**About Sets of Analysis Files and Data Files that Document Subsurface Temperatures and Porosity Near Ithaca, NY**

**for “Feasibility of Direct District Heating for the Cornell Campus Utilizing Deep Geothermal Energy”**

 **Tier 2 Submission**

**DE-EE0008103, Earth Source Heat: A Cascaded Systems Approach to DDU of Geothermal Energy on the Cornell Campus**

The purpose of this document is to describe the contents contained within a submission to the Geothermal Data Repository (GDR) node of the National Geothermal Data System (NGDS) in support of Earth Source Heat: A Cascaded Systems Approach to DDU of Geothermal Energy on the Cornell Campus.

**Abstract**: Cornell completed a comprehensive evaluation of the potential for Earth Source Heat (ESH), Cornell’s specific application of Deep Direct Use (DDU) geothermal energy, to create viable heat energy for its Ithaca, NY campus district heating system. The study included assessment of the natural rock properties within and surrounding two potential reservoirs, with the objectives of estimating the temperature, heat transfer properties, density, and porosity of those rocks and the fluids that they contain under natural subsurface conditions. The data needed for that assessment were gleaned from state-maintained records from oil, gas, and geothermal exploration, and studies of deep groundwater in central and western New York State and north-central Pennsylvania. Thereafter, the study involved the use of numerical and analytical geothermal reservoir models that coupled thermal and hydraulic equations to describe fluid moving through a solid rock matrix while exchanging heat. Two fluid-rock interaction scenarios were modeled: a scenario of flow through an interconnected network of pore spaces, and flow through fractures. With these models and the gathered uncertainty in their geologic and thermal parameters, the range of values of delivery of heat to the surface that could be achieved by operation of a two-well geothermal production system was explored. The comparative heat production capacities, the probable life spans of useful heat extraction, and the uncertainties involved for each of the two reservoirs are reported.

**Keywords:** Cornell University, direct-use heating, Appalachian Basin, New York, low-temperature geothermal, reservoir temperature, reservoir porosity, reservoir simulation, techno-economic analysis, uncertainty analysis

**Contents of Submission:**

**Main Folder:** CornellDDU-subsurface\_data

**Contents:**

**1. File:** brine composition density compilation.xlsx

This .xlsx files lists locations in New York State and Pennsylvania for which there exist published reports on the major element compositions of subsurface brines.

**2. File:** wells used for porosity density log data simple.xlsx

This .xlsx file lists the unique API identifier numbers, names, and locations of the set of wells accessed from the New York State “ESOGIS” database (Empire State Organized Geologic Information System, <https://esogis.nysm.nysed.gov>) that are used to estimate the effective porosity in the targeted geological reservoirs. The file lists the distance of each well from the Cornell University campus in Ithaca, NY, and the deepest geological unit for which the well log data are available.

**3. File:** ESH well tops ESH for reservoir property analyses.xlsx

This file .xlsx file lists the unique API identifier numbers, names, and location coordinates (latitude/longitude) and surface measurement datum (feet above sea level) of the set of borehole accessed from the New York State “ESOGIS” database (Empire State Organized Geologic Information System, <https://esogis.nysm.nysed.gov>) that are used to estimate the depths of specific geological units whose properties are deemed important for simulating reservoir behavior. For each borehole, the file describes the depth to identified geological formations in successive order from shallow to deep parts of the borehole. For boreholes that deviated from vertical, both a drillers reported depth (MD, in feet) and a True Vertical Depth (TVD, feet) are listed. The units were identified as explained in Al Aswad (2019, Cornell thesis).

**4. File:** ESH well tops to estimate Cornell tops.xlsx

This file .xlsx file lists the unique API identifier numbers, names, and location coordinates (latitude/longitude) and surface measurement datum (feet above sea level) of the set of borehole accessed from the New York State “ESOGIS” database (Empire State Organized Geologic Information System, <https://esogis.nysm.nysed.gov>) that are used to estimate the depths below Cornell University, Ithaca, NY, at which specific geological units will be found. For each borehole, the file describes the depth to identified geological formations in successive order from shallow to deep parts of the borehole. For boreholes that deviated from vertical, both a drillers reported depth (MD, in feet) and a True Vertical Depth (TVD, feet) are listed. The units were identified as explained in Al Aswad (2019, Cornell thesis).

**5. Files:** effective porosity data 6 wells used for reservoir model

a. 31109227890000+EPOR0+1.csv

b. 31109227890000+EPOR6+2.csv

c. 31109227890000+EPOR12+3.csv

d. 31109227890000+EPOR0+1.csv

e. 31109227890000+EPOR6+2.csv

f. 31109227890000+EPOR12+3.csv

g. 31109227670000+EPOR0+1.csv

h. 31109227670000+EPOR6+2.csv

i. 31109227670000+EPOR12+3.csv

j. 31101216240000+EPOR0+1.csv

k. 31101216240000+EPOR6+2.csv

l. 31101216240000+EPOR12+3.csv

m. 31099204460000+EPOR0+1.csv

n. 31099204460000+EPOR6+2.csv

o. 31099204460000+EPOR12+3.csv

p. 31011161200000+EPOR0+1.csv

q. 31011161200000+EPOR6+2.csv

r. 31011161200000+EPOR12+3.csv

s. ReadMe file

Files in this folder contain input data used to calculate, and results for, effective porosity of the geological rock intervals evaluated in the reservoir simulations.

File name structure: Well API + Porosity Type #Shale Neutron Porosity Percentage + File Indicator

The Well API numbers are found in the well tops and locations spreadsheets.

The porosity type EPOR, effective porosity

The shale neutron porosity was either 0, 6, or 12, corresponding to 0, 6, or 12% (this is described in further detail in J. Smith (2019) pg. 255-257.

The file indicator ranges from 1 – 3, and each well has exactly one of each indicator. All of the 1s correspond to the same type of file, all the 2s the same type, etc.

**References:**

Al Aswad, J. A. A., 2019, A Stratigraphic and Petrophysical Study of In-situ Geothermal Reservoir Quality of the Cambro-Ordovician Strata in the Subsurface at Cornell University, Ithaca, New York: MS thesis, Cornell University, Ithaca, NY USA, p. 172.

Smith, J. D., 2019, Exploratory spatial data analysis and uncertainty propagation for geothermal resource assessment and reservoir models: PhD thesis, Cornell University, Ithaca, NY USA, p. 255.