

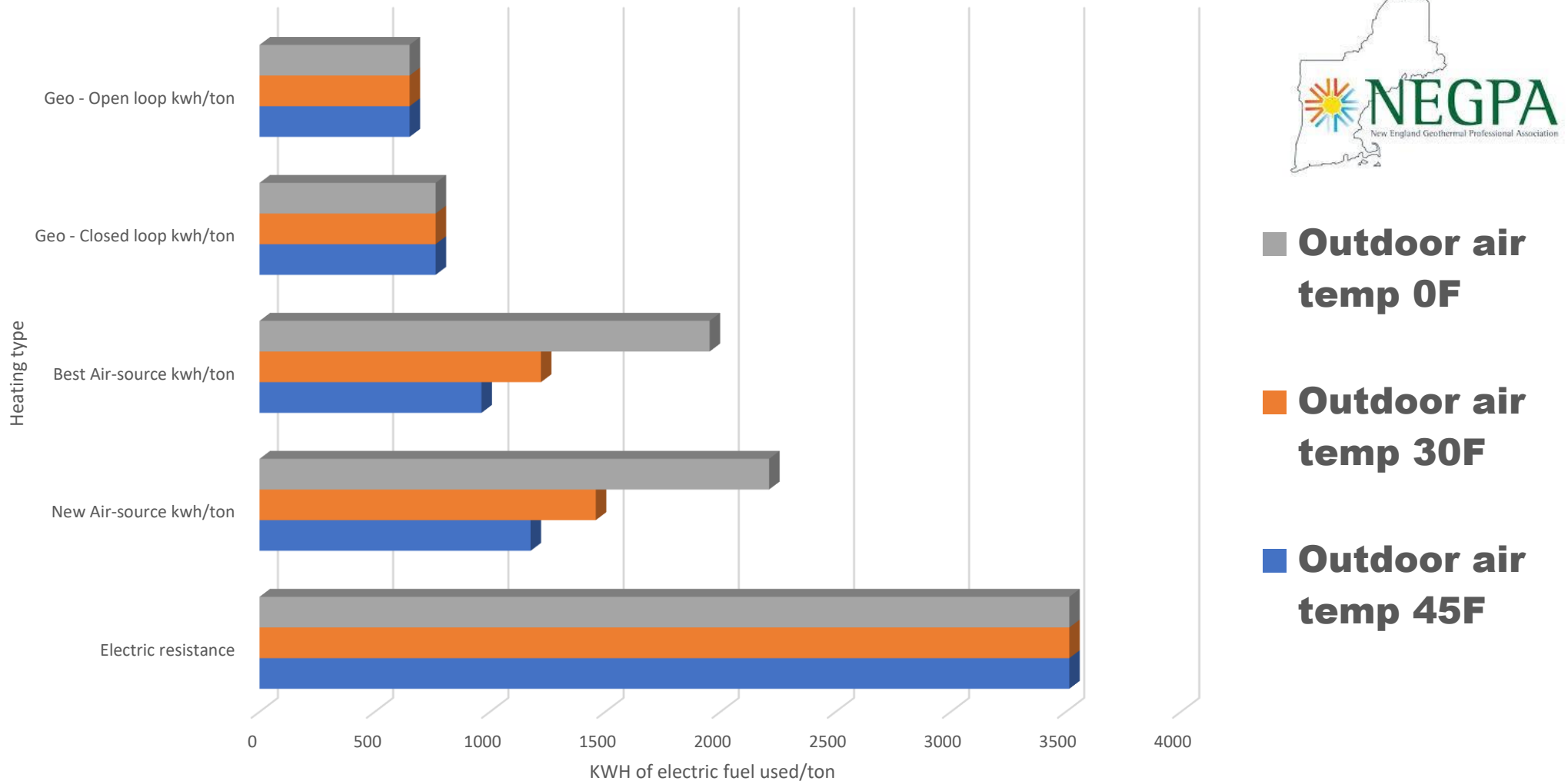


Comparing ACTUAL Air –source and Groundsource HP Efficiencies and related Effects on Grid Modernization

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Comparing Geo to Air – Source in Zone 5

One ton of heat delivered - KWH expended at varied outdoor air temperatures



- Outdoor air temp 0F
- Outdoor air temp 30F
- Outdoor air temp 45F

Electrification of space conditioning in Massachusetts



Why should GSHPs top the list?

- GSHPs in Massachusetts climate more than 2X annual performance of best air-source HPs
- System life is more than 2X air-source systems with no outdoor elements
- GSHPs provide consistent efficiency regardless of outdoor air temperature
- GSHP earth loop provides PERMANENT & CLEAN SOLAR BATTERY to the property/loop owner
- Groundsource delivers year - round efficiency without dramatic peak on the electric grid
- Groundsource provides for most manageable/predictable electrical demand at winter AND summer peaks
- “Community” GSHP loops can be owned & financially optimized by 3rd party

ON THE 7 - YEAR SIMPLE PAYBACK REQUIREMENT... ARE ALL METRICS CONSIDERED?

Metrics to consider more carefully...

- Typical GSHP system life from 35 to 45 years. Loops last more than 50 years
- Current tariffs on electricity - Confound GSHP payback & penalize ALL renewables investment
- Continued subsidies/APS inclusion and incentives on fossil – Ensures decades of additional fossil burning/related emissions and skews metrics against renewables and electrical grid development
- GHGs (not just carbon) effect on air quality/public health costs should be factored in to “simple” payback for the Commonwealth – *\$106/ton health cost from fossil
- Focus should be EXCLUSIVELY on deploying/incentivizing non-fossil solutions that support grid balancing and minimize future electricity use of ZERO carbon goals
- GSHP loop remains as valuable property asset for future generation GSHPs
- GSHPs will ultimately drive down electricity and grid costs with flattened summer AND WINTER peaks leading to best ISO - NE outcome and fastest path to ZERO carbon future

*R. Tol “The Marginal Costs of Carbon Dioxide Emissions, An Assessment of the Uncertainties” Carnegie Mellon University, Pittsburg, PA



FOR THE LONG RUN!

On why Canada chooses Groundsource over Air - Source



“Heat pumps are the most promising solution to heating homes and buildings in the low-carbon Canada of the future,” said Martin Luymes, VP of Government and Stakeholder Relations at HRAI, “and, while The latest air source heat pumps perform at impressive efficiencies, a unique benefit of ground systems is their ability to perform consistently at high efficiencies regardless of outdoor air temperatures, due to their reliance on the more stable thermal energy stored in the ground. Deployed at scale they will effectively ‘flatten the curve,’ reducing peak electricity demand for the whole grid.”

Source – Dunsky report – Beneficial Electrification and GSHPs -
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*OGA is an affiliate of the **Heating, Refrigeration and Air Conditioning
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