A Case for Geothermal Heat Pumps' Contribution to Renewable Portfolio Standards

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Much confusion surrounds how geothermal heating and cooling differs from geothermal electricity generation. Both forms have the capacity to reduce reliance on non-renewable, carbon-emitting energy sources by using thermal energy created and stored within the earth. Geothermal heat pumps (GHPs), which make use of underground pipes filled with water that exchanges temperatures, tout extreme efficiency and actually reduce the amount of electricity needed to maintain atmospheric comfort levels in a building. Considering current electricity prices, Oak Ridge National Lab estimates that the widespread use of ground source heat pumps would represent savings between $33 and $38 billion in retail utility bills within the United States, which exceeds current renewable energy contributions from solar photovoltaic, wind and geothermal power combined.

By transferring a combination of stored solar energy and geothermal energy that is manifested as a constant temperature just below the earth's surface, GHPs reduce energy consumption and correlated air pollution emissions up to 44% compared to air-source heat pumps and up to 72% compared to electric resistance heating with standard air-conditioning equipment. With 400% operating efficiencies in mind, it is hard to deny that GHPs are a sensible and ecologically advanced alternative to traditional HVAC methods. Combined with a desuperheater, GHPs can also serve as a water heater that does not require additional energy to operate, and—unlike natural gas furnaces—the magic that contributes to GHPs' reduced electricity reliance is replenished daily.

Essentially, geothermal heat pumps bypass the need to produce power by using a natural means to heat and cool. Oddly enough, though, GHPs are overlooked by many states' Renewable Portfolio Standards (RPS), which are put into effect to increase renewable energy production. Only eight out of 32 states that require or recommend that utilities produce energy from renewable sources and/or promote efficient technologies list geothermal heat pumps as qualifying devices. Some would argue that the reason for this is because GHPs do not generate power, yet most RPSs only address renewable energy—not renewable power or renewable electricity. Heat is energy, and heat in the earth's crust is renewable. Ergo, the heat that we are transferring to and from the earth is indeed renewable energy. This renewable energy can be used to reduce household and building-wide energy usage by 60%, thus decreasing demand for electricity that may otherwise be produced using sources that are unsustainable and polluting.

Federal and state organizations alike define geothermal heat pumps as using energy that is renewable. The EPA cites GHPs as a form of energy production that has been evaluated for use on formerly contaminated sites, including abandoned coalmines. The U.S. Department of Energy recognizes GHPs as a means of using renewable energy and allocates funding for GHP project through the State Energy Program, which provides grants to states and their energy offices. The DOE's National Renewable Energy Laboratory sets

States with RPS Goals including GHPs

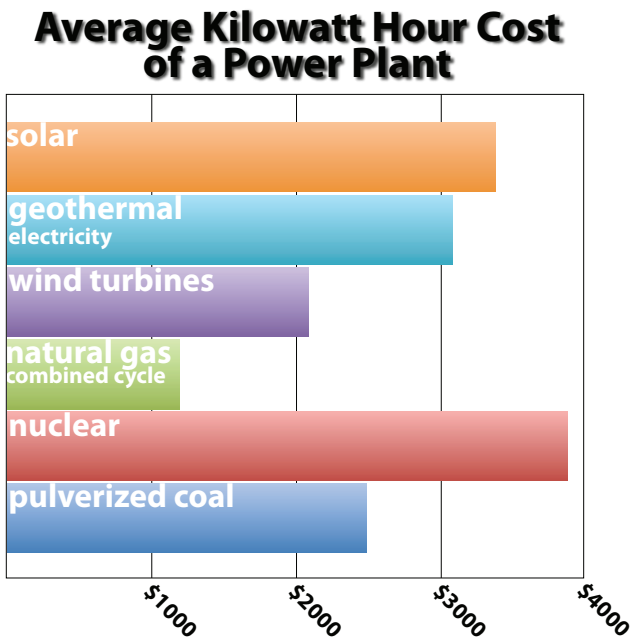
	% of Renewable Sources	Goal Year
Arizona	15%	2025
Nevada	25%	2025
Texas	5,880 MW	2015
Wisconsin	10%	2015
Michigan	10%	2015
Pennsylvania	8%	2020
North Carolina	13%	2021
Hawaii	20%	2020

Source: dsireusa.org

guidelines for policymakers looking to increase the deployment of geothermal energy for heating and cooling purposes. Furthermore, GHPs are recognized under the Business Investment Tax Credit, among other federal incentives provided for the installation of energy efficient and renewable energy technologies—including a 100% MACRS 1st year depreciation Investment Tax Credit. Propoert Assessed Clean Energy With all of the recognized "green" benefits associated with GHPs, it is hard to fathom a reason that they are not encouraged by state legislators who are clearly trying to ramp up dependency on renewable energy—yet some states' governing bodies do not credit GHPs as a renewable resource under RPS standards. A glaring example of the inconsistency is present in the state of California; the California Energy Commission includes GHPs in the "Renewable Energy" section of its website, but it is not counted towards the state's 33% by 2020 RPS goal.

One might infer that energy production is more easily measured in terms of power generation, thus making RPS credits easier to calculate. Most people don't realize that the "renewable energy" component of geothermal heat pumps can also be directly quantified by placing an energy meter (or "heat meter" as they are sometimes referred to in Europe) on the heat pump or pumps – calculating the energy placed into or extracted from the earth loop – and then subtracting out the electricity required to power the heat pump. On average, this "renewable energy component" that is extracted from the earth is 4 to 5 times (COP of 4 or 5) greater than the energy used. The energy meter can also be put on the bore field, but the diversity of the building would reduce the energy recorded by as much as to 30%. Additionally, energy savings could easily be compared against other HVAC system's energy use for an appropriate baseline and contribution towards green energy goals. GHPs, after all, reduce demand for electricity, which eliminates the need for manufacturing additional equipment for large-scale facilities—a feat that can require nonrenewable materials and added maintenance despite the source of renewable generation (i.e., wind turbines, solar PV panels, geothermal steam turbines, etc.). It must be noted, though, that this argument isn't for reducing the capacity to produce electricity from renewable sources; it is merely advocating a decrease in the overall demand for electricity through the use of RPSs.

In some cases, GHPs can make use of renewable resources where other technologies cannot. For example, GHPs work year-round in parts of the United States that do not receive as much wind or sunlight. Where land is scarce, vertical-loop systems can be hidden beneath buildings, conserving space and remaining unobtrusive. As far as RPS requirements go, utilities could easily incentivize GHPs or pursue a loop-ownership program to meet states' yearly goals of renewable reliance.



Electricity generation from renewable sources does have its place in reducing—and even eliminating—carbon emissions, especially when combined with GHP systems. GHPs allow higher-cost renewable generation to power homes with lower electricity demands, thus making it easier and more cost-effective to develop net-zero buildings. Net-zero infrastructure seems to be the eventual goal of Renewable Portfolio Standards—why not make this goal easier to achieve by encouraging the incorporation of geothermal heat pumps into building retrofits and new construction? In terms of legal definitions, a reevaluation of GHPs as a renewable energy source is in order to ensure a reduced demand for electricity and increased use of renewable energy sources.

Existing legislation or executive orders do not need to be amended—a simple addendum will do the trick: "The renewable energy transferred from the earth by geothermal heat pumps shall be included in the calculation to meet the State's renewable energy portfolio requirements." Semantics aside, GHPs are a realistic solution for a permanent transition to clean energy sources.