RFI #976465

City of Ann Arbor, MI – Sustainable Heating Request for Ideas and Qualifications

Ann Arbor, Michigan

June 9, 2023

Stantec

Contents

Stantec Consulting Services Inc.

1168 Oak Valley Drive, Suite 100, Ann Arbor, MI 48108

June 9, 2023

Reference: City of Ann Arbor, MI – Sustainable Heating Request for Ideas (RFI) and Qualifications

Missy Stults, PhD.
Sustainability and Innovations Director
MStults@a2gov.org

Dear Missy,

The City of Ann Arbor (the City) adopted A^{2}ZERO to achieve a just transition to community-wide carbon neutrality by 2030. We understand the City is currently seeking ideas on how to achieve a managed transition to clean, safe, healthy, reliable, equitable, stably priced, and decarbonized heating for all Ann Arbor homes and businesses.

As a team, we are proud to say Stantec has worked on some of the most complicated and progressive energy transition and sustainability-focused heating projects around the world. Our dedicated Climate Solutions team focuses on projects involving decarbonizing energy systems. We're impressed with what the City is exploring and we have brought together a team of Stantec experts to provide insights from past projects focused on sustainable heating systems at a city scale.

Experience: We have gathered an international team of technical experts, hailing from the US, Canada, England, and the Netherlands, to augment our Ann Arbor-based client manager. This group has direct and current experience working with clients specifically on distributed heat sharing networks. We realize that there are many pathways to achieve decarbonization, but we have focused our response on distributed heat sharing networks because these networks use a systems approach suitable to citywide change that is less reliant on individual behavioral decisions. We also acknowledge that a distributed heat sharing network is one part of a successful program and localized electrification (e.g., air-source heat pumps) will also be an important tool to deploy, especially for users that may be integrated into a heat network during later phases.

Familiarity: Stantec has supported sustainable heating projects ranging in size from campus-based to citywide systems. We perform feasibility studies and economic evaluations in the early stages of a project, analysis of existing networks, engineering support, and everything in between. Perhaps most relevant at this stage of your journey, our experts can provide guidance on technical-economic questions as well as the policy and governance aspects that are key to the successful deployment of a sustainable heating utility company. We also have expertise on the human front, with how to conduct the community engagement associated with adopting this form of system.

Ideas: In this RFI response, we have proposed initial ideas on what an Ann Arbor heating network might look like, provided reference to peer cities located around the world, and identified tools, risks, and mitigation strategies.

This project holds significant importance for our team because it represents an opportunity for us to help a US city implement deep change to a citywide heating system. We believe this work will be needed throughout communities in the US (as it has already begun in earnest in other regions of the world). Again, we commend the City for leading through example and exploring the options for sustainable heating. We look forward to continuing a strong relationship with the City of Ann Arbor, and the community in which we live, work, and play. If you have any questions or would like to discuss any aspect of this document, please feel to contact us.

Thank you for considering us to be your trusted partner.

Sincerely,

Jeff Schroeder
Senior Principal, Business Center Practice Leader
(613) 784-2232
jeff.schroeder@stantec.com

Curt Bjurlin
Vice President, Climate Solutions Leader, US
(608) 839-2033
curt.bjurlin@stantec.com

About Stantec

We are Stantec

Creating communities is our purpose.
Designing with community in mind is our promise.

Founded in 1954, Stantec unites more than 26,000 professionals in over 400 offices who provide professional consulting services. As a global design practice focused on creating better design at every scale, our philosophy is simple and holistic: Begin with the end in mind, from planning to design to construction to operations. Our proactive approach leads to greater participation from everyone touched by these projects. We routinely take ambitious ideas and concepts and turn them into iconic projects.

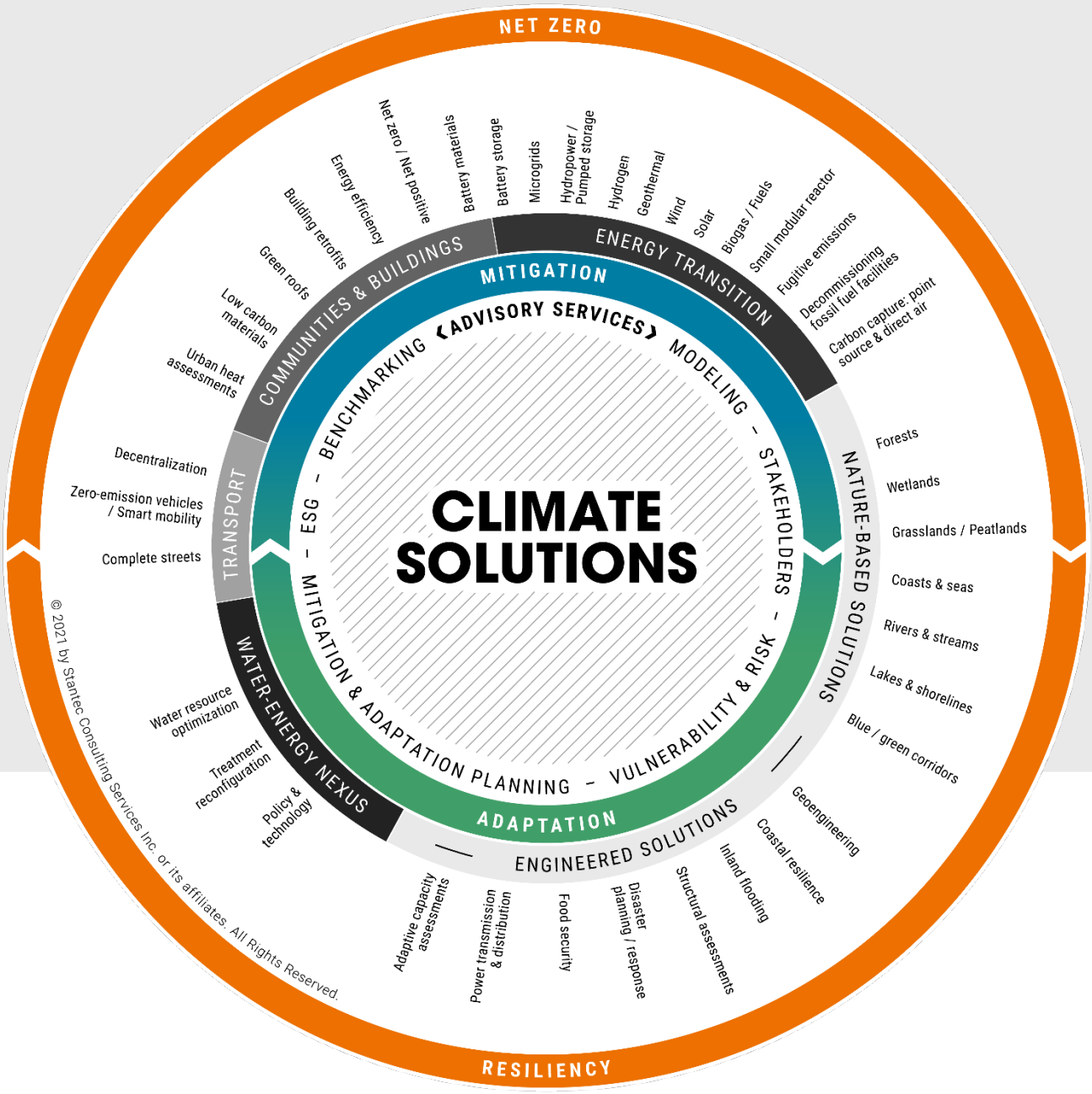
Stantec has been providing services for climate change planning, mitigation, and adaptation for decades. Our innovative Climate Solutions **helps our clients see every project through a climate lens**—then we help them act on their findings with expertise in net zero design, climate resiliency modeling, nature-based climate solutions, and more.

For more than 35 years, Stantec has partnered with the City of Ann Arbor on countless projects, including projects that have worked toward the City's commitment to achieve a just transition to community-wide carbon neutrality by the year 2030.

- Stantec was hired by the City for the Ann Arbor Hazard and Mitigation Plan and Climate Adaptation Plan. In addition to identifying cost, benefits, responsible entity, and timeline for the projects, we further enhanced the mitigation action plan by prioritizing mitigation actions using the following criteria: feasibility, equity (as tied to Ann Arbor Opportunity Index), climate resilience, public preference for project type, public perception of hazard of greatest concern, risk reduction, and cost.
- We performed an Ann Arbor Area Transportation Authority bus propulsion study, in which we completed emissions modelling to determine how greenhouse gases are reduced by a switch to zero emission bus technologies.
- We supported Ann Arbor Public Schools in improvements in heating, ventilation and air conditioning systems, lighting systems, and controls for ten schools, beginning in 2021.
- We provided Ann Arbor Charter Township a water system reliability study. We started by utilizing the hydraulic network analysis (HNA) model to model the existing system and ended with a report that was submitted to the MDEQ.

While this RFI is specific to ideas for sustainable heating, our diversified global platform of professionals allows Stantec to quickly bring the necessary integrated skill sets to the project as required. Our experienced sustainable heating specialists, paired with our broader Climate Solutions team, provide the value of a vantage point that interconnects sustainable heating with the broader A²ZERO goal of **community-wide carbon neutrality by the year 2030**.

In addition, we recognize that securing funding and leveraging tax credits and incentives is a critical component in helping the City affordably achieve these ambitious sustainability targets. Stantec has a North American Funding Program (NAFP) team comprised of more than 150 dedicated funding specialists in the US and Canada who work directly with our technical experts at various stages of project development to provide funding guidance. For 30+ years, Stantec has partnered with clients to successfully apply for grants and loans, securing more than **$6 billion in funding** for our clients' projects.



Our Approach to Climate Solutions

We recognize that to fulfill our promise to design with community in mind we need to consider climate change in our project work.

Stantec has assembled our climate services into what we call the Climate Solutions Wheel. Each of these areas represents an assemblage of services that we provide on a routine basis to our clients. By clicking on the hyperlink below, you can further explore these services, see project examples, read blogs written by our experts, and generally learn more about our team. Our portfolio of work includes countless projects for which we've led sustainability efforts and/or collaborated with a partner to achieve certifications through design.

Learn about the Climate Solutions Wheel.

Firm-specific Commitment to Sustainability

Our dedication to sustainability is mirrored in Stantec's corporate priorities. We achieved carbon neutrality in 2022 and are working toward net-zero emissions. In recognition of our corporate sustainability efforts in 2023, Corporate Knights ranked Stantec number seven globally, and number one in the firm's industry peer group, placing the company among the top one percent in the world on sustainability performance.

The primary evaluation in the Corporate Knights ranking is a company's percentage of "clean" revenue. Stantec's high ranking reflects the progress we're making in supporting the United Nations Sustainable Development Goals (SDGs) through our project work.

To fulfill our promise to design with community in mind, our project work considers issues such as climate change and social justice. We help our clients see their projects through these lenses—and then our designs bring these ideas to life, creating positive environmental and social value for the world.

We recognize our greatest potential for positive impact comes from the projects we deliver to clients.

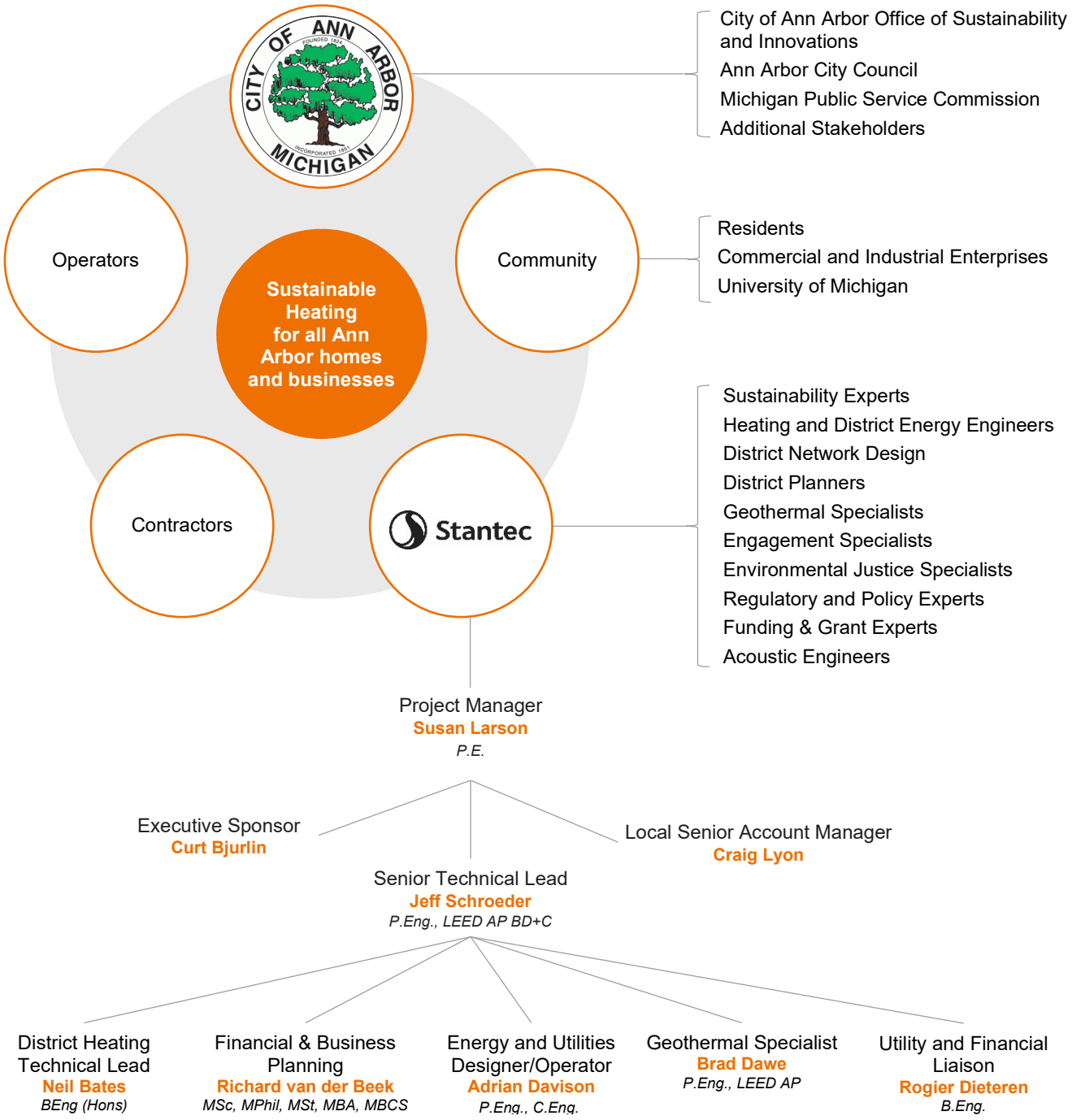
Stantec Annual Sustainability Reporting

Stantec issues an annual Sustainability Report highlighting our contributions to and focus on sustainability for our key stakeholders. The report identifies and provides information about Stantec's material environmental, social, and governance (ESG) issues and achievements.

View Stantec's 2022 Sustainability Report

Sustainable Heating Experts

As the City embarks on its sustainable heating journey, Stantec has developed the below preview for how a team might be built. Based on experience, we have found that these are the likely parties that will be involved, and a successful project will require both strong stakeholder engagement and diverse technical expertise. We commend the City for already initiating the stakeholder engagement process with this RFI. If asked to provide up front planning support, Stantec will work closely with the City to understand the expectations and drivers for this project and to bring together the necessary subject matter experts.



See Stantec's Key Personnel bios beginning on next page.

Susan Larson *P.E.*

Project Manager

Susan Larson, P.E., is an experienced leader with 38 years in the energy sector. She has managed numerous district energy heating and cooling system projects and utility-scale generation projects. Susan is a licensed mechanical engineer, managing project feasibility studies, development, regulatory filings, permitting, RFI/RFP, design, procurement, construction, and commissioning. She has managed projects at the Hennepin County Energy Center serving the Hennepin County Medical Center, and the addition of the Pittsburgh PNC Ballpark as an anchor tenant to the Pittsburgh District Energy Plant. As Engineering Manager, Susan has led chilled water and heating plant and distribution system projects at the Minneapolis Energy Center and satellite plants, including restoring the Foster House, an 1880s National Register of Historic Places building, to house a central cooling plant providing chilled water to the Minneapolis Federal Reserve. Susan's recent experience includes regulatory filings and project management of engineering services for self-generation and utility scale solar projects. She has led organizational development teams to establish a best practice engineering and construction Project Management Office (PMO). Susan prioritizes bringing all stakeholders to the table to ensure the inclusion of all parties to develop sustainable, efficient, equitable, and economical community infrastructure.

Curt Bjurlin

Executive Sponsor

Curt leads Stantec's Climate Solutions business in the United States. An experienced leader in the energy sector, Curt is knowledgeable in the delivery of climate change adaptation and greenhouse gas mitigation strategies. Curt has spent much of the last 18 years developing renewable energy projects both as an owner/operator and as a consultant. For these projects, Curt has organized and participated in countless stakeholder engagement discussions. One area of technical expertise for Curt is leading Stantec's linear infrastructure routing and siting technical team, in which he has worked for most of the largest utilities in the United States. His routing skill set will be of critical use during the route evaluation phase of a district heating retrofit. As executive sponsor he has assembled the team in this response and will stay connected with the City to make sure the best of Stantec's technical experts are available.

Craig Lyon

Local Senior Account Manager

Craig is a strategic leader located in Ann Arbor with 22 years of management and hands-on government experience. He brings lessons learned through his successful planning, management, and oversight of municipal public services departments with combined department budgets totaling over $30 million. He skillfully establishes organizational objectives and successfully builds and leads large, high performing, multi-disciplinary teams in municipal departments including Water and Sewer, DPW, Engineering, Planning, Building, Solid Waste/Compost, and Call Center. He leads with a keen focus on and aptitude for continuous improvement efforts including capital improvement project development and implementation, revenue, and budget growth, and developing relationships with outside agencies to accelerate project permitting and funding opportunities. He is adept at quickly developing trusting relationships with multiple stakeholders to align with a common goal.

Jeff Schroeder *P.Eng., LEED AP BD+C*

Senior Technical Lead

Jeff is a Senior Mechanical Engineer with 19 years of experience specializing in district energy systems, cold climate design, and sustainable buildings. Jeff is committed to providing exceptional service to his clients. He has worked on a number of campuses and complex buildings for commercial, institutional, and federal clients. Jeff's project experience includes Central Heating and Cooling Plants, hospitals, primary and secondary education, laboratories, corporate offices, and city protective services (fire and police).

As Senior Technical Lead, Jeff provides leadership on multi-disciplinary teams through all project phases – from initial project pursuit through programming and visioning, design, and project execution. A strategic thinker, Jeff works closely with the project team to draw out innovate and sustainable solutions, while aiming to keep solutions simple to operate and maintain. Jeff combines his knowledge from design, building information modeling (BIM), construction, and commissioning to provide effective coordination and communication.

Jeff has worked on the concepts, design and construction of mechanical and plumbing systems that exceed current building practice standards, such as geoexchange heating and cooling systems, river water cooling, thermal storage, ambient loops, biomass heating, combined heat and power (CHP), and cascading hydronic systems.

Neil Bates *BEng (Hons), ACIBSE*

District Heating Technical Lead

As an experienced, mechanically focused Building Services Engineer, Neil's recent experience across a number of decarbonization and district heat networks will bring design experience to this project. Neil has supported and led many projects across sectors, including defense, retail, commercial, education, and healthcare. With a passion for energy efficiency, and sustainability, Neil has undertaken many decarbonization studies, using innovative techniques such as network modelling, to run simulations and investigate options. He is a driven individual who can work within a team as well as lead a design team to program and on cost. Neil's experience across many recent decarbonization and district heat networks will provide value to this project.

Richard van der Beek *MSc, MPhil, MSt, MBA*

Financial & Business Planning

Richard is an experienced consultant working on the interface of Science, Business, and Policy, with particular interests in Finance, Energy, Supply Chain, and the Rural Economy. He focusses on business cases and financial models for district heat networks, solar energy, and energy storage. Richard has advised various local governments on large-scale district heating projects, covering the political and administrative decision-making process, participation and involvement of the local community, analysis of available heat sources, technical and financial modelling of existing and proposed networks, and governance structures where governments actively participate in constructing and exploiting heat networks. He also advises on funding, such as (inter)national grants or equity and debt from national promotional banks and institutions, commercial banks, and the European Investment Bank. Recently he wrote grant applications for € 35,000,000 in district heating subsidies on behalf of two Dutch cities.

Adrian Davison *P.Eng., C.Eng*

Energy and Utilities Designer/Operator

Adrian is a commercially and operationally experienced energy and utilities professional engineer with over 30 years of experience in district energy, power generation, and energy efficiency for power generation utilities, industrial, and municipal clients. His experience extends to operating and optimizing district energy and industrial heat and power networks, creating, and executing biofuel supply chains, carbon strategies, and detailed designs of power facilities. Adrian's involvement in low and zero carbon heat and power generation projects spreads across North America and the United Kingdom. In addition, Adrian is a Six Sigma Blackbelt and is skilled at creating and executing original business strategies from concept through construction into commissioning for regulated power processes. He has been engaged in the design, construction, and operation of first-in-class systems and contracts, increasing viability and leading cross functional teams with P&L accountability. Notably, Adrian worked on the design and permitting of the 2012 London Olympic energy centers and has experience trading power and renewable credits and purchasing heat and power systems.

Brad Dawe *P.Eng., LEED AP*

Geothermal Specialist

Brad brings nearly 20 years of experience in mechanical system design for buildings, including defense, public safety, healthcare, commercial, institutional, and industrial facilities. Throughout his career, Brad has played a major role in the design and delivery of several dozen small and large scale vertical closed loop geoexchange projects, for both new construction and retrofit projects. He has extensive experience as design lead and providing subject matter expertise to geoexchange system designs ranging from small light commercial projects to large institutional projects. Brad specializes in designing cost effective mechanical systems that meet project requirements for reliability, maintainability, security, sustainability, and indoor air quality. He has a sustainable design focus with involvement in dozens of LEED certified projects ranging from LEED Certified to Gold, many of which include high-performance geothermal systems.

Rogier Dieteren *B.Eng.*

Utility and Financial Liaison

Rogier brings over 20 years of experience as an environmental and acoustic engineer, focusing on innovation and sustainability, predominantly in the public sector. Rogier works with political and administrative leaders in local governments to develop district heating projects and advises on facilitation or direct participation in heating utility companies. Additionally, he has designed projects tackling Energy Poverty for various cities in The Netherlands. Rogier had a fundamental role in setting up the sustainable heating utility company 'Groene Net' in The Netherlands. He not only founded the company, but also saw the project through the implementation and exploitation stages as development director. Rogier is known for "taking his job home", where he has installed an energy storage system, heat pumps, and over 100 solar panels.

District Heating Peer Communities

Over the following pages, we've assembled a brief description of communities that are similar in size and/or other characteristics to the City and may offer insight into how the City can implement a sustainable heating system. We would be happy to provide more information on these communities in an open discussion with the City or provide direct introductions to representatives from these communities.

City of Groningen

Groningen, The Netherlands
2021 - ongoing

The capital of the north, Groningen is a university town with over 230,000 inhabitants, consisting of a moated mediaeval city center surrounded by a dense urban geography. The city is located just east of the Groningen gas field, one of the largest in the world. Until recently it was the base for natural gas production in The Netherlands.

Since 2021, Stantec has been advising the City Council and the local heat utility company (jointly owned by the City and the local water company) on expanding the existing district heating infrastructure to encompass all areas surrounding the city center. In the current phase, this involves the development of a business case and technical/financial model for connecting an additional15,000 houses, the university hospital, university campuses, and new heat sources. Stantec is actively involved in securing funding for this project and participates in talks with funding bodies, public banks, and the European Investment Bank. Stantec has recently helped the City submit a grant application for € 22,000,000.

Geothermal energy is a politically sensitive topic and there is potential seismic risk in Groningen due to its gas mining history. Instead, the heat network will utilize solar thermal energy, residual heat from data centers and a sugar factory, and bio-fuel peak and back-up facilities. In the future, residual heat from the Eemsdelta Seaport will complement this.

City of Amersfoort – Heating Feasibility Studies

Amersfoort, The Netherlands
2021 - ongoing

The city of Amersfoort is located in the middle of The Netherlands and has 160,000 inhabitants. Within Amersfoort, three private companies operate existing district heat networks. In light of a Bill currently being discussed in Parliament, which would enforce a minimum 50%+1 public ownership of heat networks, and the city's ambition to transition from individual gas-fired boilers to more sustainable solutions by 2030, Stantec has been asked to investigate how the City can facilitate or participate in the expansion of the heat network(s) in Amersfoort.

Stantec is performing availability and feasibility studies into potential sources (geothermal, aquathermal, biomass, residual heat, and heat from wastewater), modelling the network, and creating business cases to visualize impacts of various choices. In addition, our team is advising the City Council on governance choices available to them under the new law. Together with the City Council and one of the heat companies, Stantec has just submitted grant applications for national funding of two expansions of the network, to commence construction in 2024.

Kingston University – Heat Decarbonization Plan

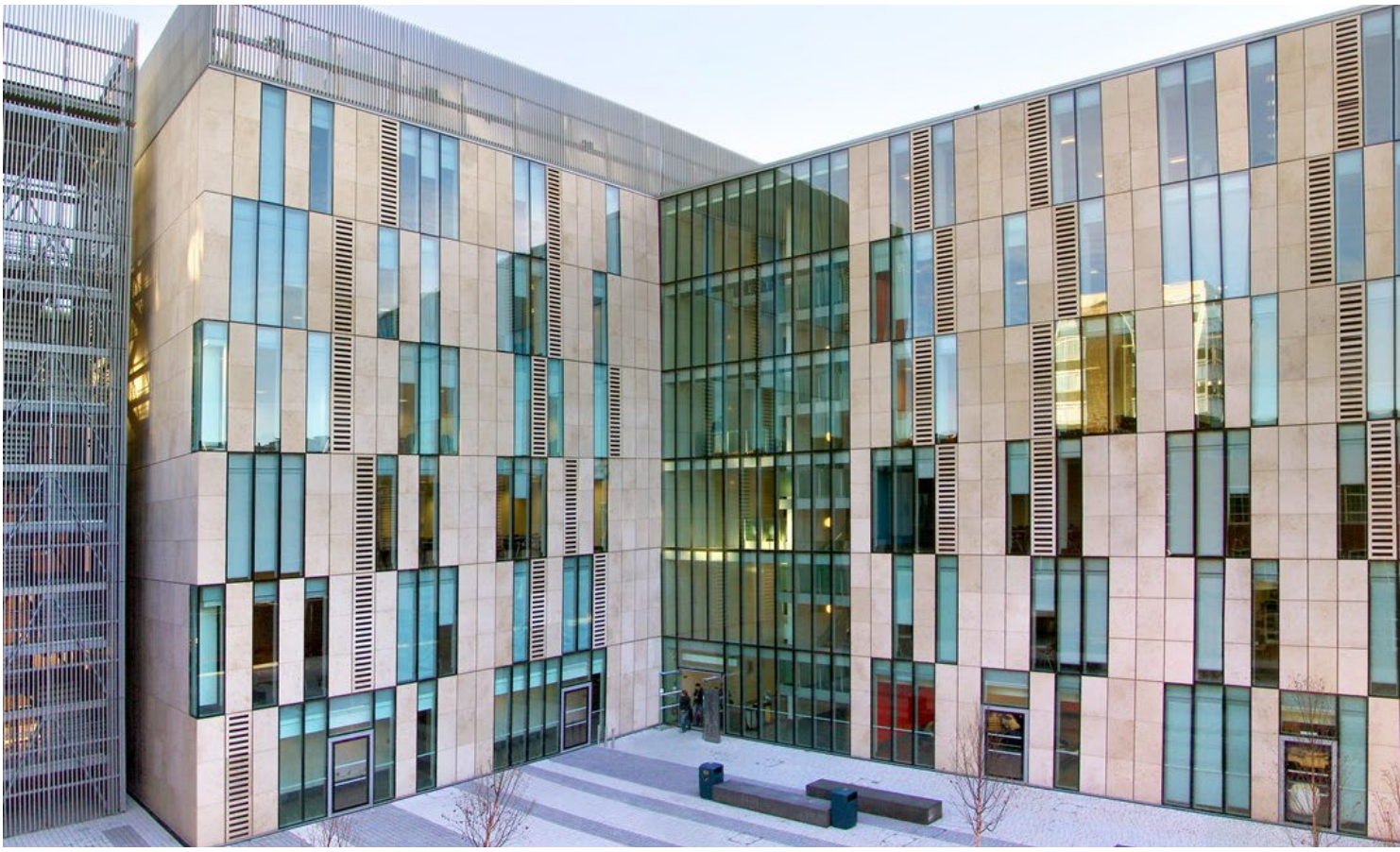
Kingston Upon Thames, London, England
2021 – ongoing

The Royal Borough of Kingston (RBK) has a population of roughly 170,000. A largely urban environment, it is home to Kingston University (the University), a highly recognized university that accommodates a wide range of facilities including Engineering and Life Science laboratory blocks.

Stantec has worked with the University to develop Decarbonization Strategies across four campuses providing the University with a series of projects and interventions to strategically phase out the University's reliance on fossil-fueled heating and hot water generation and support the delivery of a Net-Zero campus by 2038.

Stantec have subsequently been appointed to provide the University with specialist Mechanical, Electrical and Sustainability Consultancy to implement the recommendations of the Heat Decarbonization Plan across their main Penrhyn Road campus, including the construction of a new Energy Centre.

Key to the success of this system is the connection to the proposed District Heat Network. Our team has worked closely with RBK and their specialist consultant, to inform the design criteria and business case. The system will utilize heat recovery from a local foul water treatment works, combined with heat pumps, which will be a first in the UK. The project has required a top-down and bottom-up approach to future estate planning. An appreciation of the holistic influences on decarbonization strategies by the University team means that the road map will be integrated and deliverable – alongside the other drivers on a large-scale university campus.



Canadian Federal Government – Ottawa – District Energy Modernization

Ottawa, Ontario and Gatineau, Quebec, Canada
2014 – ongoing

$1.1 Billion Energy Services Acquisition Program (ESAP) district energy system modernization connects over 80 buildings (21 million sqft) in Ottawa, including the Parliament Buildings. The program's goal is to reduce greenhouse gas emissions (GHG) in operations by 63% by 2025, while adding safety and resiliency. A deeper greening initiative is underway to further reduce GHG emissions by 90%. Many of the buildings that were part of the scope were heritage or had 24/7 operations and therefore implementation planning was needed to support seasonal constraints.

In collaboration with the client, Stantec provided multidisciplinary engineering support, including project management, mechanical, electrical, structural, architecture, landscape, civil, geotechnical and geomatic surveys, and was further supported by specialized contractors. Stantec engaged with multiple stakeholders throughout the program of work, including client teams for smart buildings, energy services, utilities management, building operators, and users.

Services provided include:

- Business case development and project risk analysis.
- Cost estimating and life-cycle cost options analysis.
- Evaluation of energy center modernization solutions including cogeneration, thermal storage, biomass, river water free cooling (geoexchange), system redundancy and similar energy and load management options.
- Feasibility and Schematic Designs, including detailed site surveys, assessment of high-pressure steam, condensate and chilled water distribution, seasonal peak calculations and testing, calibrated load calculations, systems options analysis, seismic evaluations, major equipment selections, system schematics, control diagrams, laser scanning paired with 3D modeling, and user group presentations.
- Development of technical and performance standards for district energy system modernization and conversion.
- Enhanced Detailed Design including development planning, renderings, cost estimating, phasing and implementation planning, and virtual 3D walkthroughs with facilities teams.
- Construction Document design reviews for third party operator and for deeper greening initiative to further reduce greenhouse gas emissions.
- Construction Administration services including shop drawings and site inspections.

Sustainable Heating Approach

Sustainable heating can be achieved through numerous pathways, including a distributed heat sharing network (district energy) that can utilize waste heat and low carbon heat generating sources. A complementary technology includes localized electrification (e.g., residential air-source heat pumps). The reason these technologies are often paired is because distributed heat sharing networks, by their nature, need to be phased by region and user. Localized electrification provides a decarbonization solution that is readily available and easily deployable for customers that will be in future phases of interconnection to a heat sharing network.

A distributed heat sharing network's strategic advantage is that it is a system approach (does not rely on individual behavioral change) and includes the interconnection of many types of low carbon heat generating technologies that can be developed at scale to support the greater community.

With decades of district energy experience supporting clients in creating, expanding, and modernizing district energy systems, we have established steps that result in a dependable approach to implementation. For the City of Ann Arbor, Stantec can serve as a partner to progress the project through technical feasibility and planning. As this partner, we have found the following methodology to be effective:

1. **DATA GATHERING**

This phase would seek to identify the potential customers, technologies, demands and locations.

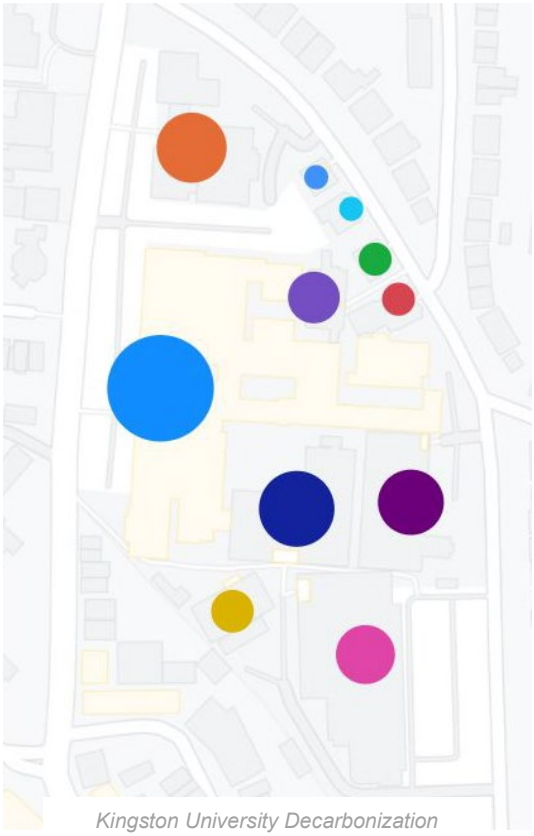
A "heat map" showing the density of demand, coupled with potential sites for heat generation can quickly demonstrate potential heating solutions and distribution routes. The graphic on the right demonstrates a simple heat map, the larger the dot, the greater the demand.

Data used in developing demand could include actual meter data or modelled data, combined with surveys and engagement with the local businesses and residents.

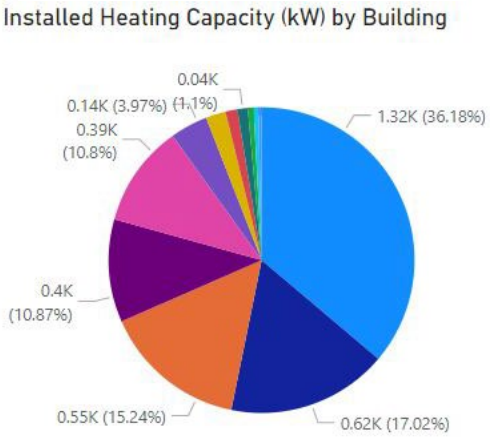
This stage would also include a high-level assessment of potential energy generation technologies, using a RAG (Red Amber Green) scoring technique to rank them on criteria such as capital and operational expenditures, impact (Carbon emission savings), space demand, noise, and other environmental impacts.

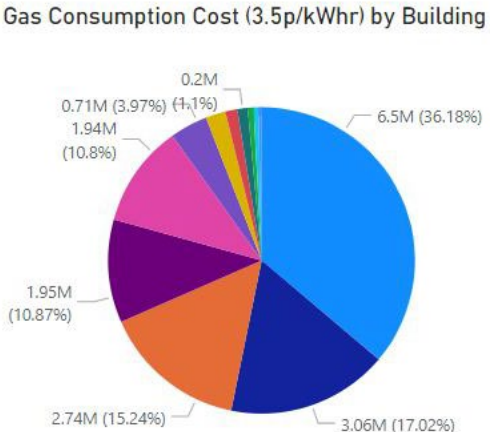
2. **DATA ANALYSIS**

The data would be assessed to determine total simultaneous demand. The heat demand profiles for different areas of the city can be overlayed and combined with reasonable diversities to inform the total demand requirements. The demand profile influences the combination of sources and system designs that are best suited and the sustainability impacts of these choices. In our experience, distributed energy sharing systems are typically best suited for dense community areas.

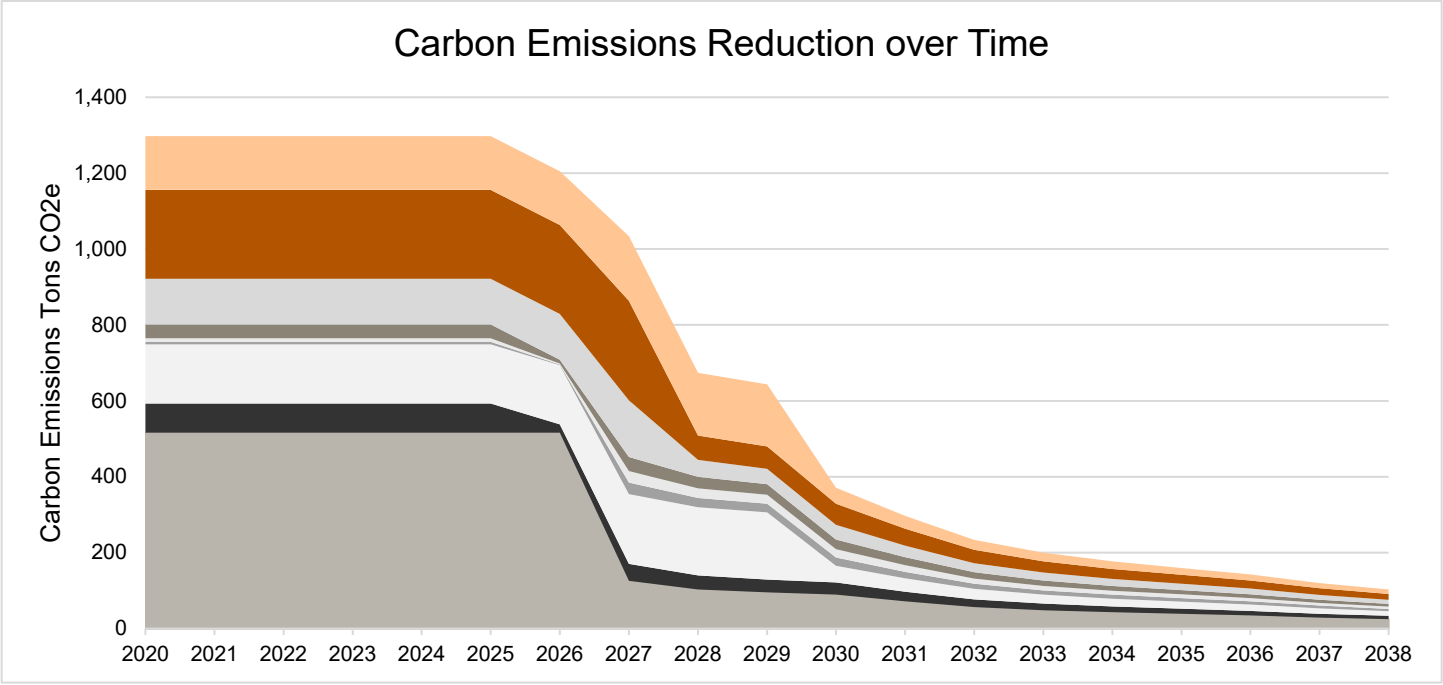


Kingston University Decarbonization Study: Example Heat Mapping Diagram





The graphics above are an example of analysis of existing heating demand used as a "baseline" from which optioneering was undertaken / sustainable



The graphic above shows how total carbon emission for a Stantec client was estimated to be reduced from circa 1200 Tons CO2e in 2020, towards zero in 2038, each band indicating a separate intervention.

3. PRACTICAL CONSTRAINTS REVIEW

Both the development of a distributed heat sharing network and localized electrification would be disruptive. Key to delivering a high-quality, successful project is the consideration of practical constraints, including the routing of a Heat Network. Opportunities, such as locating pipework within sidewalks to minimize traffic disruption, safe-work considerations, and coordination with other utility providers to combine work with other upgrades, should be explored. As this stage develops, iterations will inform costing and sequence phasing.

4. BUSINESS CASE

Sustainable heating must be financially and economically viable. History has taught us that plans eventually fail if they cannot be appropriately funded, not only through their implementation, but into the future with best-practice maintenance, operations, and continued evaluation to refine and improve the system.

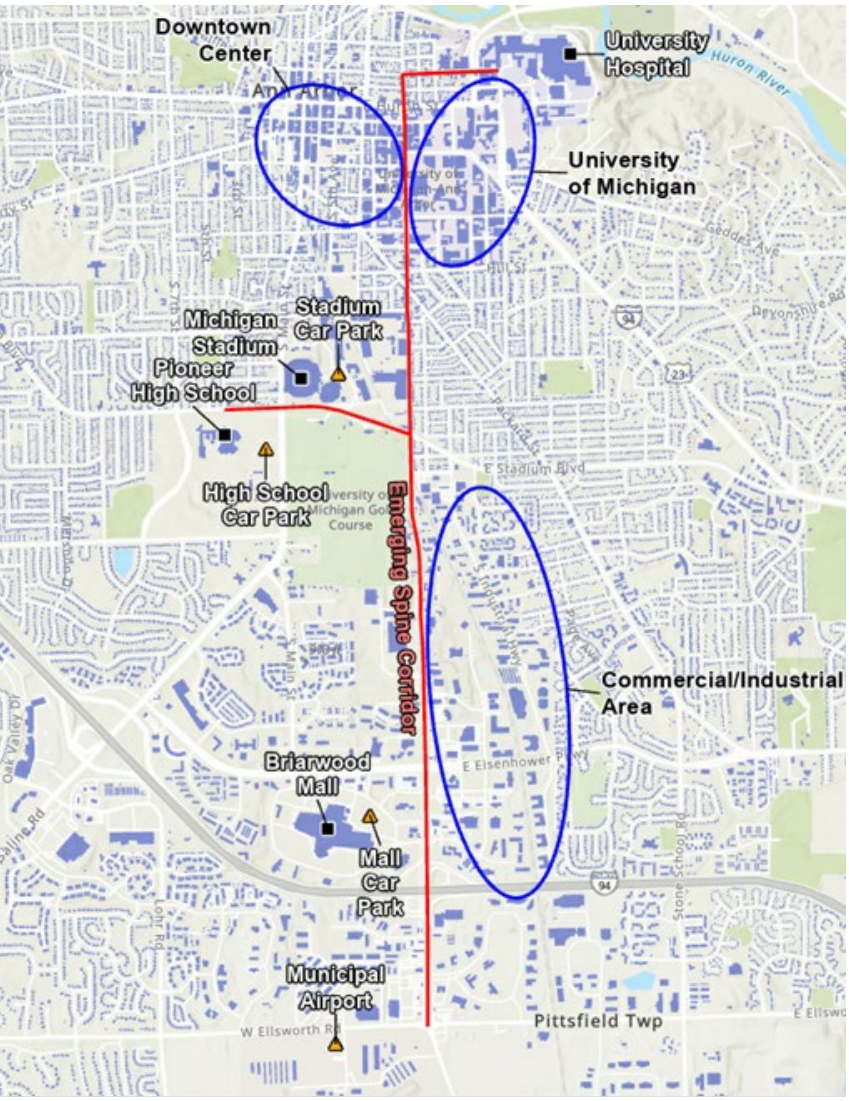
Our financial analysts, combined with our experience in operating energy supply companies, would develop a robust business case to confirm that the plan is viable, while also providing insight into the effects of design, implementation, and governance choices.

5. COMMUNICATION

The above steps would be collated into a series of documents, both technical papers to inform funding backers, and graphics boards and development of a website to provide awareness and support within the community. Support from the community is critical to the buy-in needed for a viable plan. Further steps can include workshops at local schools and community centers, virtual public meetings, interviews on local news streams, and billboard messaging.

Conceptual Ideas

Undertaking a review of the geography of Ann Arbor has raised some initial concepts to spur conversation. The development of a sustainable heat sharing network will need to include large anchor tenants and suitable energy center locations. Potential sites are highlighted on the plan below. This concept is not intended to be comprehensive, but rather to show the types of anchor tenants, energy center locations, and corridors that could be evaluated.



POTENTIAL ANCHOR TENANTS

- City Buildings
- Pioneer High School
- Malls
- Crisler Center / Michigan Stadium
- University Campus Buildings
- University Hospital

Additional tenants could include buildings in the downtown center and commercial and industrial areas, followed by individual residences and smaller businesses.

POTENTIAL ENERGY GENERATION LOCATIONS

Energy sources can include wastewater heat recovery, industrial waste heat, and large areas of land for vertical geothermal heating. Potential locations could include:

- Large trunk sewer heat recovery
- Pioneer High School
- Michigan stadium parking lots
- Airport parking and fields
- Mall parking lots

EMERGING "SPINE CORRIDOR"

Mapping these potential tenants and potential Energy Center locations has highlighted a potential "spine corridor" for a heat network, potentially creating the initial infrastructure that could be extended over subsequent phases to serve proximate properties.

OFFSETTING INCREASED ELECTRICAL DEMAND

Moving towards a net carbon zero solution will likely have a significant increase in electrical demand. To mitigate high infrastructure costs, and provide a stable electricity consumption cost, it is recommended renewable electrical energy solutions are sought, which is in alignment with the A²ZERO plan for increase of solar and battery renewables. Hydroelectric power from nearby dams could also be considered a renewable electricity source.

Potential Risks

Potential risks should be considered when delivering a Sustainable Heating Strategy. While not a comprehensive list, Stantec has identified the following risks associated with preparation and implementation based on our experience with sustainable heating programs.

DATA ACCURACY

Risk: The accuracy of the available data will be critical to the decision-making process. The age and condition of buildings can heavily influence the priority and sequence of work, while energy consumption data will drive implementation as well as anticipated carbon reductions.

Mitigation: This risk can be mitigated by allowing suitable time at the data gathering stage for obtaining as accurate a representation of data as possible. Stantec would work closely with the City's Sustainability team and the local community to obtain energy consumption data. The new commercial benchmarking ordinance will be very useful for this task.

CHANGE OF USE / NEW DEVELOPMENTS

Risk: While the data gathering exercise will assess historical demands, this will not reflect any proposed change of use or new development that may be implemented in the future.

Mitigation: Any forethought or vision towards change in energy consumption profiles should be considered to accommodate future flexibility and scalability in the installed services.

SPACE

Risk: Space is always at a premium, especially in city center locations. Identifying potential locations for energy generation close to the demand will be a challenge, and routing of the heat sharing network should be carefully considered.

Mitigation: Our geographic information systems and 3D design software would be utilized to coordinate service routes below ground to mitigate impacts and delays during construction.

INSTALLED SERVICES CAPACITY

Risk: Regardless of the decarbonization approach, there will be an increased demand on the electrical infrastructure.

Mitigation: Through the data gathering phase we would liaise with local utilities to identify constraints, opportunities, and scale of interventions required that may influence the proposed solution and recommendations.

COST

Risk: While there are challenges with respect to space, potential disruption, planning conditions, and the like, the financial cost for implementation of large-scale heat sources as well as connecting individual users with lower heat demand may be difficult to overcome.

Mitigation: The preparation of a robust business case is necessary for a successful project. Considerations can be given to:

- Phased installation starting with anchor clients, resulting in phased capital expenditure.
- Modular energy center solutions to mitigate replacement costs and allowing flexibility as the solution expands.
- Carbon cost. The reliance on fossil fuels is a significant cost to the environmental. While not directly translatable into currency, the environmental cost reduction of the proposed solution must be considered when reviewing potential solutions.
- Government grants to reduce investment and/or operational costs. Stantec supports numerous clients with grant applications, including research and monitoring of available grants, writing and technical capabilities with experience in district heating funding.

UPTAKE

Risk: A distributed heat sharing network is a collective solution, much like the existing energy networks. For it to be a viable solution, however, there needs to be sufficient uptake to justify investments in sources and infrastructure.

Mitigation: Stantec would support the City in highlighting the benefits of a heating network. The City will have an active role in promoting the system to the community, providing funding opportunities for small consumers, or an ownership role in the heating utility to improve uptake (and thus mitigate the cost risk).

DISRUPTION

Risk: All construction work involves an element of disruption, be it temporary road or sidewalk closures for excavation, construction noise, or movement of materials to/from the site.

Mitigation: Careful planning of the network routing, the sequence of installation, and coordination with other utility providers should be considered to minimize disruption. Other considerations include pre-fabrication reducing the time required on the construction site.

Technologies

FUTURE CLIMATE AND RESILIENCY

The changing climate will place additional burdens on infrastructure, both in terms of required energy use and the need for more robust design and construction to deal with extreme weather events. This creates an opportunity to further justify high performance low carbon energy development that can adapt to future climate conditions.

INTEGRATION OF RENEWABLE ENERGY ASSETS

The need to achieve zero carbon operations means that non-traditional and distributed generation sources must be integrated into the solution. Opportunities exist to diversify energy sources which improves resiliency and reliability and lowers overall cost of supply. Establishing a plan for generation infrastructure to accommodate future diverse energy sources improves flexibility and allows for future innovation.

OPTIONEERING

During the concept and data analysis stage, we would consider all low carbon energy technologies. Each solution has advantages and disadvantages, ranging from capital and operating costs, space demand, environmental impact, and carbon emissions saving. An initial high-level assessment of each technology would be undertaken to identify the most feasible solutions which could then move forward for more detailed analysis.









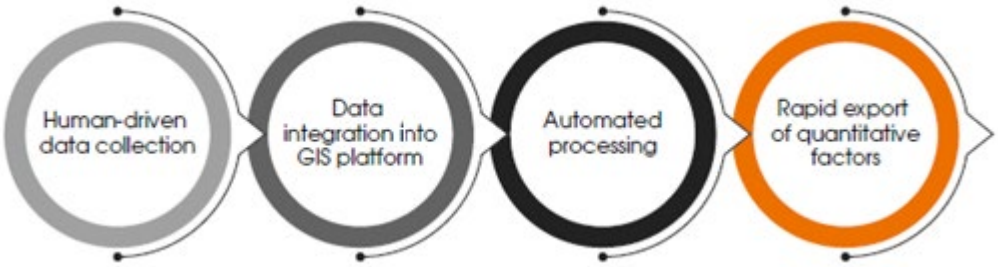


Tools and Techniques

Stantec utilizes a wide range of tools and techniques to develop sustainable heating and zero carbon energy strategies.

GEOGRAPHIC INFORMATION SYSTEMS (GIS)

The power of modern GIS is in the ability to perform accurate, real-time data analysis and data sharing. Our team has developed an agile, easy-to-use **WebMap Platform** that facilitates the sharing of project-specific data with project stakeholders. When it comes to routing complex linear infrastructure, our **GIS Accelerator** tool expedites the analysis of segments, end-to-end routes, and suitability of hubs for a variety of criteria. Used together, the WebMap collaboration environment and GIS Accelerator tool creates a best-in-class GIS toolset for siting complex energy infrastructure.

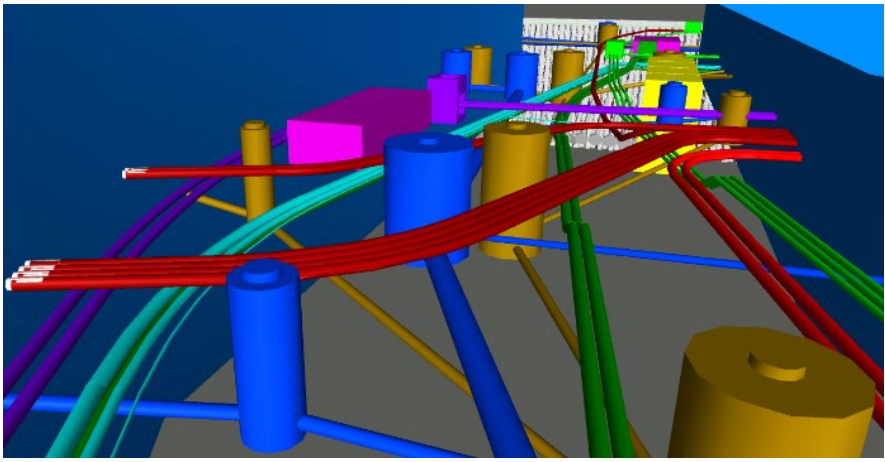


BUILDING INFORMATION MODELING (BIM)

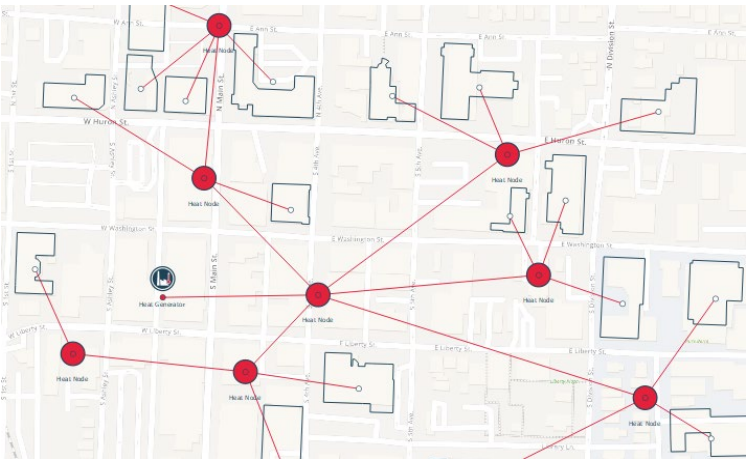
3D modelling of the existing utility services and overlaying a sustainable heat network will provide a key resource in the detailed planning of a system.

Coordination will allow pre-fabrication of elements of the network, will mitigate interference, and reduce delays during construction.

Our expertise with Civil and Mechanical Engineering and 3D modelling will be critical to the successful delivery of the system.



BIM 3D image coordinating below-ground utilities.



2D Virtual network modelling, building a schematic arrangement for network analysis.

ENERGY MODELLING

Energy modelling will be required to profile the energy demand, the potential impact of interventions, and inform system sizing and solution types.

This can be developed in fine detail based on actual building data, or as a high-level assessment for speculative new construction where the detail has yet to be defined.

IES Virtual Environment is a tool Stantec uses to prepare a 3D model of a project and build occupancy and usage patterns, to accurately assess the performance and energy profile. These are then utilized within the IES “CD” and “iVN” packages to assess city wide systems.

The image below includes a small proportion of Ann Arbor, centered on the intersection between East/West Huron Streets and North/South Main Street, with a “Virtual Heat Network” connecting a hypothetical “Heat Generator” to the buildings via a series of “nodes” representing heat interface or “sub stations”.

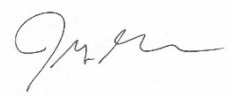
Simulations can then be run with alternative heat generation sources, adding (or removing) properties, and adjust the sequence of the network “nodes”. These will enable the optimization of the initial phases whilst allow flexibility for future expansion and “what if…” optioneering.

In Closing

We hope this package has provided useful information to the City as you implement your plan for a city-wide sustainable heating system. Stantec would be pleased to partner with the City to provide consulting during the planning phase of this project, drawing on our global expertise in sustainable heating design, financing, and implementation. Together, we could develop a clear roadmap for a viable, phased, sustainable heating system. We would be happy to start this work at your convenience under a suitable contract mechanism. We believe our expertise in this area makes us uniquely qualified to provide the City with this critical planning support.

Please reach out to us for further discussion.

Sincerely,



Jeff Schroeder
Senior Principal, Business Center Practice Leader
(613) 784-2232
jeff.schroeder@stantec.com

Curt Bjurlin
Vice President, Climate Solutions Leader, US
(608) 839-2033
curt.bjurlin@stantec.com