Dear Quadrennial Energy Review Task Force,

The Geothermal Energy Association (GEA) would like to thank the QER task force for undertaking this initiative. GEA has participated in this review over the past few years and appreciates the continuing opportunity to share our opinion. Our main objective would be to remind this task force (1) about the opportunities and barriers in relation to the energy infrastructure for geothermal power and (2) help identify areas where geothermal power can mitigate threats, reduce risks, and create opportunities for U.S. energy and climate security. Specifically, these comments will address how geothermal energy can support energy transmission and distribution.

GEA is a trade association composed of over 100 U.S. companies who support the expanded use of geothermal energy and develop geothermal resources worldwide for electrical power generation and direct-heat uses. Our companies vary widely from small business to multimillion dollar Independent Power Producers.

According to the United States Geological Survey the United States has over 30 GW of geothermal power resources spread across all 11 western states, Alaska, and Hawaii.[1] When counting Enhanced Geothermal Systems (EGS) , which are expected to be economical within the next 10 to 15 years, that number can reach up to 100 GW and include states in the mid-Atlantic, northeast and Midwest.[2] Another important feature of EGS is its capability to provide both electricity and heat on a continuous basis without a need for storage as it is deployed in regions where demand was high.

In addition to generating electricity and providing heat for the nation, U.S. companies are exporters of the technology and engineering services that support the Administration's export initiatives. U.S. companies are some of the leading world experts in geothermal resource development. GEA's member companies already export goods and engineering services to Eastern Africa, Guatemala, Mexico, Indonesia, Philippines, Japan, Turkey, the Caribbean, and others, thereby increasing U.S. energy and economic security and bringing capital back to the United States.

When building a geothermal power plant in the U.S., well placed transmission is critical to geothermal power's success. Unlike other energy sources that can be built near existing transmission infrastructure, geothermal resources are constrained by their location. In order for a typical 50-MW geothermal project to be economical a viable transmission grid interconnection point must be within 20–30 km of the plant depending on local conditions. The good news is according to the Energy Information Administration geothermal power has one of the highest capacity factors (92%) of any energy technology.[3] As a result geothermal power will use that existing transmission capacity most efficiently. Other resources with lower capacity factors may still need to consume the entirety of the same transmission line even though they may seldom use the full capacity of that line. As a result, existing transmission capacity becomes unavailable to other generators. Geothermal power on the other hand will almost fully use the transmission capacity that it reserves from that same line requiring less transmission infrastructure to be built to transport the same amount of electricity.

Since transmission infrastructure planned today will effect geothermal resources development for the coming decades, it's important that areas with geothermal resources are considered during today's

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[1] "Assessment of Moderate- and High-Temperature Geothermal Resources of the United States", United State Geological Survey
[2] "The Future of Geothermal Energy: An Interdisciplinary MIT Study", Massachusetts Institute of Technology
[3] "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2014", Energy Information Administration

transmission planning proceedings. While not a comprehensive list by any means, some key counties in the U.S. that contain geothermal resources are listed below. Local governments and transmission operators will need to be aware of the resources in their communities when planning for and constructing transmission networks.

Yukon-Koyukuk Census Area, Alaska
Nome Census Area, Alaska
Greenlee County, Arizona
Imperial County, California
Modoc County California
Siskiyou County, California
Sonoma County, California
Chafee County, Colorado
Pitkin County, Colorado
Adams County, Idaho
Boise County, Idaho
Cassia County, Idaho
Custer County, Idaho
Franklin County, Idaho
Fremont County, Idaho
Idaho County, Idaho
Lemhi County, Idaho
Lewis and Clark County, Montana
Sandoval County, New Mexico
Churchill County Nevada
Elko County, Nevada
Esmeralda County, Nevada
Eureka County, Nevada
Humboldt County, Nevada
Lander County, Nevada
Mineral County, Nevada
Nye County, Nevada
Pershing County, Nevada
Washoe County, Nevada
Deschutes County, Oregon
Harney County, Oregon
Klamath County, Oregon
Lake County, Oregon
Lane County, Oregon
Malheur County, Oregon
Beaver County, Utah
Iron County, Utah
Juab County, Utah
Millard County, Utah
Whatcom County, Washington

Once developed, geothermal resources provide a number of values to the electrical grid that help mitigate security threats, reduce environmental risks from climate change, and create opportunities for U.S. energy and climate security.

- Geothermal power is a reliable, economical, and clean option to provide baseload power for the growing U.S. power system. Retirement of emission-heavy coal plants will provide opportunities for more environmentally-friendly geothermal power plants. Among energy sources which are suitable for baseload production, geothermal power represents arguably the smallest carbon footprint. Binary geothermal power units have significantly lower CO_2 emissions than most if not all energy technologies.

- Despite previous misconceptions geothermal power can be engineered to operate in a flexible mode that can quickly adapt to uncertainties in the U.S. power system. These flexible solutions include a range of service including, but not limited to, baseload, regulation, load following or energy imbalance, spinning reserve, non-spinning reserve, and replacement or supplemental reserve. Binary geothermal power plants can ramp up and down very quickly, multiple times per day to a minimum of 10% of nominal power and up to 100% of nominal output power. The normal ramp rate for a geothermal Organic Rankine Cycle turbine is 15% of nominal power per minute.

- Geothermal power has a very small land usage compared to other energy sources, particularly when weighed against other renewables. Unlike solar, wind, and biomass sources, which are predicated upon gathering diffuse ambient energy over large tracts of land, geothermal exploits a concentrated, subterranean resource. This plant design equates to less planetary surface area needed to produce comparable levels of power.

A recent paper estimates the intensity of land use associated with various energy sources based on the anticipated state of technology in the year 2030. Assuming 8,766 hours in a year, Geothermal power's estimated usage of 66 km^2/GW is better than coal (85), solar thermal (134), natural gas (163), solar voltaic (323), petroleum (392), hydropower (473), wind (632), and biomass (4,760).[4]

- Geothermal power's established history of consistent output demonstrates a level of reliability unmatched by other renewables and fossil fuel based generation. For example, geothermal power plants have demonstrated a unique resilience to natural disasters. During the recent typhoon in the Philippines the geothermal power plants were clustered on one of the hardest hit islands of Leyte. Of the five plants located on the island two were able to place power back onto the grid within two weeks.[5]

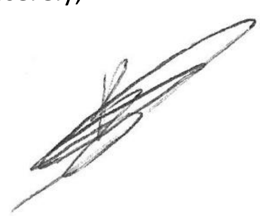
For more information on the potential for Enhanced Geothermal Systems potential please read "The Future of Geothermal Energy" published in 2006 by Massachusetts Institute of Technology.

For more information on the values and benefits of geothermal power when compared to other technologies please read "The Values of Geothermal Energy: A Discussion of the Benefits Geothermal Power Provides to the Future U.S. Power System" published in October of 2013 by Geothermal Energy Association.

For more information of the potential for conventional geothermal power resources in the U.S. see "Assessment of Moderate- and High-Temperature Geothermal Resources of the United States" published in 2008 by the United States Geological Survey.

For more information on the key and necessary ingredients to develop a geothermal power project read the "Best Practices for Geothermal Power Risk Reduction Workshop Follow-Up Manual" published by Geothermal Energy Associations and the U.S. State Department in July of 2014.

Sincerely,



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[4] "Energy Sprawl or Energy Efficiency: Climate Policy Impacts on Natural Habitat for the United States of America", PLOS.
[5] "Can Certain Geothermal Technologies Better Withstand Climate Change than Others?", Renewable Energy World.