Parsippany-Troy Hills

Sustainable Jersey Certification
Parsippany Green Team (PGT)

Library Education Series – January

Geothermal Ground Source Heat Pumps (GSHP)

1/19/2021

The mission of the Parsippany Green Team is to collaborate with our residents, town government and business community to identify and implement programs that improve our quality of life and the physical, environmental and financial sustainability of our community.

Sustainable Jersey Certification Requirements

Diversified efforts across multiple categories

PARSIPPANY GREEN TEAM

SUSTAINABLE JERSEY • CERTIFIED • A Better Tomorrow, One Community at a Time

2021 goal!

Bronze Certification Requirements:

- Establishment of **mandatory green team**
- Implement 2 of 12 priority actions
- Complete actions in 6 of 18 categories
- Total of at least 150 points

2022 goal!

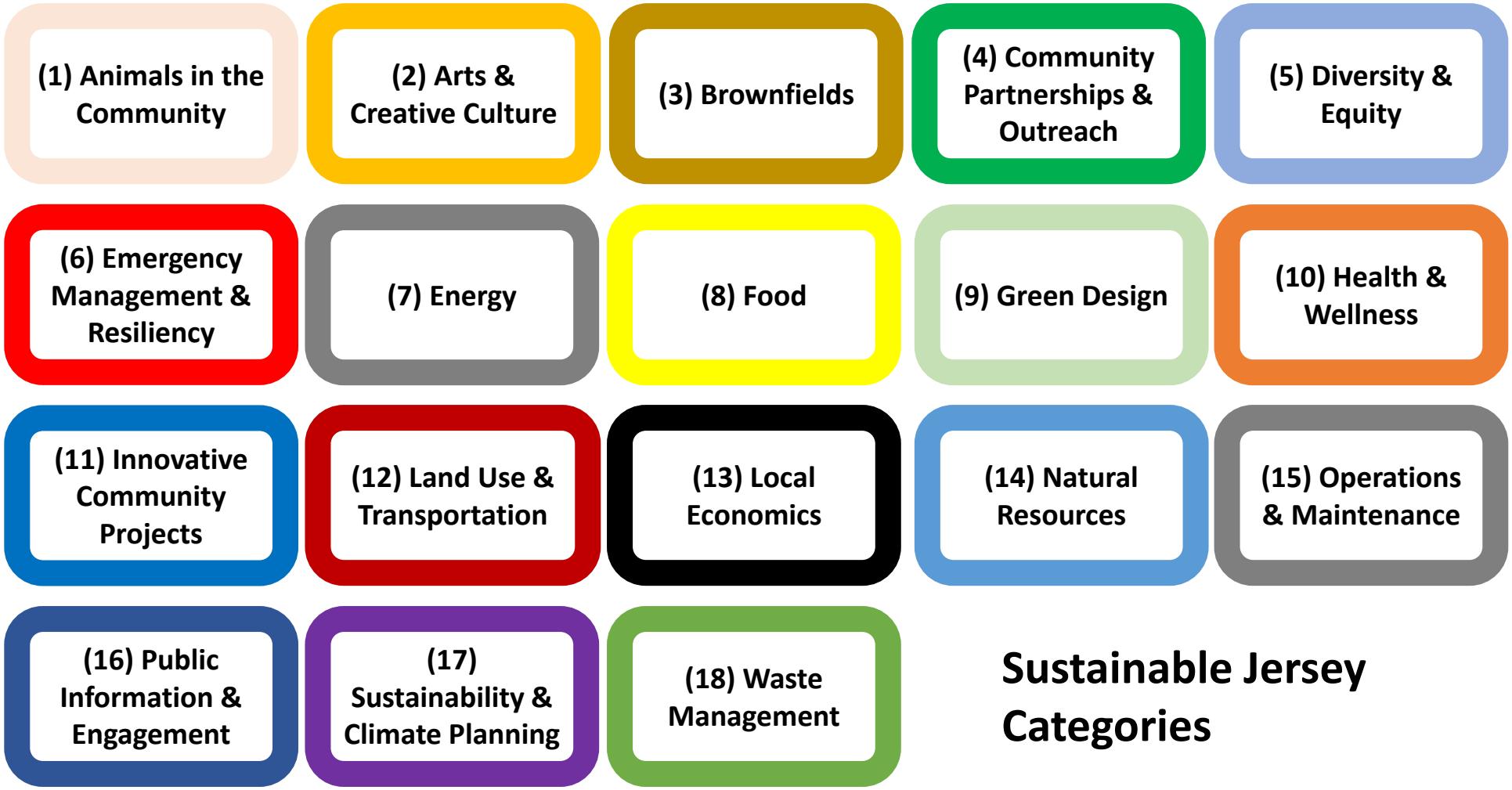
Silver Certification Requirements:

- Establishment of **mandatory green team**
- Implement 3 of 12 priority actions
- Complete actions in 8 of 18 categories
- Total of at least 350 points

2023 goal!

J rog#F huwlilfdwrq#Jhtxluhp hqw#Hqhuj|,

- Hvwdedvkp hqw#ri#p dqgdwru|#juhhq# whdp
- Suryhq#juhhqkrxvh#gv#hgxfwrq#jrdov
- : frp p xqlw|#z lgh#dfwrqv#htxlhg


(1) Animals in the Community
(2) Arts & Creative Culture
(3) Brownfields
(4) Community Partnerships & Outreach
(5) Diversity & Equity
(6) Emergency Management & Resiliency
(7) Energy
(8) Food
(9) Green Design
(10) Health & Wellness
(11) Innovative Community Projects
(12) Land Use & Transportation
(13) Local Economics
(14) Natural Resources
(15) Operations & Maintenance
(16) Public Information & Engagement
(17) Sustainability & Climate Planning
(18) Waste Management
Sustainable Jersey Categories

PGT / Parsippany Troy Hills Library Education Series

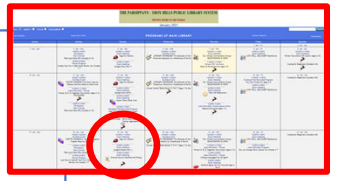
THE PARSIPPANY ~ TROY HILLS PUBLIC LIBRARY SYSTEM
A WORLD OF IDEAS

Agenda Topics and Dates

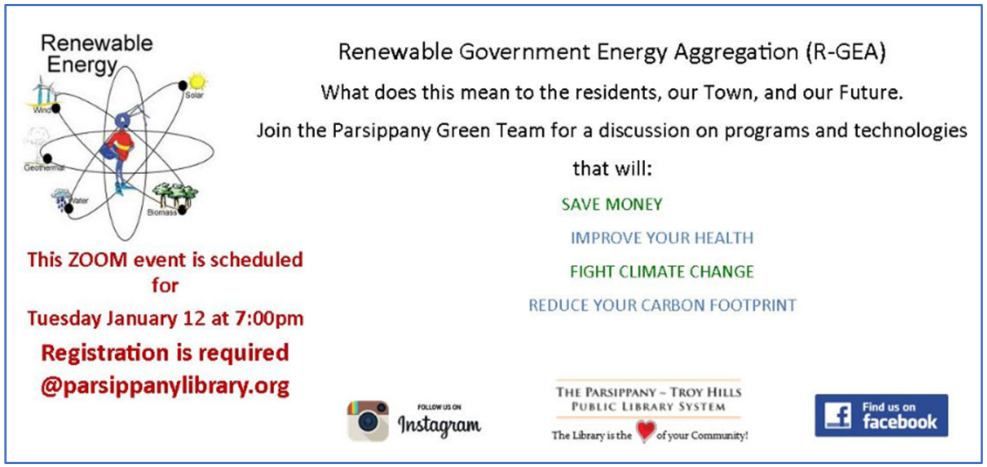
- **Jan 12 @ 7-8 pm** : What is **Renewable Government Energy Aggregation** (R-GEA) and what does it mean to residents, our town, our future?
- **Jan 19 @ 745-845 pm** : What is **Ground Source Geothermal Energy** and how can we tap into this abundant energy provided by the earth?
- **Jan 27 @ 7-8 pm** : **Solar Energy**: The most plentiful energy source is becoming more accessible for households, for municipalities
- **Feb 2 @ 7-8 pm** : The Accessibility of **Electric Vehicles** for individuals and municipalities

Highlights

- Zoom / virtual series
- Go to ***parsippanylibrary.org*** to sign up
- Thank you, Jean Embler!!
- Advertised on FB, Twitter, Patch, Township and Virtual Backpack



Par-Troy Library Pamphlet (*first topic R-GEA*)



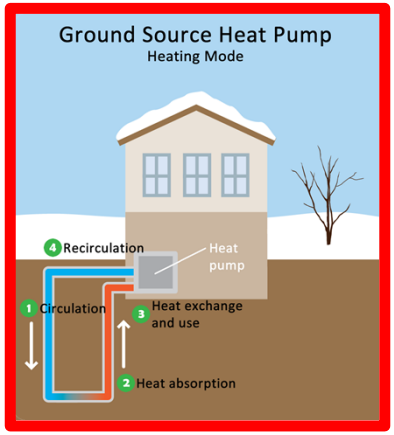
Ground Source Heat Pump – What is it?

- A geothermal heat pump (GHP) or ground source heat pump (GSHP) is a central heating and/or cooling system that transfers heat to or from the ground, often through a vapor-compression refrigeration cycle. Commercial and residential applications. [1]
- Also known as a "geoexchange, earth-coupled, or earth energy system" (different from pure geothermal). [1]
- A ground source heat pump extracts ground heat in the winter (for heating 1) and transfers heat back into the ground in the summer (for cooling 2).[1]
- Takes advantage of near constant temperature in the upper 20ft of the Earth's surface due to the sun's energy [2]

PARSIPPANY GREEN TEAM

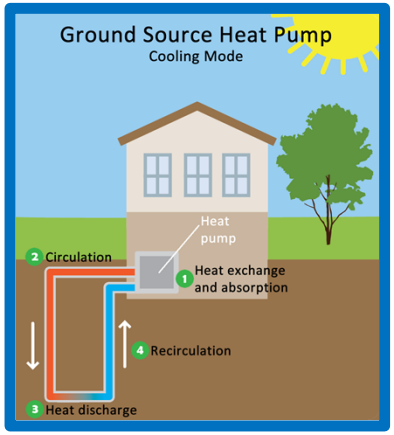
Heating Mode – Extracting heat

1



Cooling Mode – Moving heat to the ground

2



Ground Source Heat Pump – Benefits [3]

- Low Energy Use (25-50% less energy, ~500% COP)
- Free or Reduced-Cost Hot Water (uses excess)
- Year-Round Comfort (quieter, lower humidity)
- Design Flexibility (new or retrofit)
- Improved Aesthetics (no external heat exchangers)
- Low Environmental Impact (~44% reduction)*
- Durability (no exposed parts, 25-50yr warranty)
- Reduced Vandalism (no outdoor parts)
- Low Maintenance (1/3 of cost)
- Zone Heating/Cooling
- No fossil fuel supply chains (natural gas, oil)
- Commercial and Residential Applications

Select a Technology ▾ Geothermal vs. Natural Gas

	Geothermal	Natural Gas
Efficiency Rating	500%	98%
Capable of Zoning	✓	✓
Does Not Use Fossil Fuels or Release Harmful Emmissions	✓	×
No Combustion	✓	×
No Carbon Monoxide or Oil Leaks	✓	×
Not Impacted by Volatile Operating/Fuel Costs	✓	×
Heating and Cooling in One Unit (and hot water capabilities)	✓	×
Most environmentally friendly (According to the EPA)	✓	×
No Outdoor Equipment	✓	×
Uses the Earth's Free Heat (For every 1 unit of electricity used, you get 4 units free)	✓	×

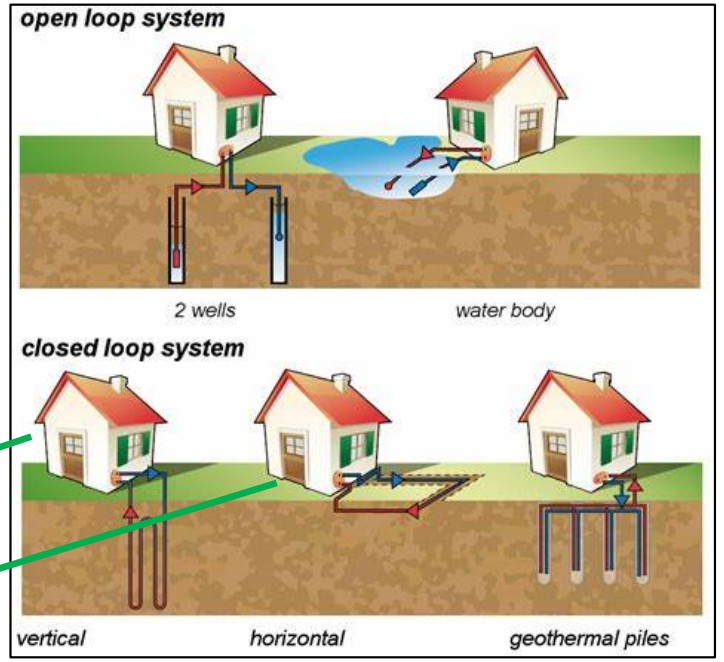
[5]

- A GSHP system can be installed in virtually any area of the country and will save energy and money. [3]
- According to the Environmental Protection Agency (EPA), GeoExchange systems are the most energy efficiency, environmentally clean and cost-effective space conditioning systems available [4]
- A GSHP is 5 times more efficient than a gas boiler. This combined with the low carbon intensity of the grid, means that installing a GSHP instead of a gas boiler, will reduce emissions by 87%. [6]

*Environmental impact is reduced even more when paired with renewable energy electric sources like solar PV or clean energy purchasing ~ 0

Ground Source Heat Pumps – Types [1]

1. **Open Loop**
    1. Well, groundwater heat pump
    2. Heat exchange with a direct water source (well or pond)
2. **Closed Loop**
    A. Drilled or buried ground heat exchanger depending upon space and geology
    B. Vertical
    C. Horizontal
    D. Pond



(B) Vertical Drilled Borehole

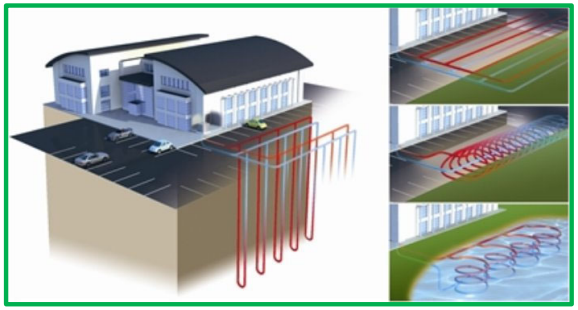
(C) Horizontal Trench

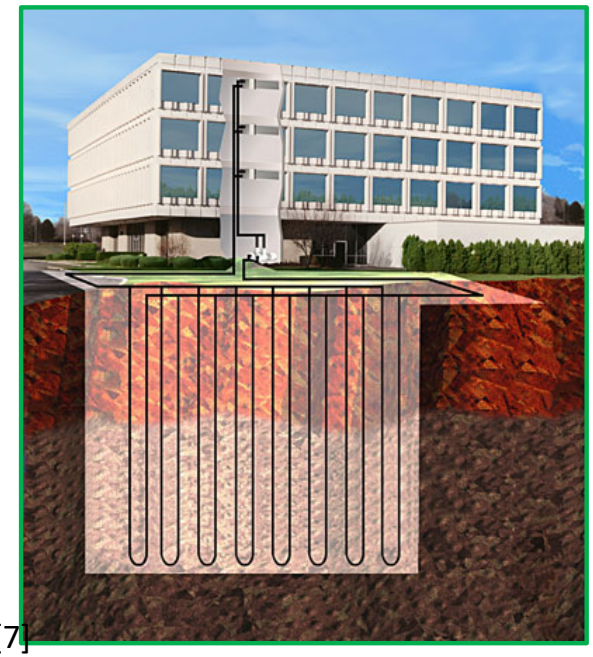
(D) Submerged Pond Loop

PARSIPPANY GREEN TEAM

Ground Source Heat Pump – Commercial

- GSHPs can be used for commercial buildings for space conditioning
- Retrofit or new construction
- Heat exchanger under parking lot make use of wasted space





[7]

PARSIPPANY GREEN TEAM

Our Install (2020)

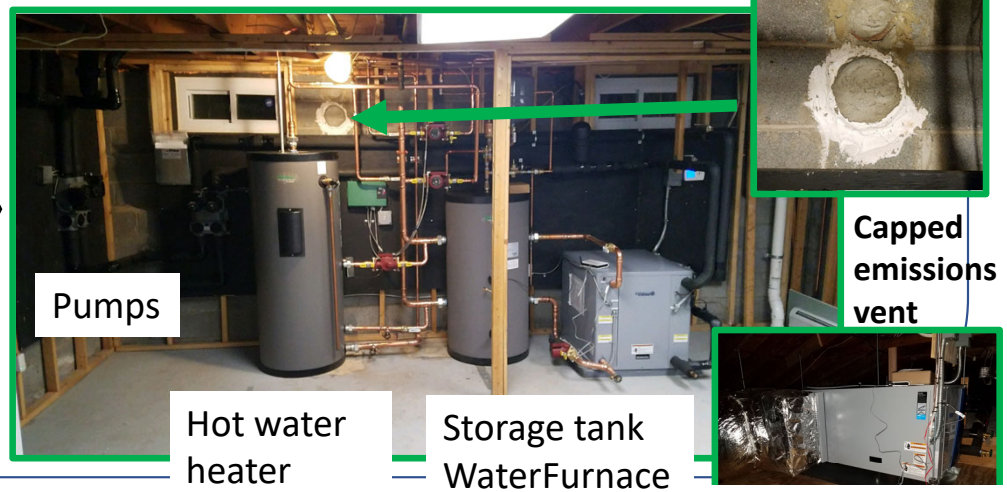
- **Drilling** (1 week)
  - (3) 250’ deep vertical ground exchange wells
  - Single underground loop
- **Install** connection and equipment install (6 days)
  - Attic (heat/cool air handler + insulation)
  - Basement (water heater, pumps, storage tank, WaterFurnace, remove outside AC condenser

Before (natural gas furnace and hot water heater)

Removed

Removed

After (GSHP heating, air conditioning and water heater)



Pumps

Hot water heater

Storage tank WaterFurnace

Capped emissions vent

Attic air handler

References:

- [1] “Geothermal Heat Pump” (2020) Geothermal heat pump - Wikipedia
- [2] "Groundwater temperature's measurement and significance - National Groundwater Association". National Groundwater Association. 23 August 2015.
- [3] “Geothermal Heat Pumps,” DOE/GO-10098-652 FS 105, September 1998. Geothermal Heat Pumps | Department of Energy
- [4] “Space Conditioning: The Next Frontier,” EPA 430-R-93-004, April 1993. Document Display | NEPIS | US EPA
- [5] “The Advantages of Geothermal” (2020), GeoComfort.com. Geothermal Benefits (geocomfort.com)
- [6] “Energy Infrastructure of the Future: Ground Source Heat Pumps” (2020), NIBE. NIBE GSHP PAPER.pdf
- [7] “Community Builder” (2018), MattamyHomes. PowerPoint Presentation (escribemeetings.com)

Additional Resources:

- https://www.energy.gov/eere/geothermal/geothermal-heat-pumps (US Department of Energy)
- http://www.geoexchange.org/ (Geothermal Heap Pump Consortium, Inc (GHPC)
- https://igshpa.org/geothermal/ (International Ground Source Heat Pump Association (IGSHPA)
- https://www.energystar.gov/products/energy_star_most_efficient_2020/geothermal_heat_pumps (Energy Star.gov)
- Geothermal Heating and Cooling Technologies | Renewable Heating and Cooling: The Thermal Energy Advantage | US EPA (US Environmental Protection Agency)
- https://en.wikipedia.org/wiki/Geothermal_heat_pump (Wikipedia.org)
- https://www.nyserda.ny.gov/Residents-and-Homeowners/Heat-and-Cool-Your-Home/Heat-Pumps (NY State Energy Research and Development Authority)
- https://www.sustainablejersey.com/ (Sustainable Jersey)
- https://www.facebook.com/ParsippanyGreenTeam/ (Parsippany Green Team-Facebook)