.

Drilling Permit Fees

As stated above, fees are based on well depth (eg. 4000 ft. = $1620, 6000 ft. = $2380, 8000 ft. = $3140).

Water Withdrawal Permits

The forms for Water Withdrawal Permits are found on the DEC website - http://www.dec.ny.gov/lands/94327.html. Applications for "New Permits" are submitted to the Division of Environmental Permits in the DEC region where the water extraction will be located. Projects expected to produce at least 100,000 gpd are required to submit a permit.

Injection Well Permits

A well permit is required from the Division of Mineral Resources for any brine disposal well deeper than 500 feet. Also a Class IID Underground Injection Control permit must be obtained from the Region II Office of the USEPA before operating any well for brine disposal. EPA staff review proposed operations with respect to protection of groundwater aquifers. Parameters reviewed by the EPA may include well construction and plugging plans, proposed injection rate and pressure, injectate composition, and proposed injectate and groundwater monitoring plans. The EPA contact for New York permits is:

Ms. Nicole Foley Kraft
USEPA Ground Water Compliance Section
290 Broadway, 20th Floor
New York, NY 10007-1866
(212) 637-3093 Fax: (212) 637-3953

County/City Building Permits

There is a State of New York 2010 Building Codes and Energy Code that all buildings must meet. Depending on the county size and city size, there may be local building permits. For example, the city of Ithaca, NY requires a building permit if changes occur to building plumbing. The usual permitting process approval/rejection timeframe for Ithaca is 30 days. Whereas, the county of Steuben has a planning office that will provide technical assistance to local municipalities in land use planning and regulation, economic development and environmental protection. If there are not specific requirement for permits related to construction, buildings, drilling, etc., then zoning requirements will need to be followed along with all the state codes.

Pennsylvania Geothermal Permitting

Pennsylvania Department of Environmental Protection (PADEP) is the agency overseeing the permitting of the Oil and Gas Industry. As there are no established mineral rights for geothermal energy in Pennsylvania, our project well depth falls most closely within the permits of this agency.

Oil and gas exploration is regulated under the state's oil and gas laws (Oil and Gas Act, Coal and Gas Resource Coordination Act, and Oil and Gas Conservation Law) and the environmental protection laws that include the Clean Streams Law, the Dam Safety and Encroachments Act, the Solid Waste Management Act, the Water Resources Planning Act and the Community Right to Know Act. As we develop a geothermal district heating system, the wells drilled for production and injection will be regulated under these laws.
http://www.portal.state.pa.us/portal/server.pt/community/laws%2C_regulations___guidelines/20306

Drilling Permit

With so many permits required, Pennsylvania has an online tool to help determine which type of permits, bonds, licenses are needed. It is called the Permit Application Consultation Tool (PACT) http://www.ahs.dep.pa.gov/PACT/. There is a Pre-Application Conference with PADEP to discuss and verify project results and permit coordination.

Once the required specific documentation is determined, we will find them in the Permit/Authorization Packages in the e-Library. Forms and information for the Oil and Gas Industry can be found at http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8294.

Tracking the progress of permits through Pennsylvania's Environment Facility Application Compliance Tracking System (eFACTS) is possible through the website http://www.ahs.dep.pa.gov/eFACTSWeb/default.aspx. It is also possible to receive updates from PADEP's Electronic Notification System (eNOTICE). This will be helpful for confirming the project permits are staying on the designated timeframe.

Note – In Pennsylvania there is a lot of underground coal mining so this is something they look at closely when a permit is submitted.

During Phase 1 of this project, our team has held two meetings with the Pennsylvania Department of Conservation and Natural Resources (PADCNR) to discuss their existing well data and to update them on our results. We plan on working with them throughout the permitting process as they provide valuable input and can help liaise with PADEP. In the most recent meeting in August 2015, PADCNR were especially interested in working with us to find locations we could develop for geothermal district heating. The permitting process with their assistance will take time, but is expected to have a workable solution to fit the considerations of geothermal drilling into the oil and gas regulations.

Drilling Permit Fees

Fees are calculated using drill depth. For example, 5000 feet = $650, 10,000 feet = $1650

Water Withdrawal Permits

In general, there is no comprehensive legal or institutional approach to water use in Pennsylvania. The Department of Environmental Protection Bureau of Water Supply Management grants allocation permits to public water systems that use surface water. We will contact this agency to see if they require a permit for our project.

Reinjection Wells

In Pennsylvania, deep injection wells or brine disposal wells are regulated by the Environmental Protection Agency through the Underground Injection Control Program (UIC). The US EPA took over the task of permits, inspections and enforcement from state regulators in 1985.

County/City Building Permits

Pennsylvania has a statewide building code, the Uniform Construction Code (UCC), which falls under the Department of Labor and Industry. The UCC is administered and enforced locally and at the state level. Municipalities within PA can opt-in or opt-out. The status of municipalities is available from http://www.portal.state.pa.us/portal/server.pt?open=514&objID=553835&mode=2.

As we move into Phase 2 of the Play Fairway Analysis Project and narrow down the locations of most interest for development in Phase 3, the city/county required permits and codes can be determined.

West Virginia Geothermal Permitting

In West Virginia, geothermal wells are not yet established as a specific category. There are no legislative rulings on how geothermal projects will be classified or how the royalties associated with extracting geothermal fluids from the ground will be linked with the mineral rights owner or the surface owner. To get around this potential barrier of no legislative predetermination of geothermal rights, the focus for West Virginia will look to locations where the surface and mineral right owner is the same entity and there is a large enough tract of land to contain both the production and injection wells.

Drilling Permit

The depth of the wells we are anticipating to drill for this project are similar to those in the oil and gas industry. Therefore as a starting place the permits for drilling and exploration fall within the West Virginia Department of Environmental Quality Office of Oil and Gas. The details for permitting can be found through their website http://www.dep.wv.gov/oil-and-gas/Pages/default.aspx.

West Virginia has many documents rather than a combined few to submit. A check list for all the filings required is provided (see list below). For a new well, the requirements include the same items as New York, with the addition of surface and royalty owner signatures needed and a worker's comp plan established.

Table of West Virginia Check List of forms to submit for Permitting a well.

_____ WW-2B
_____ WW-2B signed off by inspector
_____ WW-2A
_____ Certified Mail Receipts or affidavit of personal service
_____ Surface Owner Waiver
_____ Coal Owner/Lessee/Operator Waiver
_____ WW-2A (1) including page and book and royalty percentage
_____ WW-2B (1) (If sources to be tested –names, addresses and location on topo listed as water testing)
_____ WW-9 (page 1 and 2)
_____ Inspector Signature on WW-9
_____ Reclamation Plan
_____ Mylar Plat
_____ Topography Map of the proposed location

_____ Database for Coal Depths, Permits, Boundaries
_____ Bond Agreements
_____ A check for $650.00 shallow well, $900.00 Deep well
_____ Workers Comp/Employ/Registered with the SOS.

Drilling Permit Fees

As stated above, fees are based on well depth with a fee of $650.00 for shallow wells (wells drilled and completed in a formation above the top of the uppermost member of the "Onondaga Group"), and $900.00 for deep wells (wells drilled and completed in a formation at or below the top of the uppermost member of the "Onondaga Group").

Water Withdrawal Permits

There are permits for withdrawal of water from surface streams, lakes, etc. and drinking water aquifers, that our project will not fall under. The brine fluids expected to be produced in this district heating project will be from formations deeper than potable water sources.

Reinjection Wells

There is a permit for a geothermal reinjection well under the code for the UIC Industrial Commercial Septic Application. This is expected to be only for geothermal heat pumps and not for the larger district heating project brine injection wells. There is also a permit for brine injection wells with a set of permits to submit through the Office of Oil and Gas, which has developed a comprehensive permit package to assist in the preparation of a UIC permit application. Our geothermal district heating project will be under the category of WV Code 1479 Solution Mining wells (3S) that includes recovery of geothermal energy to produce electric power from geothermal injection wells. Although not generating power from the well fluids, the size and flow rates for the wells are more closely tied to electric generation than geothermal heat pumps. For a detailed description and required forms see the document: Underground Injection Control (UIC) Permit Application Package Class 2 & 3. The application fee of $550.00 is submitted with the completed documentation to:

West Virginia Department of Environmental Protection
Office of Oil and Gas
Underground Injection Control (UIC)
601 57th Street, SE
Charleston, WV 25304
http://www.dep.wv.gov/oil-and-gas/GI/Forms/Documents/UIC%20APPLICATION%20PACKAGE%2006-25-2014.pdf

There is a form for Oil and Gas companies injecting more than 300,000 gallons of water to hydrofrac a well. They are concerned about the flowback and thus disposal of that water. The water produced in this project will be contained within the pipes and be injected properly into a permitted injection well.

County/City Building Permits

The State of West Virginia follows the 2012 International Building Code, 2012 International Plumbing Code, and the 2009 International Energy Conservation Code. Depending on the county size and city size, there may be additional local building permits and fees. For example, the county of Kanawha does not require any additional permits related to construction, buildings, drilling, etc., but it does have the Kanawha County Commission Department of Planning and Development with additional requirements for oil and gas well drilling pertaining to floodplains. The Kanawha County Health Department has an

Environmental Division, which oversees water (typically well or surface water), who are an example of a group to contact as part of the effort for grassroots education on geothermal development. For locations with no specific requirement for additional permits then we will need to be follow all the state codes.

References

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