BUILDINGENERGY BOSTON

Unlocking Residential Geothermal: How Builders Are Overcoming Cost and Complexity Barriers

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Curated by Lauren Baumann

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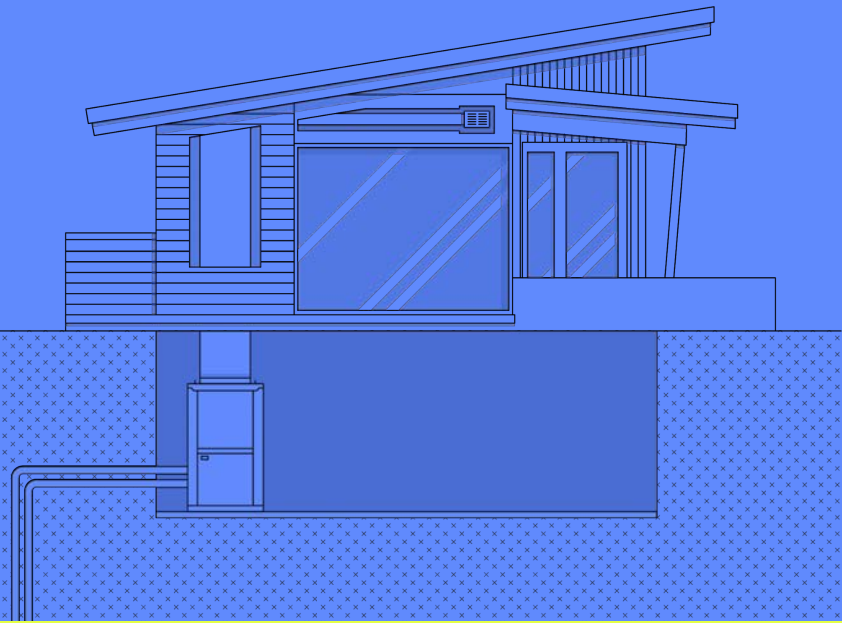
Unlocking Residential Geothermal

How Builders Are Overcoming Cost & Complexity Barriers

Bryan Roberts | Director, Business Development



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Core Question:

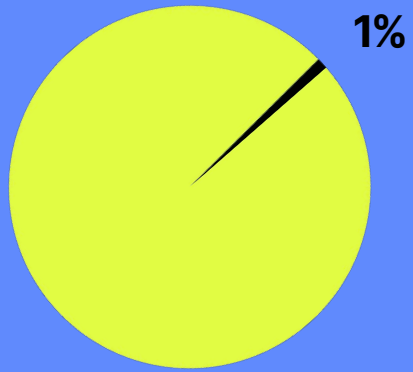
If geothermal is the highest-performing residential HVAC option in cold climates, *why isn't it the default?*

The oldest “new” home technology

75+ Years
of geothermal installations

1.5 Million
Geo heat pumps installed

80K
Residential installs/year



And yet... Only 1% of US homes use geothermal heat pumps for heating & cooling

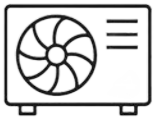
Electrification Performance Baseline

Yes, geo is reliable... But it's also just *better.*

Cold Weather Climates

Natural Gas + AC

Burns fossil fuels, less efficient, more emissions
~15 yr lifespan; 15 yr cost of ownership $49.5K
Gas COP ~0.95



Air Source

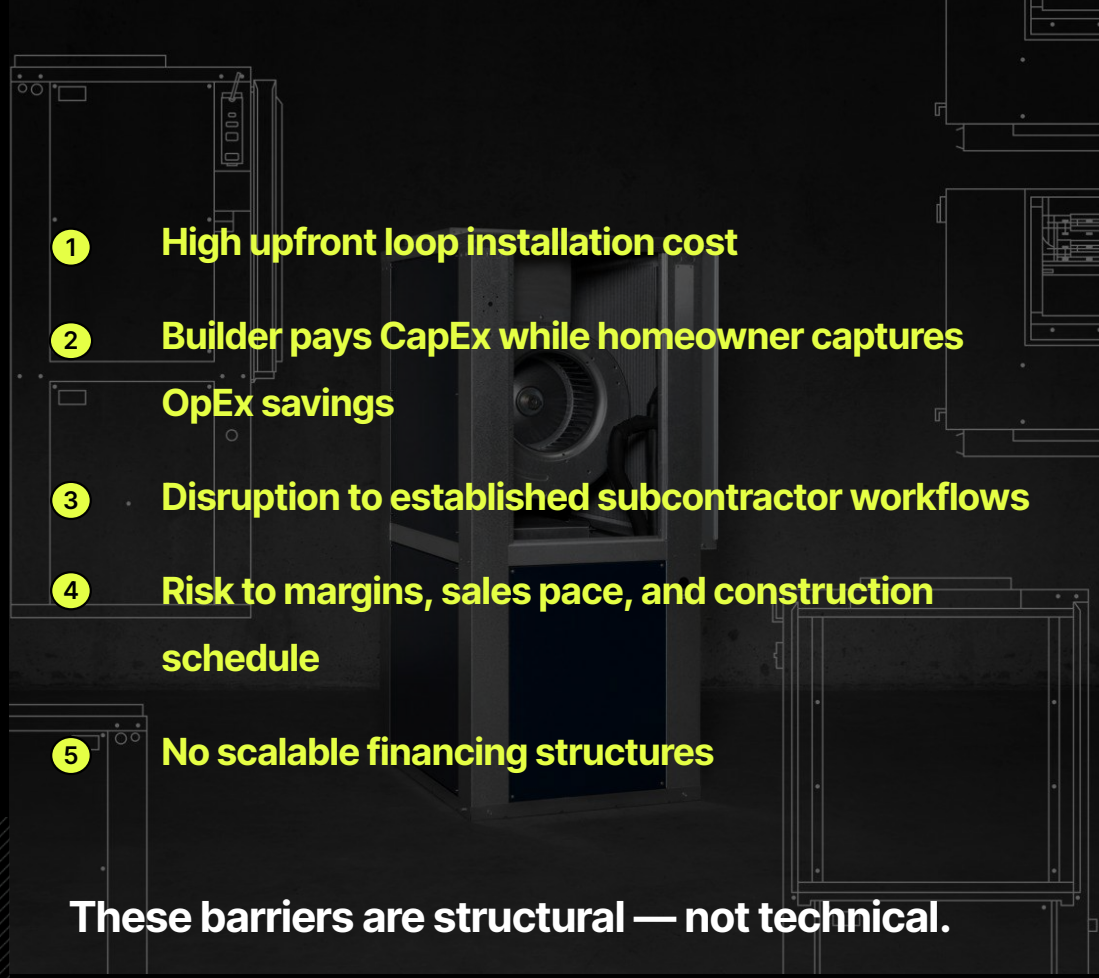
Relies on outdoor air, efficiency varies with temperature
~12-15 yr lifespan; 15 yr cost of ownership: $59K
ASHP seasonal COP ~1.9–2.3

Geothermal

Uses stable ground temperature, highest efficiency
~25 yr heat pump lifespan; 15 yr cost of ownership: $28K
Geothermal COP ~3.8–4.2

So again, why is it not the default?

Barriers for Builders



1. High upfront loop installation cost
2. Builder pays CapEx while homeowner captures OpEx savings
3. Disruption to established subcontractor workflows
4. Risk to margins, sales pace, and construction schedule
5. No scalable financing structures

These barriers are structural — not technical.

How Developers Actually Evaluate Technologies

1. **Developers optimize for:**

- capital exposure
- construction schedule
- margin certainty
- sales pace / absorption
- subcontractor reliability
- buyer acceptance

2. **Technology gets adopted when it:**

- reduces risk
- improves economics
- simplifies infrastructure
- aligns with policy or incentives
- works within existing workflows

Developers don't adopt technologies. They adopt risk profiles that work.

How Developers Actually Evaluate Technologies

UPFRONT COST

ONLY LOOKS AT EQUIPMENT COST

- Conventional HVAC: $12k
- Geothermal system: $30k

  → *Geo appears $18k more expensive*

DEVELOPMENT COST

TOTAL DEVELOPMENT COST

- Conventional HVAC also requires:
  - gas service extensions
  - condenser pads
  - site space for outdoor units
  - electrical upgrades
  - future electrification retrofit risk

When evaluated at the project level, the gap is often far smaller than assumed.

2 Pathways to Affordable Geothermal

1 Strong Policy Environment
(Rare but Powerful)

Large incentives / rebates

Example effects:

- Loop cost largely offset
- Immediate cost parity
- Straightforward builder adoption

Examples:
MA MassSave SF, Colorado Xcel utility program, Maryland GREC + rebates, NYSERDA SF

2 Structural Alignment
(More Common)

Projects become viable when several moderate factors combine

Policy: federal tax credit + moderate state incentives

Infrastructure: gas extension cost + electrification requirements

Financing: TPO / leasing

Delivery: production scale + standardized loop design

Site constraints: eliminate outdoor equipment

Bottom line: sometimes one lever works—more often, it's several moderate ones aligning.

The Structural Framework

Projects often become viable through combinations of levers

1. Federal and state incentives
2. Third Party Ownership / Leasing
3. Utility structures
4. Holistic cost reframe (total development cost vs equipment)
5. Constraint-driven entry (no gas, tight lots, electrification policy)
6. Production standardization
7. Integrated delivery models

Federal & State

Federal & State

Available incentives...

- Sect 48 eligibility via third-party ownership or build to rent: 30% - 50% tax credit
- Geothermal Rebate stacking
  - The hottest markets are offering $5k-$15K per home for geo specifically
  - Stack on top of electrification rebates with geo as a HERs reduction anchor
- Renewable Energy Credits (GRECs)
  - $500/ton ($3,300/ton in MD!)
- Impact on net installed cost

Leasing

Third-party ownership (TPO)

Benefits of TPO...

- Builder avoids upfront loop CapEx
- Third party owns loop and heat pump
- Unlocks commercial Federal tax credit, even when homes are for sale
- Converts to structured OpEx
- Residents pay a lease fee equal to or less than OpEx savings from geo

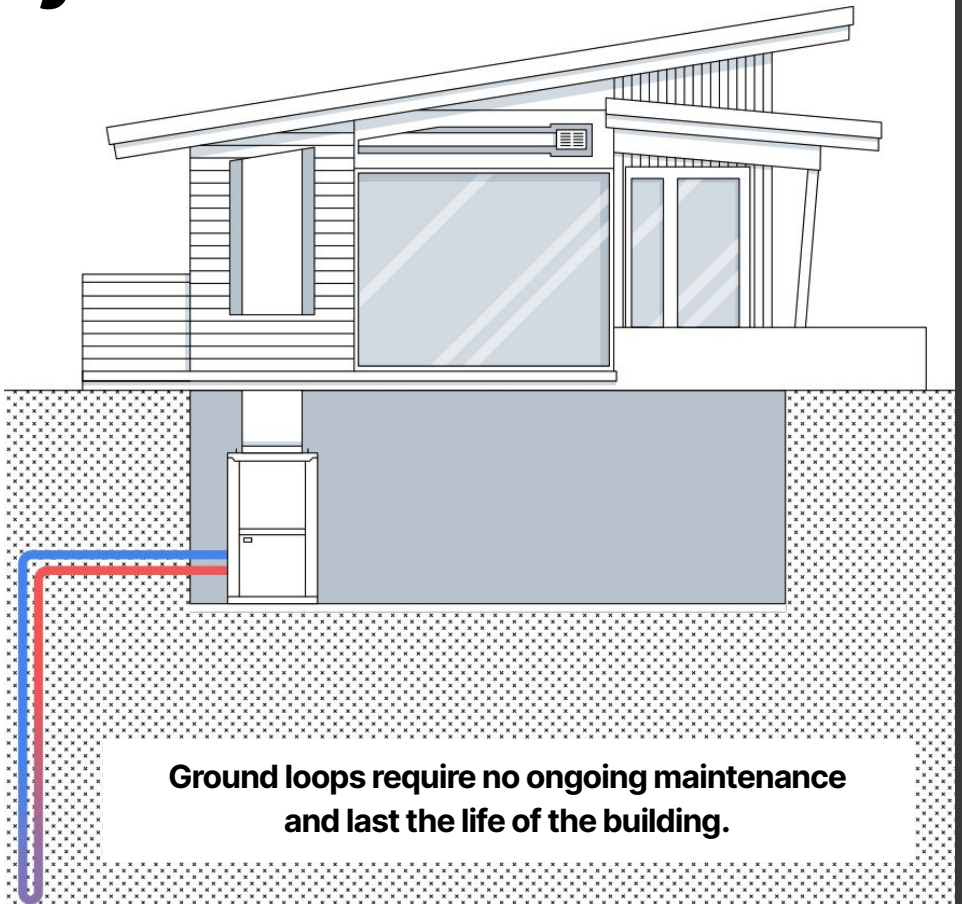
Utility

Utility supported loop infrastructure

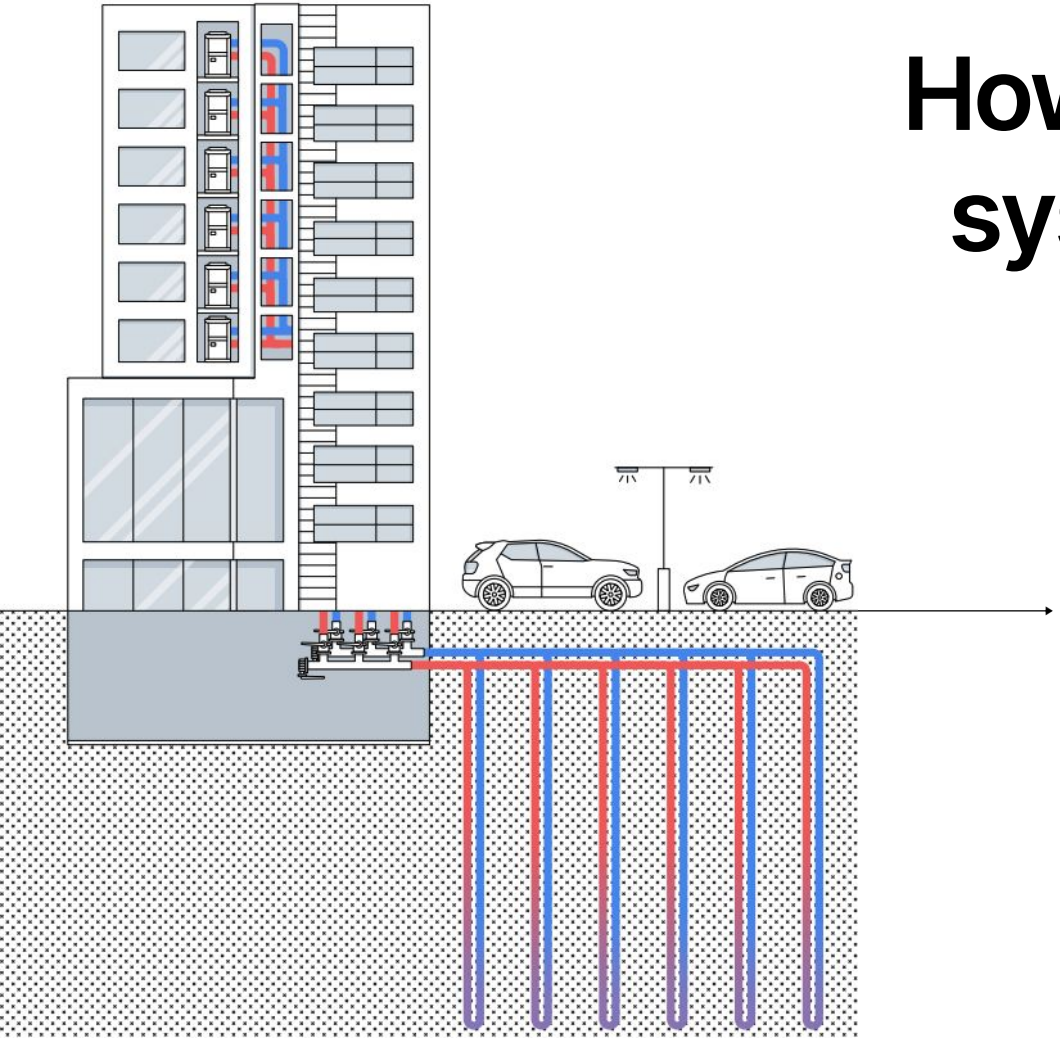
- Utility-funded or utility-supported loop models
- Risk transfer away from builder
- Reduced upfront CapEx
- Converts to structured OpEx
- Residents pay a monthly utility fee equal to or less than OpEx savings from geo
- Utilities extend energy as a service model to an increasingly electrified future
- Replicable model

How a residential system actually works

1. Ground loop heat exchanger
2. Stable subsurface temperature exchange
3. Proper sizing can cover full design load (no required fossil backup when designed correctly)
4. Mechanical room: heat pump + flow center
5. HVAC distribution: ductwork, radiant...
6. Installed and serviced like conventional HVAC



Ground loops require no ongoing maintenance and last the life of the building.



How a geothermal system works for multifamily?

Same principle as single-family, just applied at building scale

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Network vs. Individual Loops

System Design Options

Thermal Energy Networks

- ➔ Best suited for dense, balanced-load environments
- ➔ Central infrastructure, shared pumping, advanced controls
- ➔ Multi-year coordination and capital complexity

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Individual Building Loops

- ➔ Individual loops operate at building level
- ➔ No central plant or shared balancing required
- ➔ Simpler infrastructure, servicing, and deployment in residential contexts means *significantly* lower cost

Lennar x Dandelion

1,500+

Single-family homes in Colorado
Accessed massive rebates & incentives

200+

Townhomes in Maryland
Using leasing structure

Energy Bill Savings

Energy bill savings averaging $1,125 / year

Fewer Replacements

Systems lasting 2-3X longer than traditional HVAC

Winter Performance

65% more efficient in the winter

Summer Performance

20% more efficient in the summer

Improved Home Aesthetics

No noisy, bulky condenser units –reclaimed outdoor space

Reduced CO2 Emissions

Each home saves ~5,000 lbs of CO2 in 1st year (= planting 90 trees)

Woodland Peak x Dandelion

15

Townhomes in Bellingham, MA

Utility rebates & in-house rebate support

Performance & Homeowner Value

- COP ≈ 4
- ~45% annual opex savings and annual CO_2 reduction
- ~25 year HP life and GL for the life of home
- Clean, quiet, reliable HVAC

Development Benefits

- Eliminates outdoor condensers
- Improves neighborhood aesthetics
- Appeals to multiple buyer sensibilities
- Differentiates the product

Vermont Gas Systems x Dandelion

36 **Apartment & townhomes, affordable for rent**

Performance & Homeowner Value

- COP ≈ 4
- ~45% annual opex savings & annual CO_2 reduction
- ~25 year HP life and GL for the life of home
- Clean, quiet, reliable HVAC

Developer Benefits

- Utility loop ownership and leaseback solves CapEx
- Eliminates outdoor condensers
- Frees site space for landscaping or dwelling units
- Low cost HVAC OpEx for affordable housing

Toll Brothers x Dandelion

Landmark Project: Magnolia Square
Princeton, NJ

30
New, All-Electric Townhomes

Secure Buy-In
Win City Council approval with green credentials.

Maximize Space
Removed outdoor condensers to eliminate noise & clear deck space.

Differentiation
Enhanced home saleability with a safer, more efficient HVAC.

Simplify Install
Eliminating refrigerant lines to cut costs and warranty risks.

Future-Proof
No compromises, fully-electrified heating & cooling solution.

Green Certified
Community is a landmark in sustainable development

Where geothermal works best

Conditions were deployment becomes practical

1. **Cold-climate** Single and multi-family housing that are heating dominant
2. **Production housing** with repeatable loop fields
3. Sites facing **NG infrastructure costs** or electrification mandates
4. **Projects constrained** by outdoor equipment, noise, or aesthetics
5. **Rental** or longer-term ownership models
6. **Sites where individual loops** are feasible without network-level coordination

Recap: Why Geothermal

Reasons for choosing geo

Cost Alignment

→Incentives & utility participation
→ Leasing / TPO
→Holistic cost reframe
→Production standardization

Infrastructure Alignment

→No gas infrastructure cost
→Meet electrification requirements

Design Advantages

→No noisy, ugly outdoor condenser units
→Site planning flexibility

Superior Performance

→Uses stable underground temperature
→Higher COP

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The smartest build starts underground.

Thank you! Any Questions?

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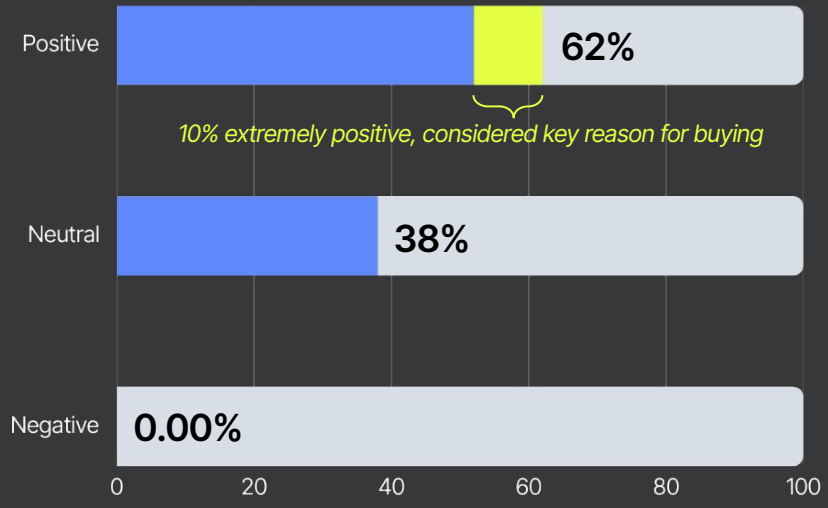
Please fill out an evaluation for this session

or: *nesea.org/eval*

Northeast Sustainable Energy Association (NESEA)

In 2026, homebuyers LOVE geo

We analyzed all Lennar CO potential homebuyer conversations that talked about geothermal



"That makes me like this even more. I already love the location, but that is really appealing to me."

"For me, it was a selling point for the lower energy cost."

"My current HVAC is loud... and that's not fun. I'm excited to have geothermal."

Geothermal helps you sell homes

Lennar's sales team gave us the scoop on why they love selling geo

34% of their homebuyers in geo communities convert compared to **27%** in other communities

"**I start my tours in the basement** to show off the system."

"Multiple buyers have **come in just because of the geothermal**."

"For many buyers, it was the **primary reason for buying**."

"Selling geo instead of solar is **the best thing that's happened**."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