Municipal Geothermal Energy System

Updated March 2018

Updates include new resubmission requirements and action name - This action used to be called Geothermal Energy and was under the Innovation & Demonstration Projects category

Geothermal technologies draw upon the energy stored in the earth for heating or electrical production. In New Jersey, low to moderate temperature geothermal resources are available and are primarily suitable for heating applications. Closed-loop ground-source heat pumps are the most widely applicable geothermal technology and can be installed in most types of locations. These geothermal heat pumps take advantage of the relatively constant temperature (50-60°F) of the earth's surface layer as a heat source in winter and a heat sink in summer. Water circulates through wells to reach this moderate temperature, requiring less energy from electricity, gas, or oil for heating and cooling.

Because of the long-term reduction in energy purchases, investing in a geothermal heat pump often produces a significant net cost savings. Geothermal heat pumps reduce fossil fuel emissions while providing a comfortable indoor environment. This technology can be retrofitted to an existing structure or incorporated to new construction.

Why is it important?

Geothermal systems reduce energy costs. A geothermal heat pump requires 25% to 70% less energy than a conventional heating system, generating substantial long-term savings on energy purchases.1

Geothermal systems reduce carbon footprints. Reductions in purchases of energy from fossil fuels lower the municipality's contributions to greenhouse gas emissions and reduce the local carbon footprint.

Geothermal heat pumps offer superior performance. Compared to conventional HVAC, geothermal systems require less interior building space, are less likely to require rooftop equipment, are easier to maintain, require less maintenance and last longer. They also offer the advantages of flexible, zone-specific space conditioning and consistent humidity levels.

A demonstration geothermal system is an educational resource. A demonstration project can raise local awareness about geothermal heating and encourage the spread of this technology. Complementary educational and outreach programming can involve businesses, homeowners and schoolchildren.

Geothermal technology is also viable for homeowners and businesses. A typical geothermal heat pump system for homeowners costs about $25,000, can be installed in as little as two weeks, and will generate paybacks in about 8-12 years.2 Rebate programs and federal tax credits make this investment even more affordable.

Who should lead and be involved with this action?

The Department of Public Works and/or the Engineering Department should lead and be involved in implementing this tool.

Timeframe

The time frame for this action is 6 months and up.

At least six months are required for site planning and contractor bidding. Installation can be completed in as little as several weeks. Significantly more lead time may be necessary to secure financing.

Project costs and resource needs

Pricing for a geothermal heat pump varies widely depending on the building size and system design. Compared to conventional HVAC systems, geothermal heat pumps have lower lifetime costs but require a larger initial investment. In well-conceived systems, the higher price for installation will be recovered through long-term savings on energy purchases and maintenance costs. Grants or utility company rebates are often available to offset the installation costs. See the "How to" section for an outline of financing options.

What to do, and how to do it ("How to")

Below we have listed the requirements for earning points for this action.

1) As long as the geothermal system is currently in use for the year in which you are applying for certification, the installation may have been completed at any time to be eligible for points.

2) The geothermal heat pump or another geothermal technology must be installed at a new or existing municipal facility. The municipal government must be significantly involved in the implementation of the project, and the installation must be completed. Outreach must be performed to educate the community about the installation.

We have provided extensive guidance and recommendations for implementing the action. You do not need to follow this guidance exactly as long as your final product meets the requirements.

Appoint a staff member to coordinate the initial planning for a geothermal system. NJ SmartStart Buildings (see resource section) and the local electric utility should be contacted for planning and technical assistance. Engineering consultants may be hired for system design and contractors will be needed for installation.

Site Selection: Determine potential locations for geothermal systems. Consider any plan for new construction as an excellent opportunity to incorporate geothermal technology into the building design. A geothermal heat pump can also be retrofitted to almost any existing structure.

FINANCING:

Refer to the Sustainable Jersey action to "Inventory and Audit All Buildings" for a description of how to enroll municipal facilities in New Jersey Clean Energy Programs including the Local Government Energy Audit, Direct Install, and Pay for Performance programs. These Clean Energy Programs can provide funding for whole-building energy improvements, which could include the installation of geothermal systems.

NJ SmartStart Buildings, also one of the Clean Energy Programs, offers an equipment incentive for Ground Source Heat Pumps of $450-750 per ton. See the resources section for a link to program details.

Financial assistance may be available from the local electric utility.

As an alternative to the traditional option of funding energy efficiency projects from the municipality’s capital budget, New Jersey recently passed legislation to enable Energy Savings Improvement Programs (ESIPs). ESIPs allow municipalities to undertake facility upgrades with minimal up front expenditures. A geothermal system could be included as part of a whole-

10 Points
building energy upgrade. The ESIP framework offers two mechanisms to finance building improvements through energy savings obligations: (1) refunding bonds or (2) a lease-purchase agreement. Using either mechanism, the municipality does not pay the installation costs up front but instead budgets the energy savings to pay off the bond debt or to make lease payments. Under an ESIP, the upgrade process can be managed directly by municipal staff or through an Energy Service Company (ESCO). See the resources section for a link to ESIP details.

Also refer to the energy efficiency financing information from Energy Star (in the resources section) which provides an overview of innovative financing methods.

**Design and Construction:** Design of the geothermal system can be provided by municipal engineers or engineering consultants. For new construction, direct the project architects to plan for a geothermal system. Issue bid specifications to area contractors, order system components, and schedule construction. The International Ground Source Heat Pump Association (see resources section) provides a directory of design and installation professionals.

**Outreach and Educational Programming:** Use the geothermal system as an opportunity to educate the community about energy efficiency and publicize the municipality’s investment in lower energy costs and reduced carbon emissions. Initiatives might include:

- Educational signage in the facility.
- Geothermal technology included in local school curricula.
- Tours, lectures, or training workshops about geothermal technology.
- Project profile and geothermal resources for local homeowners and businesses on the municipality’s website.
- Geothermal heat pump brochures for homeowners or businesses.
- Profile of the geothermal system in newsletter for residents.
- Outreach partnerships with local geothermal technology design and installation professionals.
- Incorporate geothermal technology into a green job training program.

**What to submit to earn points for this action**

In order to earn points, your submission must meet the following standards:

1. As long as the geothermal system is currently in use for the year in which you are applying for certification, the installation may have been completed at any time to be eligible for points.
2. The geothermal heat pump or another geothermal technology must be installed at a new or existing municipal facility. The municipal government must be significantly involved in the implementation of the project, and the installation must be completed. Outreach must be performed to educate the community about the installation.

Submit the following documentation to verify the action was completed to the above standards. (Log in to the password protected webpage where you submit your online application for certification to write in the text box and upload documents).

1. In the text box, please provide a short narrative (300 word max) to summarize what was accomplished and the general steps taken to accomplish it.
- Upload: Project documentation that may include project scopes and paid contracts.
- Upload: Documentation of an outreach initiative that was conducted.

**Resubmission Requirements**

To resubmit for points under this action, please provide documentation that the installation is still operational for the year in which you are applying for certification.

Documentation may include recent equipment maintenance invoices from within 12 months of the June submission deadline or a signed statement by an authorized municipal official that the system is still operational as designed.

**Approved Action Expiration Date**

Approved actions will be set to expire 5 years from the date of the installation OR if resubmitting for this action, the date of the equipment maintenance invoices or signed statement from a municipal official the system is still operational.

**IMPORTANT NOTES:** You can upload up to six separate documents for each action. Please excerpt relevant information from large documents. Please remember that your submissions will be viewable by the public as part of your certified report.

**Spotlight: What NJ municipalities are doing**

**WEST WINDSOR TOWNSHIP**

When constructing a new middle school in the 1990s, the Board of Education decided to include a cutting-edge geothermal HVAC system which continues to serve as a model of operational efficiency by delivering heating and cooling while operating with less adverse environmental impact and operational maintenance than any comparably-sized conventional HVAC system. While the Board of Education of West Windsor Township had the final authority, this project was aided by inputs from various levels of the West Windsor Township government: The West Windsor Planning Board held a public hearing (September 4, 1996) and provided a “courtesy review” of the plans for the Thomas Grover Middle School. The West Windsor Health Department provided formal review and oversight of all well-drilling activities related to the project, and the Construction Department reviewed all engineering and building plans and inspected all phases of the actual construction process for this project. Additionally, the Township hosted two community outreach events to educate citizens about geothermal systems. Please see West Windsor’s certified report for details.

**Resources**

**Funding Resources:**

New Jersey SmartStart Buildings

“Presentation: Introducing Energy Savings Improvement Programs”

New Jersey Division of Local Government Services

“Local Finance Notice: Implementing an Energy Savings Improvement Program”

New Jersey Division of Local Government Services http://www.njcleanenergy.com/ESIP

Energy Star

Education/Training Resources:

- National Renewable Energy Lab
- U.S. Department of Energy
  - Geothermal Technologies Program [http://www1.eere.energy.gov/geothermal/heatpumps.html]

Case Studies:

- Atlantic County Utilities Authority Geo Building [http://www.acua.com/acua/content.aspx?id=498&ekmensel=c580fa7b_20_88_birlnk]
- General Resources on Geothermal Technology:
  - Geo-Heat Center [http://www.oit.edu/orec/geo-heat-center]
  - International Ground Source Heat Pump Association [http://www.igshpa.okstate.edu/]

1 Geothermal Heat Pump Consortium; https://www.geoexchange.org/consumer-resources/common-questions/