geoOutlook®
The official publication of IGSHPA

JANUARY 2024 VOL. 18 NO. 1

NEW YORK CITY GEOTHERMAL APARTMENT TOWER

BROOKLYN, NY

Lendlease's 1 Java Street will be powered by a vertical closed loop geoexchange system with 320 boreholes, reducing annual building carbon emissions by 53% compared to typical residential systems.

NEXT

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*Life Cycle Analysis study performed by ADM. Michigan State University professors Bruce E. Dale and Seungdo Kim reviewed the study and endorsed the results and conclusions.

* GlycoChill+®P-Series Heat Transfer Fluid is a 100% USDA Certified Biobased Product through the USDA BioPreferred® Program. The USDA BioPreferred program promotes the purchase and use of biobased products by providing trusted verification and making it easy for people to identify renewable natural resource alternatives, as opposed to non-renewable synthetic or petrochemical derived ones.

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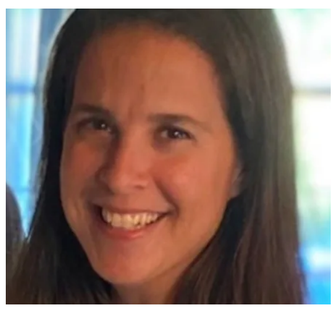
Based on square footage, building height, the 834 residential units and number of boreholes, the geothermal system at 1 Java Street will be the largest multifamily project in New York State. It is believed to be the largest high-rise residential geoexchange system in the country. Developed and constructed by Lendlease, the multifamily project is located on the Brooklyn waterfront and occupies a full, 2.6-acre city block. As an all-electric building, 1 Java Street will also avoid carbon emissions related to the use of natural gas.

Letter from IGSHPA Executive Director
By Jeff Hammond



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NGWA Building Geothermal Retrofit

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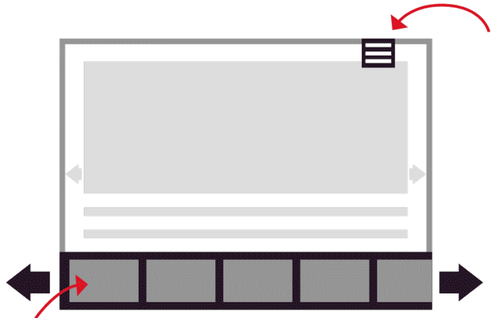

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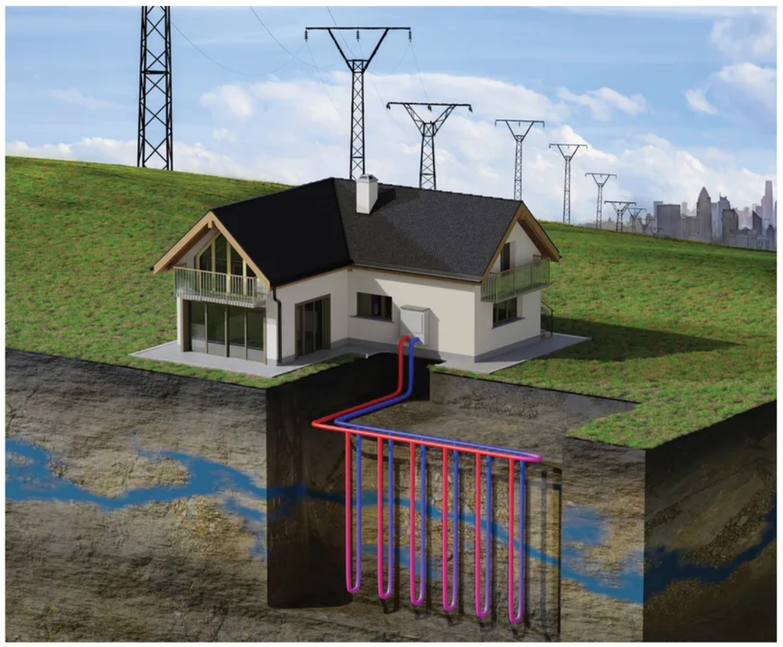
GeoExchange Breaking News!

Ground Source Heat Pump Mass Deployment reduces grid requirements by 33%!

GEOEXCHANGE®
The Geothermal Exchange Organization

U.S. Department of Energy's latest report on the grid impact of ground source (geothermal) heat pumps provides a path to electrification without "breaking" the grid.

Below are quotes from the report and a link for download.



- Even though building heating is electrified with GHP deployment—increasing winter electricity use for homes and businesses that otherwise are heated with fossil fuels—the increase is more than offset by the electricity savings from the high-efficiency performance of GHPs for summer cooling and reduced thermal loads owing to weatherization in single-family homes, resulting in substantial net reductions in grid generation, capacity, and transmission.
- The mass GHP deployment reduces transmission expansion requirements by 33% under the Grid Decarbonization scenario and by 38% under the EFS scenario. This amount equates to roughly 24,500 mi of transmission that can be avoided under the Grid Decarbonization scenario and nearly twice as much (43,500 mi) under the EFS scenario, which is enough to cross the average contiguous US coast-to-coast distance 9 and 16 times, respectively.

Download the report

LETTER FROM IGSHPA EXECUTIVE DIRECTOR

BY **JEFF HAMMOND**

IGSHPA
International Ground Source Heat Pump Association

JEFF HAMMOND

It's exciting to announce the January issue of ***GeoOutlook***! After a hiatus of nearly four years, the September issue of ***GeoOutlook*** was an opportunity to restart this great resource. In 2024, we plan to have this issue, as well as a July issue. We are taking "baby steps" at first, starting out with two issues per year, building back up to a quarterly magazine, as we are able to collect interesting articles and enough ad revenue to pay for the costs associated with publishing a regular magazine.

You may not be aware of our agreement with BNP Media, publisher of ***ACHR News, Engineered Systems***, and more. Our agreement for an E-Magazine includes distribution to subscribers of the two magazines mentioned above, which provides a much wider audience to readers in the HVACR and Engineering fields. The combination of the IGSHPA database and BNP readers provides nearly 50,000 readers! We expect a big "bang for the buck" for our advertisers and great exposure for authors of articles in ***GeoOutlook.***

In 2024, you will see a lot more updates from IGSHPA, not only in ***GeoOutlook*** but we will be providing more content in our social media posts, a new twice monthly blog on the IGSHPA website, and much more. As the industry grows, the need for frequent communication, as well as details on new training programs will be essential for keeping members abreast of the latest industry developments. Watch your Inboxes and social media pages for the latest IGSHPA news!

This year at the Iowa Geothermal Association conference, February 26-28, 2024, in Cedar Rapids, IA, we will be teaching for the first time two new IGSHPA training modules, the Installation Technician module, and the Service Technician module. We expect these two modules to be very popular with HVAC contractors interested in geothermal heat pump technology. As we continue to "modularize" the training, you will start to see new modules that were previously part of the Accredited Installer (AI) training, become available as separate training courses, which will help with workforce development for our industry as we grow. Other new modules in the works are the residential design course, a grouting module, several GHEX (Ground Heat Exchanger) related modules, and much more. Greg Kurtz, IGSHPA's technical director, or I will be providing updates as we have more details. I would like to thank IGSHPA's training committee for all the hard work on transforming our curriculum.

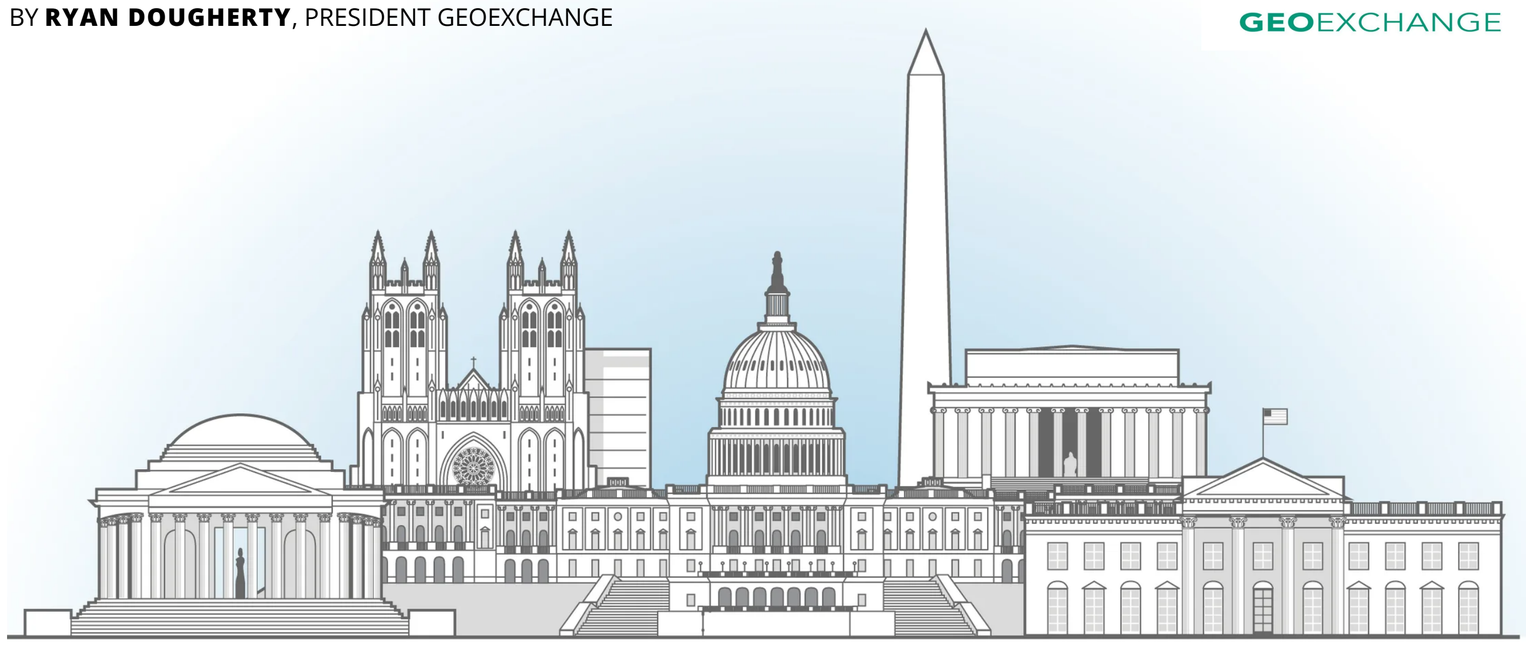
There is so much happening at IGSHPA that I quickly ran out of space on a one-page letter. So, I will leave it here for now. Watch your Inbox for details on the next annual conference, 2024 IGSHPA membership levels, and all the new developments with IGSHPA and the industry. Thanks for reading and thank you so much for your support of IGSHPA!

Best Regards,
Jeff Hammond

UPDATES FROM GEOEXCHANGE

BY **RYAN DOUGHERTY**, PRESIDENT GEOEXCHANGE

GEOEXCHANGE

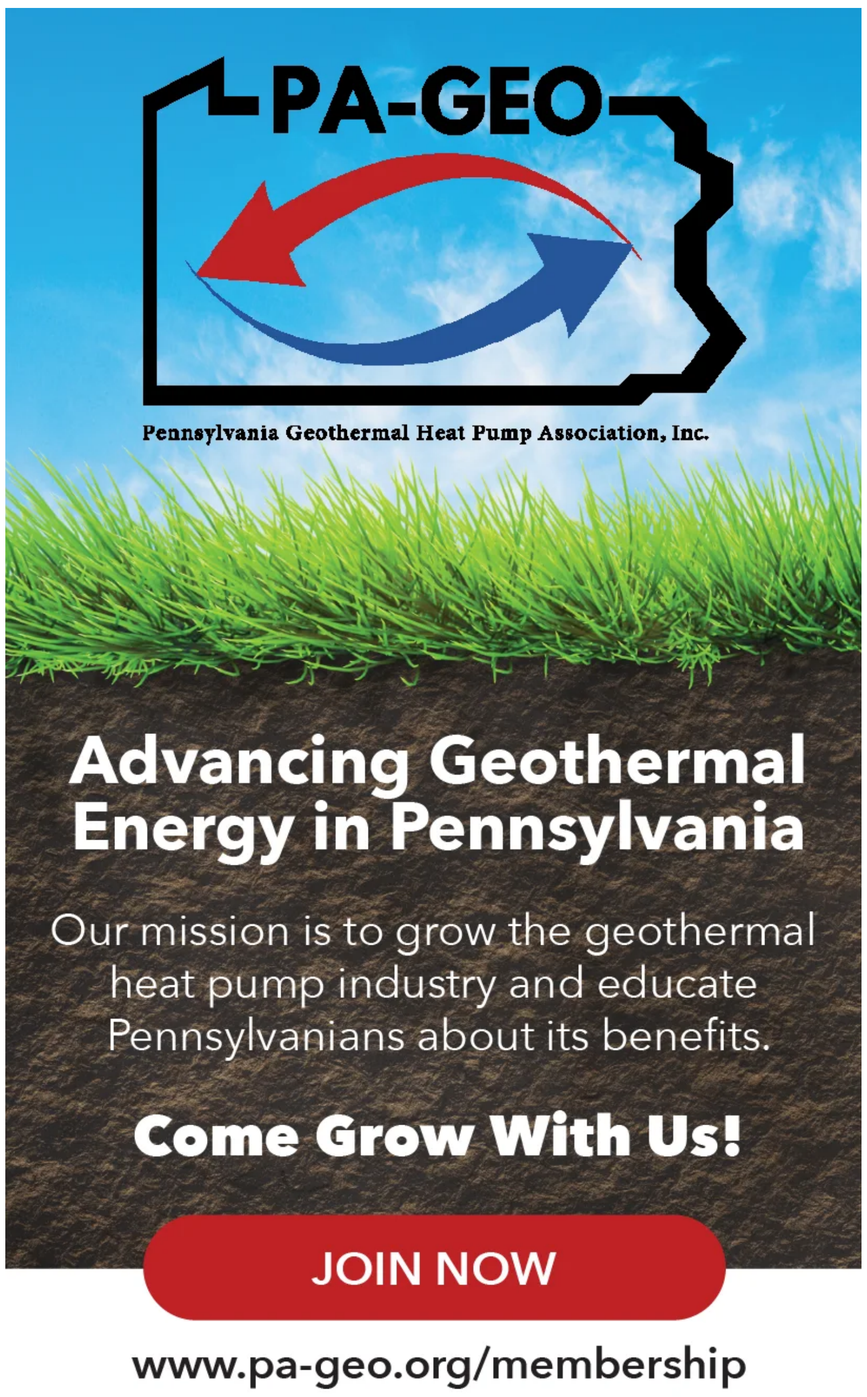


Dear Geo Outlook Reader,

RYAN DOUGHERTY

I'm typing this letter on a plane headed home from yet another trip to our nation's capital. People often say to me, "Oh, you work with Congress? That must be awful." While dysfunction in Washington is a frequent lament amongst commentators and the electorate, for a geothermal heating and cooling proponent, it isn't all that bad. Our industry enjoys considerable support on both sides of the aisle. In fact, many of our biggest supporters could be considered some of the most traditionally conservative members in Congress.

If you think about it for a moment, you understand why geothermal is embraced across the political spectrum. Technology is the most efficient way to heat and cooling a building. It drives economic activity and bolsters a skilled workforce. It strengthens our nation's electrical grid and ensures energy stability and security. It saves homes and businesses money while delivering consistent comfort. And to some lawmakers, the most important benefit is that it is a potent weapon in the fight against climate change.



Over the past decade, GeoExchange has conveyed these multi-faceted benefits in a campaign to build awareness and support with our elected officials. It hasn't always been easy. 2016 and 2017 were difficult years and it often felt like we were pushing a boulder uphill. But persistence pays off. We've been unrelenting in our advocacy on behalf of this industry and the people that are part of it. Our focused efforts have resulted in historic provisions within tax law and energy policy to drive adoption of geothermal heat pumps. The Inflation Reduction Act is driving unprecedented demand for the technology.

And while it feels good to reflect on the industry's success, there is a lot of work ahead of us. A growing focus on building decarbonization demands that we step up and get involved as clean energy policy at the state and local levels transforms the built environment. While there are challenges ahead, there are also limitless opportunities. I look forward to working with all of you as we take this industry to the next level.

IMAGE CREDIT: NAKphotos / iStock / Getty Images Plus

LETTER FROM THE EDITOR

BY **LISA M. LIPE**

Dear Readers,

LISA M. LIPE

With the departure of 2023 and the arrival of 2024, the staff and team at IGSHPA are prepared for the opportunities and challenges that this new year holds. We will never stop expressing our sincere gratitude to each and every one of you for all that you have done to advance IGSHPA's mission. Our member-driven organization would not be able to continue the vital work of developing ground source heat pump technology at the local, state, federal, and international levels without your articles, letters, advertisements, membership, and steadfast support.

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- Access to the members-only section of the IGSHPA website
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- Free subscription to GeoOutlook Magazine
- Free subscription to the monthly newsletter
- Ability to post job opportunities, and display the IGSHPA logo and membership status
- Identification as part of a growing renewal energy technoogy
- Membership I.D. Card
- Discounts on IGSHPA events, including training opportunities
- Voting rights on board elections and other member votes
- Listing in the directory, helping to increase visibility and finding products and services

IGSHPA www.igshpa.org
IGSHPA's Mission: *Working together to advance ground source heat pump (GSHP) technology.*

With ***GeoOutlook*** back in full swing, I want to take a moment to emphasize the pivotal role of member feedback in our long-term objectives and our eventual return to publishing quarterly ***GeoOutlook*** E-Magazines. We hold your opinions, expertise, and knowledge in the highest regard, as they are the cornerstones that enable us to create content aligned with the core goals of IGSHPA. To sustain this vital initiative, we rely on professionals like you to submit articles and even engage in phone interviews on topics relevant to our industry. Bringing one-on-one interviews to ***GeoOutlook*** will be a fun, informative and great way to continue to not only get to know our members, but also talk about topics that may help others understand the GSHP just a little bit more. Our E-Magazine reflects your experiences and unique perspectives, and we firmly believe that our collaborative efforts will result in even more profound and insightful coverage of the industry.

We hold your contributions in the highest esteem and eagerly anticipate the journey of working together to craft a publication that both represents and propels the Ground Source Heat Pump Industry.

We thank you for being such an integral part of our community, and we are so excited about the future of IGSHPA and the Industry. If you are interested in submitting an article or participating in a one-on-one phone interview on a topic in the industry, please do not hesitate to contact me at either info@igshpa.org or llipe@igshpa.org

Together, let's advance the Geothermal Industry and make a lasting impact!

IMAGE CREDIT: Dilok Klaisataporn / Getty Images Plus via Getty Images

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Shifting Ground for Geothermal Heat Pumps in Canada

BY **MARTIN LUYMES**, VICE PRESIDENT, GOVERNMENT AND STAKEHOLDER RELATIONS, HRAI-CANADA

Government and utility support for geothermal heat pumps has been running a bit hot and cold over the past several years in Canada, with exciting programs like GreenON (in the Province of Ontario) showing great promise, only to be cut short of their full potential due to a change in government.

At the federal government level there has been modest progress with the introduction of Greener Homes in 2021, which has offered rebates of up to $5,600 and interest-free loans up to $40,000 towards home energy retrofits, including heat pump conversions. In many provinces, these rebates have been beefed up by local program partners. Though ground source heat pumps are included in the program, they were not treated differently than air source, despite their greater potential to save energy and carbon emissions (with significantly less peaking impact on power grids). HRAI has advocated that GSHPs should qualify for more substantial incentives.

More recently, the federal government announced the extension of Clean Technology Investment Tax Credits to include investments in ground source and air source heat pumps in commercial applications. This tax measure mimics the approach taken in the US and has been welcomed by the commercial HVACR contracting sector. While the needed legislation has not been enacted yet, once it is, the credit will be retro-active to March 2023.

Meanwhile the government has been consulting with industry and other stakeholders since mid-2022 on the development of its "Green Building Strategy." The need for a more comprehensive strategy came out of a realization that, in the buildings sector at least, Canada is retrofitting (decarbonizing) buildings at a rate less than a third of what will be needed to meet the country's ambitious carbon reduction goals.

HRAI and its industry allies have been engaged with Natural Resources Canada (NRCan) in the development of the Green Buildings Strategy, and there are some signs that NRCan has been listening to industry inputs, but details of the plan will remain unclear until it is fully introduced, and the timing of its launch has been delayed several times.

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On November 9th, however, it was announced that the Greener Homes program will be wound down in 2024, an announcement that surprised many. At the same time, the government stated that it intends to follow this announcement with another in a few weeks about the Green Buildings Strategy, and the expectation is that this platform will bring new programs that will keep the industry focus on decarbonization. (At time of this writing, the announcement has not been made.)

As a result of federal and provincial supports for heat pumps, there has been a lot of media talk about the technology and its benefits, and, slowly but surely, awareness levels and market acceptance are rising. See for example, recent coverage by the CBC (click HERE).

HRAI and other groups are telling both governments and the industry that, in order to prepare for the next wave of program support for ground source heat pumps, training of technicians and other personnel will be essential. HRAI continues to be the reliable IGSHPA training partner in Canada, offering training for both installers and designers. Together, HRAI and IGSHPA are leading the way!

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MARTIN LUYMES, *bio to come*

IMAGE CREDIT: Getty Images Plus via Getty Images

Unlocking the Potential of Geothermal Heat Pump Systems: A Builders Guide

BY **GREG KURTZ**, IGSHPA TECHNICAL DIRECTOR

Happy New Year! As we enter a new year, things are changing in the residential construction industry. The pursuit of sustainable and eco-friendly homes is gaining momentum, with a growing focus on "Green Homes" and the adoption of geothermal heat pump systems. Recently, a residential home builder reached out to me with a set of questions and concerns regarding the integration of geothermal heat pump technology into their projects. Let's dive into the key issues raised and explore practical solutions for a seamless transition to greener energy alternatives.

Challenges in Geothermal Heat Pump Projects

The builder highlighted to me the evolving landscape of state residential energy codes, emphasizing the shift toward all-electric homes and the inevitable rise of geothermal heat pump systems. However, a significant hurdle emerged – the perceived reluctance of HVAC and Loop Contractors to collaborate on these projects. The builder expressed concern about the complexities involved in managing two subcontractors with seemingly conflicting interests.

In response, the builder acknowledged the need for oversight from a manager well-versed in both aspects of the project. To address this concern without overwhelming the builder, several key points were emphasized in my response.

A. Basic Knowledge is Essential: The prime contractor must possess fundamental knowledge about acceptable designs, unit sizes, installations, and commissioning of geothermal heat pump systems.

B. Specialized Contractors are Crucial: Utilize trained geothermal heat pump HVAC contractors and Loop Installers, steering clear of traditional HVAC/Plumbing contractors or water well drillers lacking geothermal heat pump expertise.

C. Avoiding Issues through Understanding: Embarking on a project without a comprehensive understanding of geothermal systems' design, installation, and commissioning may lead to potential issues and liabilities.

Slow Growth of the Geothermal Industry: Explained

The builder questioned me on whether the industry's slow growth was attributed to these challenges. My response outlined multiple reasons for the measured progression:

A. Changing Climate Concerns: Increasing awareness of global climate threats is prompting a shift towards sustainable energy solutions.

B. Energy Code Updates: Revisions to energy codes are incorporating higher efficiency requirements in building construction and HVAC system design.

C. Transition from Fossil Fuels: In the past, government subsidies to the fossil fuel industry have disadvantaged electricity as a first-cost energy option. However, a positive shift is underway, aiming to create parity among various HVAC equipment choices. This change encourages builders, HVAC contractors, and consumers to explore the benefits of proven technologies, such as geothermal heat pump systems, despite the initial higher investment costs. The availability of government incentives, including IRA Tax Credits and the Inflation Reduction Act, now makes it more accessible for a broader population to embrace these sustainable alternatives.

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D. Resistance from Traditional Players: Large residential developers, especially in collaboration with fossil fuel companies, have been hesitant to embrace non-traditional HVAC systems, fearing a disruption in their established practices.

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E. Code Adaptation: Local building codes only started addressing geothermal heat pump systems around 2016 in the United States.

F. Lack of Promotion: Traditional HVAC equipment manufacturers and contractors have been slow to promote geothermal systems due to potential impacts on their existing sales models.

Advice for Builders Considering Geothermal Heat Pump Systems

For our GeoOutlook readers, especially builders venturing into geothermal projects, consider the following advice:

A. Invest in Education: Become an IGSHPA member and attend relevant training courses to gain a comprehensive understanding of geothermal heat pump systems.

Composite material, Cloud, Sky, Wood, Shade, Fixture, Building

Font

B. Choose Certified Professionals: Hire IGSHPA members trained in geothermal design, engineering, architecture, HVAC installation, and loop installation.

C. Plan for Temporary Heating/Cooling: Provide an alternative heat/cooling source during construction to avoid reliance on geothermal systems until completion.

D. Select Appropriate Ground Loop Systems: Consult with qualified geothermal contractors to determine the best ground loop system based on site conditions, available space, and budget.

E. Prioritize Right Sizing: Base HVAC, duct distribution, and loop heat exchanger sizes on approved methods, ensuring optimal cost-effectiveness.

F. Quality Control in Construction: Ensure high-quality materials and procedures for piping, grouting, and flushing processes to guarantee the integrity of the ground loop system.

G. Careful Antifreeze Selection: Choose an antifreeze solution compatible with the system components, following manufacturer specifications and local codes.

By adhering to these guidelines, builders can navigate the challenges of geothermal projects, minimize the risk of poor-quality installations, and unlock the full potential of geothermal heat pump systems for sustainable and energy-efficient homes. Here's to a greener and more sustainable future in residential construction!

GREG KURTZ., IGSHPA, Technical Director, gkurtz@igshpa.org

IMAGE CREDIT: Getty Images / SimplyCreativePhotography / Royalty-free / E+

IGSHPA Spotlight Interview with Zeyneb and Audrey

1. Names, Company, Position and Titles:

Audrey Schulman, HEET Co-Founder & Co-Executive Director

Zeyneb Magavi, HEET Co-Executive Director

2. When did you both start to become passionate about geothermal?

Zeyneb: In 2007, I wanted to get combustion out of my home, and my research led me to the best technology to do that: the ground source heat pump. When the first estimates were out of my budget, I began to wonder if sharing an install between buildings could decrease up front costs through increased efficiency. Fast forward and I was working with Audrey on the challenges our gas utilities are facing in a decarbonizing world. I realized it was a beautiful fit—that's how the idea of a utility-scale transition from gas to geothermal networks was born, and HEET has been advancing it ever since, first in Massachusetts and now nationally.

Audrey: The timing was perfect. In the previous several years, HEET had succeeded in bringing gas executives, environmental activists, and legislators together to mandate that the utilities fix the biggest gas leaks and to help research the best way to identify those "super emitters" so they can be fixed—since it turns out that just 7% of those leaks account for 50% of the gas distribution system's methane emissions. We had also collaborated with scientists at Boston University and Harvard University to publish influential research on the composition of natural gas and the health impacts of gas stoves.

Of course, the next challenge was getting off gas entirely, and Zeyneb's idea for networked geothermal—also called thermal energy networks and district energy—was the perfect solution. It allows gas utilities to continue delivering an essential public service and providing good jobs, and it gives homeowners, landlords, tenants and businesses access to affordable, non-combusting heating and cooling.

Zeyneb: That there are benefits for all involved—and the electric grid, too—is critical to the rapid scaling we are seeing all over the country. Even as Eversource Gas installs the first gas-to-geo 'designed to scale' network in the streets of Framingham, MA, there are installations and feasibility studies in progress in 12 other states, and another installation beginning in Lowell, MA. To support this expansion, HEET and Building Decarbonization Coalition are building a national network of advocates to work in synergy with workforce, academia, industry, and a national network of gas utilities, currently 26 and growing, who formed a coalition to explore networked geothermal. So the national landscape is shifting rapidly. Daily.

Audrey Schulman and Zeyneb Magavi at an Outward Bound leadership program.

3. Share with us the beginning of your partnership as co-executive directors and its pivotal role in the remarkable achievements of HEET?

Audrey: I met Zeyneb years ago when our kids were little, but we connected on climate when she became an active member of Mothers Out Front. Her background in physics and sustainability made her an ideal partner in helping us study methods of detecting and measuring gas leaks, so we collaborated on a research project. HEET's work was rapidly gaining traction and I needed leadership support, so it became clear to both of us that bringing her on board made sense.

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Zeyneb: Audrey and I make a great team. Besides bringing complementary skills, we share an unwavering commitment to *how* we approach the work we do at HEET. The most important element—which I think is both highly unusual and the biggest driver of HEET's success—is that we invite *everyone* to the table, and then we move at the speed of trust. Listening deeply. Actually caring. This is how we have come to work effectively with such a broad, diverse group of stakeholders.

Audrey: The amazing thing is we each came to this approach independently. Neither of us is adversarial; we seek collaboration wherever possible because we understand that all social change happens through relationships. So often people forget this. We think if we come up with a great idea, it will just happen. But it won't unless people are listening and trust you, and that takes both intention and time. Zeyneb and I get that, and it has really strengthened our partnership.

4. What guidance would you offer to aspiring women entering the geothermal industry?

Audrey: When I helped found HEET 15 years ago, I had cut my home's energy bill in half but that didn't seem like enough anymore. I knew I couldn't look on as a bystander while climate change impacted my sons' future. So I started doing what I could—reading voraciously, getting my hands dirty, learning along the way, not giving up. And it worked. Absolutely do not be deterred because you are not "an expert."

Zeyneb: That's great advice—be persistent! Which of course works if you are an expert, too! This industry has a massive opportunity in front of it to change the world for the better. To succeed we need you. Please find the courage to persist right past any barriers you face in your training, education, or participation. Joining organizations whose mission is to support women in this industry, like Women in Geothermal and Society of Women Engineers, can help. And joining organizations like IGSHPA allows you to build your own network of experienced and passionate people. More than anything, please remember that the ground source heat pump industry needs every one of us to achieve the speed and scale needed to solve climate—we need exponential growth...

Audrey: Not explosive growth.

Zeyneb: No, this is non-combusting growth! And we need many committed, creative, intelligent, technically skilled, and passionate people to do the work. So we clearly need a lot more women!

5. Share three fun and interesting facts about yourselves?

Audrey: I'm the author of six novels, which have been translated into 12 languages and been reviewed by *The New Yorker, The Economist* and *CNN*. One of my best vacations was kayaking with whales in Vancouver. And I challenge anyone to have lower energy bills than I do—I'm an air-sealing and weatherization nut.

Zeyneb: My first job was for the company that built the first internet, where I was assigned to write code for underwater acoustics models for the U.S. Navy. Yes, that was more about torpedos than whales. Despite that job, plus my time as a varsity fencer at Brown University and a black belt in Uechi-Ryu karate, I am deeply pacifist.

Audrey: Still, don't mess with her.

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AUDREY SCHULMAN, HEET Co-Founder & Co-Executive Director

ZEYNEB MAGAVI, HEET Co-Executive Director

Top 10 Common Mistakes in Ground Source Heat Pump Installs & How to Avoid Them

BY **MICHAEL ROILER**, GENERAL MANAGER AT EDEN ENERGY EQUIPMENT

For the past two decades, I've had the privilege of collaborating with some of Canada's finest ground source heat pump installers. When I initially joined Eden Energy Equipment Ltd, we were a modest team of three, but our shared commitment to technical training, knowledge enrichment through collaboration, and prioritizing people over profits defined our core values and our growth.

During this remarkable journey, I've had the opportunity to contribute to a wide array of projects, both large and small. I've also been fortunate to learn from some of the most influential figures in our industry, including Tom Kinder from WaterFurnace International, Jeff Hammond from the International Ground Source Heat Pump Association, and the esteemed John Hypenhaller, P.E., whose reputation precedes him. While many others have played a part in my growth and expertise, these three individuals offered unique and sometimes contrasting perspectives that have significantly shaped my professional identity.

Over the years, I've been involved in the successful installation of ground source heat pump systems by hundreds of contractors, encompassing thousands of systems. While these installations 99.99% of the time go off without a hitch, it's crucial to take a step back and reflect on the rare instances where things haven't gone as planned. This becomes especially pertinent as ground source heat pumps gain popularity, and the industry faces pressure to reduce costs, often the wrong way.

My aim with this discussion is to initiate a dialogue on some of the most common mistakes we've encountered in our experiences. By shedding light on these issues, my hope is that we can collectively become more mindful of them and actively work to prevent their recurrence. Furthermore, I invite other industry experts to contribute their own insights and experiences regarding the challenges associated with ground source heat pumps. Together, we can foster a better understanding of these systems and elevate our industry's standards.

1. Inadequate Site Assessment:

One of the primary oversights in installations often involves neglecting a comprehensive site assessment. It's imperative to gain insights into crucial factors like soil type, groundwater availability, and space constraints. While I often advocate for traditional education through classes and courses that is only one part of a site assessment. Experienced drillers possess knowledge that can't be found in textbooks or geological maps, and this expertise can save you from potential headaches down the road.

Once the ground loop is installed, and you realize you've overlooked a proper site assessment, the damage is done, and your investment is spent. To circumvent this situation, it's advisable to inquire about your contractor's experience and the strength of their engineering and support network.

Take, for instance, TIM KIDLEN from Koolen Electric, a second-generation dealer with a track record of hundreds of successful ground source heat pump installations. Tim and his family are supported by the technical team at Eden Energy Equipment Ltd, which includes Matthew Irvine, P.Eng., one of the foremost experts in ground source technology in the country. Tim has encountered situations where he lost potential jobs, often because he refused to compromise on quality or lower his pricing to match competitors who failed to grasp the importance of this critical step.

2. Incorrect Equipment Sizing:

A common mistake in GSHP installations is installing a system that doesn't align with the property's actual requirements. Oversized systems lead to inefficiencies and inflated costs, while undersized ones can fail to meet the property's heating or cooling demands. The solution? Ensure the system is appropriately sized based on accurate heating and cooling load calculations.

Over the years, I've humorously remarked that some heat loss calculations seem to be conducted with fingers. The notion is simple: you stand in front of the house, and if three fingers cover it, you need a 3-ton system; if it takes four fingers, it's a four-ton system. This jest, however, contains a kernel of truth that sparked it.

Book, Mark, Publication, Print

But here's the key point: bigger is not necessarily better, and too small is equally problematic. Nowadays, sophisticated software is readily available to assist in performing heat loss calculations, selecting the right ground source heat pump, and conducting loop design calculations. The era of relying solely on rules of thumb is waning as heat pumps become more prevalent in Canada. And remember, harking back to point #1, if you've chosen a 3-ton GSHP when you needed a five-ton unit, rectifying the situation after the ground loop is installed and the landscaping is complete can incur significant expenses. You may even find yourself paying a competitor to fix it once the homeowner realizes the mistake.

3. Poor Loop Design:

Inefficient heat transfer often results from an improperly designed ground loop system. To mitigate this issue, it's crucial to design the loop with the right length, depth, and spacing while selecting the appropriate loop fluid based on local conditions. Using Methanol in Ontario? You have a problem. Using Ethanol? Make sure you do it safely!

For example, when considering a lake loop, it's essential to grasp the limitations of the specific body of water where you intend to install it. Similarly, if you're dealing with space constraints and considering a slinky loop but lack experience, it might be wise to seek assistance from a knowledgeable colleague. I recall my own experience with slinky loops when I extensively consulted with experts like Al Zacher (now retired). Despite favorable numbers on paper, the real world often brings unforeseen challenges that require practical expertise to address.

4. Inadequate Grouting:

Inadequate grouting in boreholes can lead to reduced heat transfer amongst other things. To address this, it's crucial to utilize appropriate grout and ensure thorough grouting without any air pockets.

In Ontario, many ground source heat pump installers wisely choose to outsource the ground loop installation, particularly when drilling is involved. Drilling is a specialized skill that requires expertise, and while I, like many dealers, am proficient in troubleshooting, diagnosing, and designing ground source heat pump systems, I recognize the value of professionals like Stanley Reitsma and others, who possess decades of field experience.

I firmly believe in individuals sticking to their areas of expertise. While I might save money by attempting to do it myself, the real question is whether it's cost-effective in the long run. After all, what savings is there when you end up with a non-functioning loop in the middle of winter, causing your ground source heat pump, which should be achieving a COP of 5, to perform no better than an electric furnace?

5. Improper Flow Rates:

This issue can be incredibly frustrating, and unfortunately, it occurs quite frequently. Improper flow rates do not always mean failure they often mean hampered system performance and efficiency. I'd like to focus specifically on water-to-water equipment in this context. Manufacturers provide valuable resources known as specification catalogues, where they outline the flow rates at which their equipment should operate.

However, setting the flow rate too high or too low can compromise the system's efficiency. It's crucial to configure the flow rate in accordance with the manufacturer's guidelines and the system's design parameters. The manufacturer does not know your design conditions and that responsibility falls on you to pick the right data points.

Let's take the WaterFurnace International Optheat water-to-water unit as an excellent example. This unit is remarkable because it can generate water up to 150 degrees while maintaining an impressive COP. However, it can only achieve this if the correct flow rates are maintained.

Where this often goes awry is when a less experienced designer looks at a table like the one below, assuming that every column offers the same benefits. They may not realize that the flow rates you need to maintain are directly influenced by the delta T (temperature difference) in the water.

For instance, if I need to raise the temperature from a 30-degree ground loop to 100-degree supply water, I have vastly different flow rate requirements compared to raising it from 30 to 140-degree water. While this may seem obvious, it's a point that's often overlooked.

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6. Incorrect Pipe Material:

Using incorrect piping materials that don't comply with CSA C448 can lead to significant durability issues down the line. It's always a wise choice to opt for high-quality polyethylene pipes that are corrosion-resistant and have a long lifespan in mind. Choose from other approved materials like PEX.

I've had numerous discussions on this topic with my friend and mentor, Lance MacNevin, P.Eng., from PPI Building & Construction Division. Lance is an industry expert who has imparted a wealth of knowledge to me regarding pipe construction and materials.

Here's an easy way to consider the importance of this: Let's say the approved piping material, such as HDPE (High-density polyethylene), costs 25% more than a material you might find at Home Depot that "looks about right." It's important to recognize that the cost of the pipe itself is just a fraction of the overall system cost. So, while you might save $500 on the job by choosing a cheaper pipe, let's circle back to our first point.

Once the pipe is installed, filled, flushed, and the landscaping is all completed, do you really want to be the one to tell the homeowner, "Oops, I'm going to need to tear up your yard and start over?" The long-term reliability and performance of the system are worth the investment in high-quality pipes.

7. Lack of Purging:

Neglecting to purge and flush the loop system can introduce air and debris, leading to problems. In closed-loop systems, like those in GSHP installations, neglecting to purge can introduce air, leading to a myriad of technical issues. One of the primary concerns is reduced heat transfer efficiency. Air bubbles or pockets act as insulators, disrupting the efficient transfer of heat. Given that water has a much higher heat capacity than air, any air present in the system can create "cold spots" where heat transfer is significantly diminished.

Air in the system can also lead to corrosion and premature circulator failure or worse. Oxygen, a component of air, can react with metal components in the system, leading to oxidation. Over time, this can weaken the system's components, making them more susceptible to leaks or failures. This corrosion can also produce debris, which can further reduce the system's efficiency and potentially clog vital components.

Another technical challenge posed by air is the potential for cavitation in pumps. As the pump operates, air pockets can lead to the formation of vapor bubbles. When these bubbles collapse, they produce shock waves that can damage the pump's impellers and reduce its lifespan.

To prevent these issues, it's imperative to ensure the system is thoroughly purged and flushed before startup. This not only removes air but also any debris that might have entered during installation, ensuring optimal performance and longevity of the system.

8. Inadequate Insulation:

Insulation plays a pivotal role in the efficiency and effectiveness of Ground Source Heat Pump systems. When pipes in these systems lack proper insulation, they can become susceptible to significant heat loss. This is especially true for pipes that are near the surface or exposed to ambient conditions.

Without adequate insulation, the heat or cold carried by the fluid within the pipes can easily dissipate into the surrounding environment. This not only reduces the overall efficiency of the system but also demands the GSHP to work harder to maintain the desired temperature, leading to increased energy consumption and wear on the system components.

In colder climates, improperly insulated pipes are at risk of freezing. When the fluid inside the pipes freezes, it can expand, potentially causing the pipes to burst and leading to costly repairs and system downtime. Conversely, in warmer climates, inadequate insulation can result in the fluid overheating, which can reduce the system's cooling efficiency and even damage certain components.

Proper insulation also acts as a barrier against condensation. In the absence of insulation, pipes carrying cold fluid can cause moisture from the surrounding air to condense on their surface. This condensation can lead to water pooling, which can cause damage to surrounding structures or equipment and even promote mold growth.

Ensuring that all pipes in a GSHP system are adequately insulated is not just a matter of efficiency but also of system longevity and safety. Proper insulation safeguards the system against external temperature fluctuations, prevents potential damage from freezing or overheating, and minimizes the risks associated with condensation.

9. Not Monitoring the System:

Monitoring is an indispensable component of any Ground Source Heat Pump system. Without a robust monitoring mechanism, a GSHP system operates blindly, potentially missing out on performance inefficiencies or undetected issues that could escalate over time. These unnoticed problems can lead to increased energy consumption, reduced system lifespan, and even costly breakdowns. The irony is that for less than $800 you can add a web-enabled performance monitor that is designed for the heat pump and logs over 150 data points every 10 seconds for 18 months. Why you would not want this hardware is beyond me.

Solutions like the WaterFurnace International Symphony are the answer. A cutting-edge web-enabled home comfort platform specifically designed for WaterFurnace geothermal systems. It provides homeowners and professionals with an in-depth look into the system's performance and health, ensuring that the GSHP operates at its peak potential.

Some of the key data points and features that the WaterFurnace Symphony can track, and log include:

1. **Real-time Energy Monitoring:** Symphony provides insights into the actual energy consumption of the system, allowing users to understand and optimize their energy usage patterns.
2. **System Performance Metrics:** It offers detailed performance metrics, such as the entering and leaving water temperatures, coil temperatures, and compressor speeds. This data is invaluable for diagnosing potential issues or inefficiencies.
3. **Remote Access and Control:** With Symphony, users can remotely access their system from any device with internet connectivity. This allows for real-time adjustments, ensuring optimal performance regardless of changing conditions.
4. **Alerts and Notifications:** The system can send out alerts for any irregularities or potential issues, such as high-pressure events, low water flow, or even routine maintenance reminders. This proactive approach ensures that minor issues are addressed before they become major problems.
5. **Historical Data Analysis:** Symphony logs historical data, allowing users to analyze trends over time. This can be particularly useful for understanding seasonal variations and making predictive maintenance decisions.
6. **Zone Monitoring:** For homes with zoned systems, Symphony can monitor and control each zone individually, ensuring consistent comfort throughout the residence.

In essence, while the intrinsic benefits of a GSHP system are numerous, its true potential is unlocked when paired with advanced monitoring solutions like WaterFurnace Symphony. By providing a comprehensive view of the system's operations, from energy consumption to detailed performance metrics, Symphony ensures that the GSHP system delivers efficiency, comfort, and reliability. My favorite feature? If a technician is on site me and my team can log into that unit and tell the technician exactly what is wrong with the unit and how to fix it.

Copyright Image: Rocky Mountain Tech

10. Skipping Maintenance:

Lastly, foregoing regular maintenance checks can lead to inefficiencies. Regular checks, including inspecting the ground loop and cleaning filters, ensure the system's optimal operation. A ground source heat pump is installed inside so it has an expected life expectancy of 25+ years. There are to this day units installed in Ontario that were first installed in the 1970's and I am not talking one or two.

Regular maintenance can very easily pay for itself by ensuring that the unit is operating properly, that it has proper heat of rejection and will a simple troubleshooting session on about an hour's work the unit can be benchmarked and tweaked. Maintenance does not have to be expensive it should be looked upon like an oil change in your car. If you don't do maintenance really bad things could happen whether it's your ground source heat pump or your lawnmower. One just happens to be a larger investment, but both should be protected.

11. Wrapping It all up

Ground source heat pumps represent the pinnacle of efficiency and environmental friendliness when it comes to heating buildings in Canada. The technology is not just promising; it's a proven solution. Brands like WaterFurnace, Climate Master, Enertech, and others have collectively installed tens of thousands of units across the province and even more nationwide. These systems not only work efficiently but are also highly reliable and remarkably easy to maintain.

I want to make it clear that my intention here is not to dissuade anyone from considering ground source heat pumps. Rather, I aim to encourage critical thinking. It's often said that you don't know what you don't know, and when it comes to heating and cooling systems, there are numerous ways to save money, but there are just as many ways to lose it.

If you find yourself uncertain about whether your contractor or designer truly comprehends the principles of sound ground source heat pump design, don't hesitate to ask questions. Reach out to reputable organizations like HRAI (Heating, Refrigeration and Air Conditioning Institute of Canada) and the International Ground Source Heat Pump Association. Additionally, consult with manufacturers to identify the real professionals in your area and try to avoid falling for persuasive sales pitches that lack substance. Making informed decisions is crucial when it comes to such significant investments in your home's heating and cooling system.

MICHAEL ROILER, is the general manager at Eden Energy Equipment. He started out working for a Cin-based HVAC company and now focuses on providing field support and technical training to contractors, engineers, and installers on heat pumps, boilers, and all things hydronics. He can be reached at edenenergyinfo@gmail.com.

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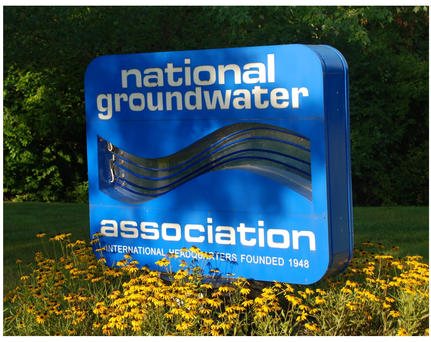
NGWA Building Geothermal Retrofit



PROJECT DESCRIPTION

NGWA broke ground on a geothermal retrofit at its headquarters on August 22, 2023, in Westerville, Ohio. Utilizing the geothermal tax credits available for nonprofit organizations that were signed into law in 2022, NGWA is replacing 9 furnaces, 9 air conditioners, and a mini split with 9 geothermal units. Ductwork and other modifications will be made to improve comfort and better utilize the building's HVAC system. Many industry stakeholders came together for this renovation, including IGSHPA and NGWA members and suppliers of equipment, pipe, and other system components. An IGSHPA member engineering firm even provided discounted pricing for design of the system. This project is a great example of how retrofit applications can work well and be good business for well water and geo- thermal contractors, engineering firms, and building owners.

PROJECT DETAILS

Building Type:	Office Building
Geothermal Equipment:	In partnership with Climate Control Group (ClimateMaster heat pumps), Enertech Global (GeoComfort heat pumps), and WaterFurnace.
Pumps/Hydraulic Separator:	Magna3 Variable Speed pumps, supplied by Grundfos; Hydraulic separator supplied by Geo-Flo
Piping:	Supplied by Centennial Plastics
Contractor / Installer:	Jackson Geothermal (drilling, ground loop); Federal Elite Heating & Cooling (heat pump/mechanical)
Engineering:	Salas O'Brien

CONSTRUCTION TYPE **Retrofit**
GEOTHERMAL LOOP TYPE **Indivual Building Loop**
APPLICATION TYPE **Forced Air**

INSTALLATION DETAILS

NGWA selected Jackson Geothermal of Mansfield, Ohio, to drill 20 boreholes for a vertical closed loop system. The company drilled two test boreholes with its Versa- Drill V-100NG drilling rig in the lower level of the building's parking lot that were both set with 65 feet of temporary casing. The drilling formations encountered were asphalt, gravel fill, sandy gray clay, coarse gravel, sand, clay & gravel, hard gray shale, light gray shale, and gray shale. Jackson Geothermal drilled the top 65 feet with fluid drilling, then set casing, and drilled out of the casing with air. It used a polycrystalline diamond compact (PDC) bit to drill the rock formation. After drilling the borehole, the loop was set, the borehole was then grouted from the bottom all the way up to the bottom of the casing at 65 feet. The casing was then removed, and the remainder of the hole was grouted up to the surface.

NGWA selected Federal Elite Heating & Cooling with locations in Pataskala, Dresden, Frazeysburg, Zanesville, Coshocton, and Dover, Ohio for the inside heat pump installation. Both Jackson Geothermal and Federal Elite are IGSHPA members. Salas O'Brien, the engineer of record, created engineering drawings for the system layout, including variable speed Grundfos Magna3 pumps.

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FIELD DAY PHOTOS

This isn't the first time NGWA has supported geothermal. The Association had an open loop heat pump using a water well installed in a new building that became its headquarters in 1985 in Dublin, Ohio. Its Airport Drive building in 1995 in Columbus was fully geothermal where more than 100 boreholes were drilled by the company of long-time geothermal advocate, the late Ralph Cadwallader of Texas. There was a geothermal unit set up for training among many others (dozens). Like at its previous headquarters, NGWA will use its vertical closed loop system to educate the industry and public about geothermal. NGWA also wanted to make the most of its geothermal retrofit by hosting a short course, Geothermal Drilling and Grouting Fundamentals, on August 29, 2023. Below are photos from the field day.

Inserting pipe and U-bend into the bore

Drill rig and construction equipment on site, ready to install ground heat exchangers

Stuart Lyle of ISCO Industries, instructing the class on the pipe fusion process

Grout and piping, ready for installation

IMAGE CREDIT: NGWA

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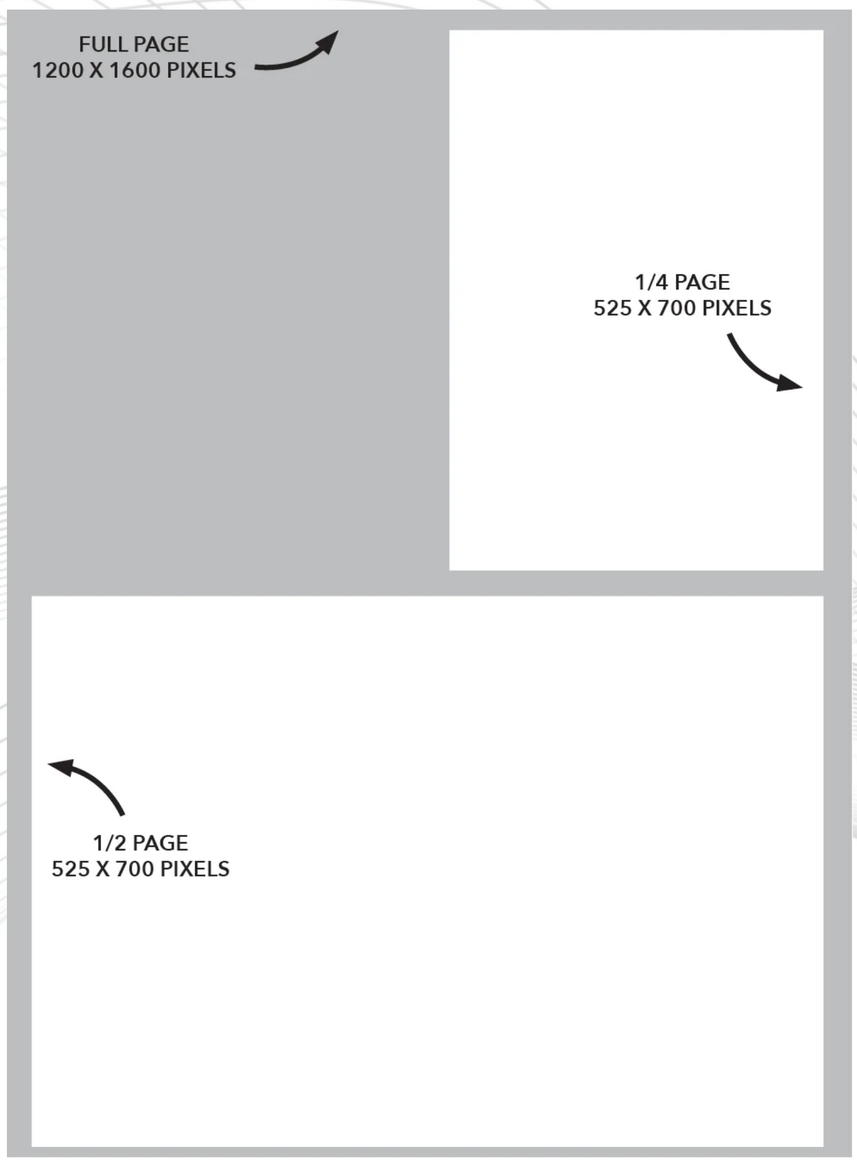

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