UBC Smart City Annual Report

May 2023

Department of Civil Engineering

Captain's Letter

Dear Reader,

Our second year as an official engineering design team has come to an end. With a 50% increase in our sponsorship revenue, I am more than excited to present you the progress and achievements our team has made over the past year.

Led by Ezekiel, our energy team undertook the Geothermal Feasibility Study project that encompassed predictive modeling for geothermal resource assessment, economic analysis, and the design of a geothermal power plant. Our transportation team, led by Sijan, created the Safe Walk app, a solution that allows users to request walks from certified and trained walkers anywhere from UBC. Finally, under my leadership, we enhanced our previous multiple linear regression model to accurately predict the base load and storage needs of intermittent power sources.

We extend our gratitude to our sponsors and the hardworking members of our team. As we move forward, we remain resolute in our commitment to engineering intelligent products and conducting sustainability research that contributes to the development of smarter, greener cities. Moreover, we will continue to foster a culture of excellence—one that upholds the values of hard work, collaboration, and innovation.

Sincerely,

Peter Kim
Captain, 2022-2023

Sponsors

Gold

CITYSAGE

Citysage offers a comprehensive suite of intelligent solutions that enable organizations to manage sites effectively by measuring and reporting on a wide range of data. Our advanced sensors and platform work together seamlessly to deliver solutions to complex problems, with the goal of creating more sustainable cities. Our smart systems enable organizations and municipalities to make informed decisions and respond efficiently to potential issues.

Deloitte.

"Deloitte" is the brand under which tens of thousands of dedicated professionals in independent firms throughout the world collaborate to provide audit, consulting, financial advisory, risk management, tax, and related services to select clients.

FLUOR®

Fluor Corporation is building a better world by applying world-class expertise to solve its clients' greatest challenges. Fluor's 40,000 employees provide professional and technical solutions that deliver safe, well-executed, capital-efficient projects to clients around the world. In 2022, Fluor was ranked 259 among the Fortune 500 companies. With headquarters in Irving, Texas, Fluor has provided engineering, procurement and construction services for more than 110 years.

Bronze

ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA

*Please refer to our sponsorship package [1] or contact ubcsmartcity@gmail.com if you are interested in supporting us!

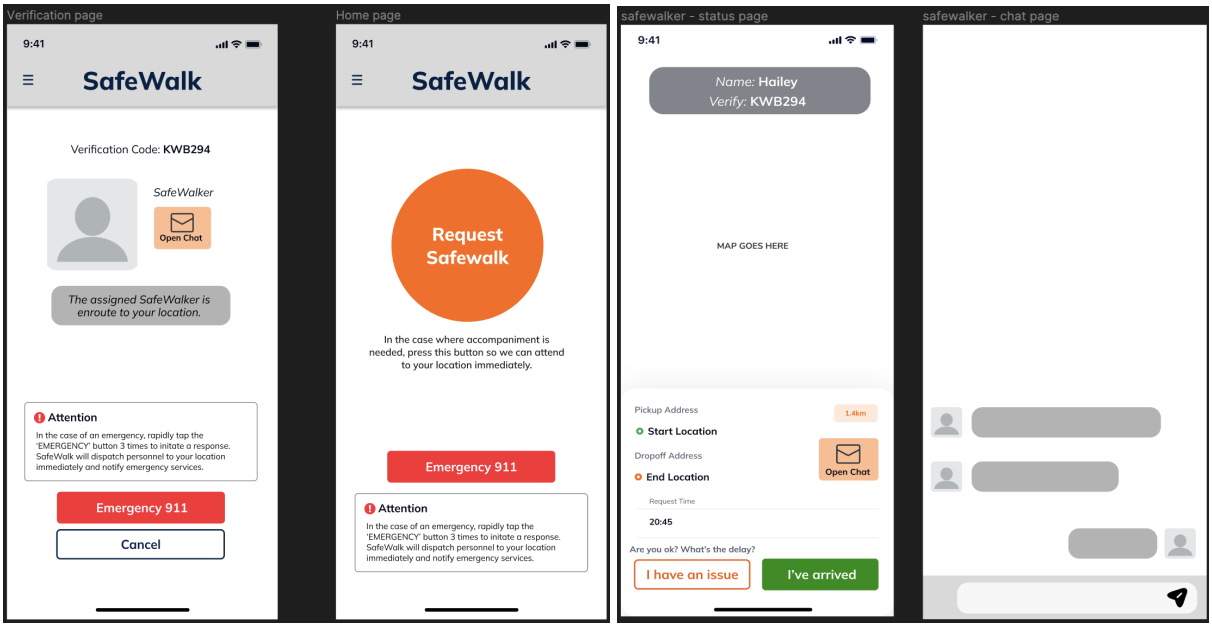
Portfolio

Safewalk App | Led by: Sijan Poudel

Throughout this year, the transportation team has dedicated efforts towards the development of the UBC SafeWalk application. This innovative mobile app facilitates the process of requesting a walk, where certified and trained safewalkers can accept the task of accompanying the requester to their destination, and only individuals with the necessary credentials can undertake the safewalker role.

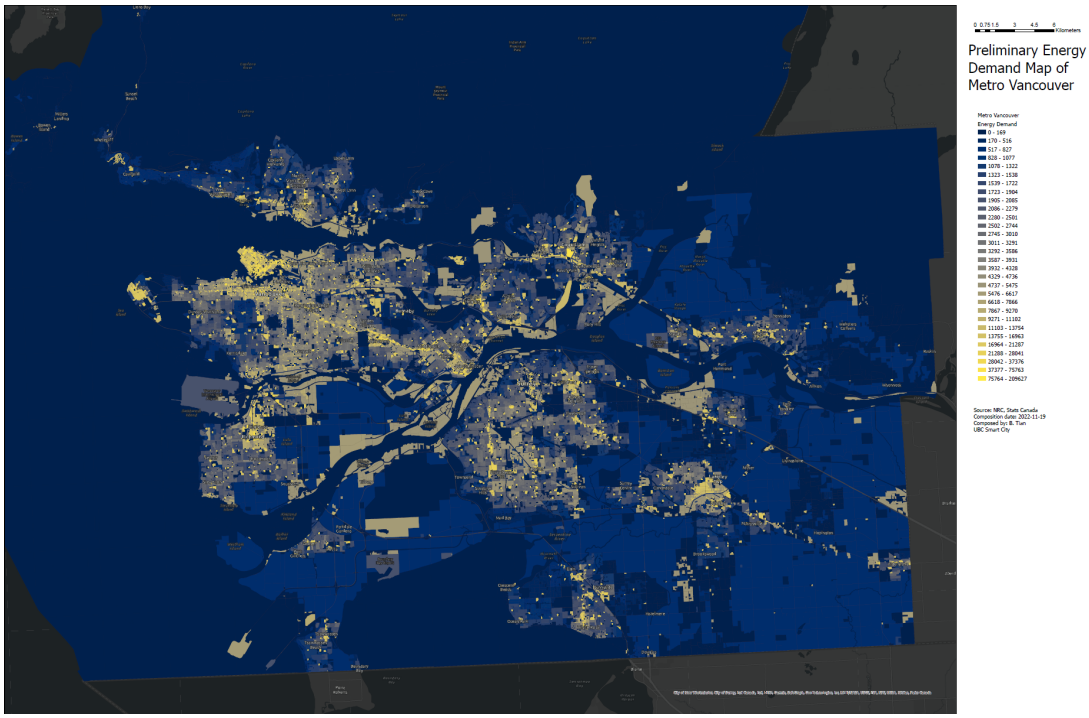
The app allows users to easily request the walk, sharing their current location and destination with ease through the app. Upon submission of the request, the user will receive a verification PIN, providing an added layer of security to an already safety-focused service. The user is then promptly matched with the designated safewalker, streamlining the entire process and ensuring that the individual can access the necessary assistance quickly and efficiently.

The newly designed SafeWalk app not only provides a valuable service for the community but also has the potential to extend its reach to other health and safety resources. The app instills a great potential for smart cities, and we hope the development of this app grows beyond the UBC community.

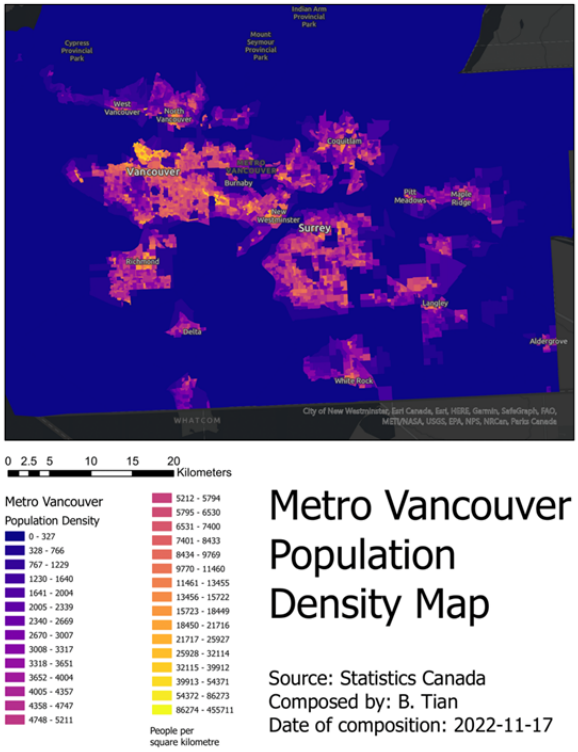


Geothermal Feasibility Study | Led by: Ezekiel Camacho

The Energy Team's core project for this year revolves around the integration of geothermal systems into British Columbia's energy grid. Geothermal energy, derived from the high temperatures of underground rocks, is found abundantly in various regions around the world, particularly along the Pacific Ring of Fire known for its significant seismic and volcanic activity. Having situated along the Pacific coast, British Columbia is highly favorable for geothermal development. The region boasts a range of subsurface temperature gradients and hotspots, making it conducive to harnessing geothermal energy efficiently and sustainably. Unlike fossil fuels, geothermal energy is widely recognized as a low-carbon energy source in its operational phase, which makes it an ideal solution to the global decarbonization challenge.

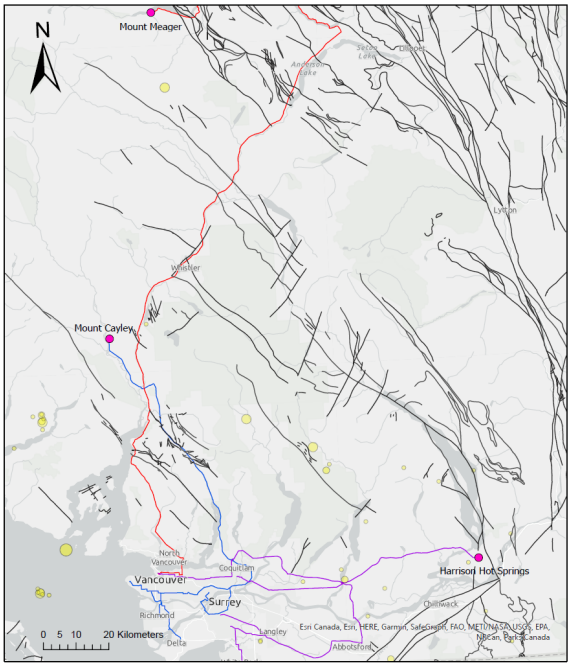


The first phase involved the analysis of case studies and extensive data collection to gain valuable insights into the availability and viability of geothermal energy sources. An energy demand model was developed to identify areas with the highest energy demand within metro Vancouver. This model was combined with a transmission lines map to identify prospective locations for new power stations. To locate favorable areas for geothermal development, we examined geological maps and processed geophysical data to characterize the subsurface conditions and understand geothermal heat flows in the region. The integration of these datasets allowed us to identify ideal drilling sites for the geothermal power plant while addressing challenges associated with impermeable rock layers.

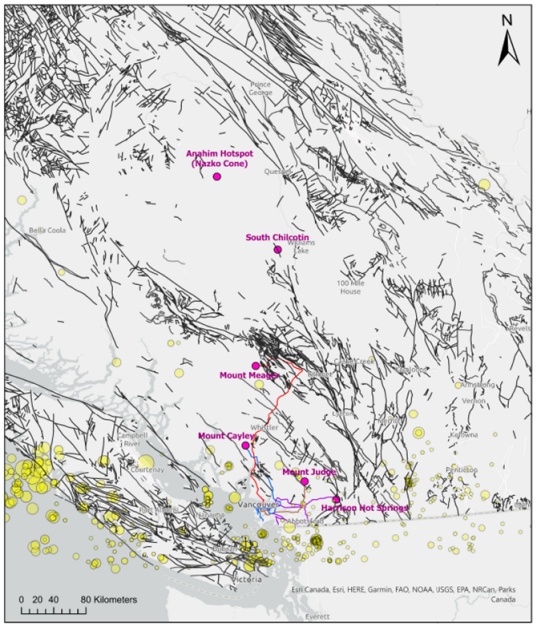


Metro Vancouver Population Density Map

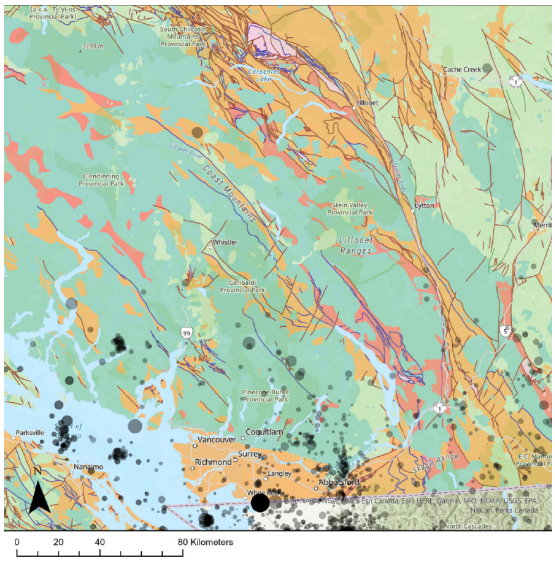
Source: Statistics Canada
Composed by: B. Tian
Date of composition: 2022-11-17



UBC Smart City
Composed by: Allison Wong
January 28, 2023



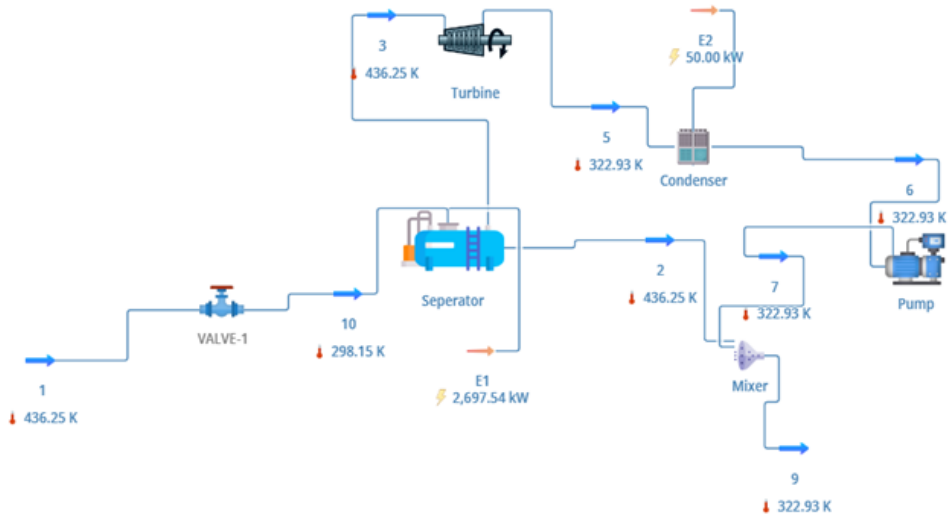
UBC Smart City
Composed by: Allison Wong
Updated: March 24, 2023

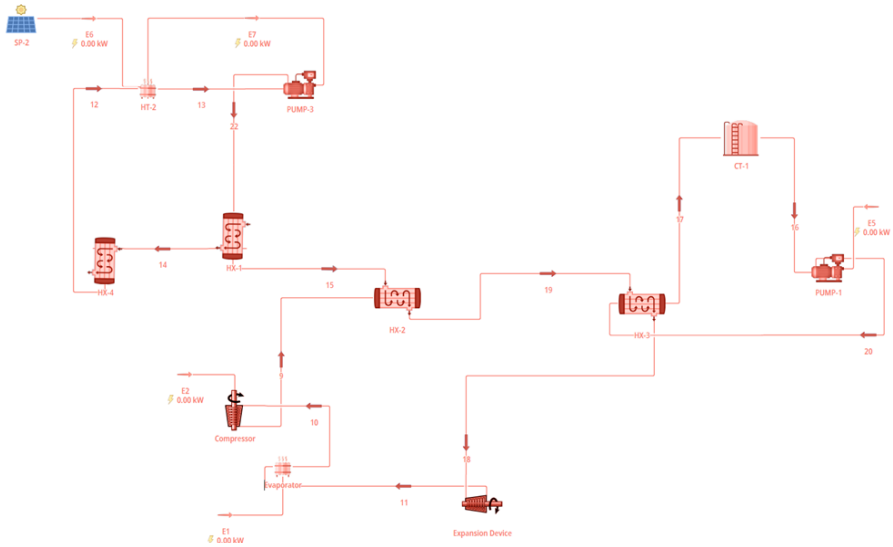


SW BC Geological Map

Source: BC Government/USGS
Composed by: UBC Smart City
Composition date: 2023-03-30

The second phase centered on adopting a community-based approach. The team developed a conceptual design for a hybrid solar-geothermal system that incorporates cascade utilization functionality. This design allows for the efficient utilization of geothermal fluids at varying temperatures, enabling them to serve multiple purposes within the system. Examples include generating electricity using high-temperature fluids, providing district heating with medium-temperature fluids, and using low-temperature fluids for agricultural applications. By optimizing the use of geothermal resources, the system becomes more efficient and sustainable in the long run. This design will be accompanied by a comprehensive evaluation of its potential for wider application and scalability.





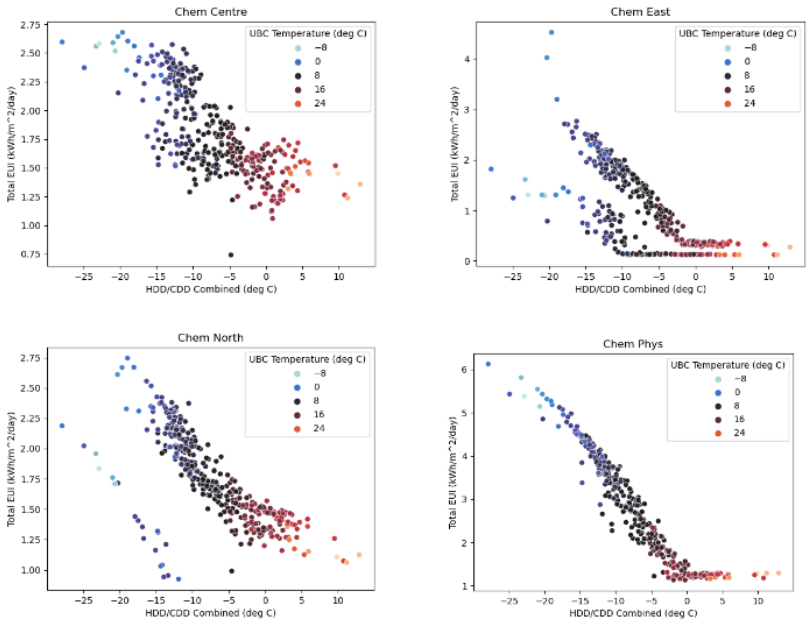
Energy Usage Intensity | Led by: Peter Kim

To overcome the challenge of intermittency in renewable energy sources and facilitate the transition to cleaner power, our research focuses on developing a predictive model for estimating base load and storage needs. Accurately predicting these requirements can help reduce the variability associated with estimating them in a given area, ultimately lowering the costs of integrating renewable energy into existing systems or constructing new infrastructure.

We employ a range of statistical tools and techniques to maximize the predictability of the dataset and parameters. University of British Columbia (UBC) serves as our base model due to its extensive data availability in energy, building, and geology domains. However, the methodology we develop is not limited to UBC's dataset, but can be generalized and applied to similar datasets in other regions.

By refining our predictive model and generalizing our approach, we can extend the benefits beyond UBC and contribute to advancing renewable energy adoption on a broader scale. Our research paves the way for accurate estimation of energy needs, enabling communities to make informed decisions regarding renewable energy integration.

We invite you to join us at the MURC 2024 conference, where we will be presenting detailed information about our research, including our findings and methodology!



Team Roster

Name	Position	Contributions
Peter Kim	Captain	Team & Project Management, Annual Report, Sponsor Relations, Website Design
Kevin Cui	Communications Lead & Safety Officer	Research, App Design, App Modelling and Interfaces, Outreach and Sponsors, Technical Writing
Ezekiel Camacho	Energy Team Lead	Project Proposal & Timeline, Project Management, Research, Data Acquisition & Analysis, Map Interpretation, Plant Design, Final Report
Sijan Poudel	Transportation Lead	Ideation, Solution Development, Programming (Frontend and Backend), Technical Advisory, Proposal Writing and Editing
Han Cho	Transportation Sub-Lead	Ideation, Solution Development, Programming (Frontend), Technical Advisory
Sant Sumetpong	Transportation Sub-Lead	Ideation, Solution Development, Programming (Backend)
Benjamin Corbett	Student Advisor	AMS Collaboration Advisory
Cameron Leong	Transportation Team Member	Ideation, Solution Development, Programming (Backend)
So Nozaki	Transportation Team Member	Ideation, Solution Development, Programming (Backend), Technical Advisory
Anshu Shibu	Transportation Team Member	Safewalk Project : Ideation, Solution Development, Programming (Frontend)
Mir Ruwayd Afeef	Transportation Team Member	Ideation, Solution Development, Programming (Backend)
Jerry Sun	Transportation Team Member	Ideation, Solution Development, Programming (Frontend)

Henry Ly	Transportation Team Member	Ideation, Solution Development, Programming (Backend)
Bowen Tian	Data Science Team (DS) Member	Data Acquisition & Analysis, Data Visualization, Model Development & Evaluation, Data Management
Helia Zeinoddini	Civil Team (CIVL) Member	Research, Plant Design, Data Acquisition & Analysis, Final Report
Allison Wong	Civil Team (CIVL) Member	Research, Data Acquisition & Analysis, Visualization, Final Report
Radman Rakhshandehroo	Data Science Team (DS) Member	Data Acquisition & Analysis, Model Development & Evaluation
Jerry Sethi	Civil Team (CIVL) Member	Research, Data Management, Financial Modelling
Jefferson Zhai	Data Science Team (DS) Member	Research, Data Cleaning
Faculty Advisor		
Dr. Omar Swei		

Budgeting

As a student team, we value responsible budgeting to achieve our goals. In the past fiscal year, we pursued cost-effective strategies, including collaboration with AMS, developing capital-light products, and conducting research which resulted in total spending of $948.68. This lean budgeting approach enables us to allocate resources towards future projects and support our members in cross-border competitions for the coming years. Furthermore, our commitment to responsibly budgeting enables us to balance short-term and long-term goals, ensuring we have resources to succeed as an engineering design team.

Forward Looking Statement

Ezekiel Camacho

I am very proud of our team's achievements since its inception in 2020. As this year's Finance and Administration Co-Captain, we will build on these successes by further enhancing our strategic planning efforts through progressive approaches.

One of our key objectives is to create comprehensive reports and documentation for our past projects. By highlighting our achievements to potential sponsors and prospective members, we aim to attract wider support and involvement in our initiatives. These reports will serve as powerful tools to showcase our team's capabilities and demonstrate the impact of our work. We will also implement a uniform system of progress reporting to effectively identify areas of improvement and proactively address challenges. Collective action based on these insights will enable us to continually enhance our projects and deliver optimal results.

Lastly, we will ensure that all our projects receive the necessary financial support, making informed decisions about resource allocation and budgeting. By maintaining stability, we can not only support our ongoing initiatives, but also invest in team-building activities to strengthen relationships among team members.

Accountability and transparency are paramount to us, and we will actively foster an environment that encourages open discussions within the team. We will ensure that all team members are well-informed, engaged, and excited to contribute to our growth and drive innovation through UBC Smart City.

Sijan Poudel

For the upcoming year, the team is committed to building strong partnerships with new stakeholders, driving brand awareness and customer engagement, and delivering measurable results that align with our mission. As we move forward, we remain focused on staying ahead of the curve and maintaining our top performance as the design team.

In the coming year, the team will embark on new and exciting ventures that will advance our current projects and support the professional growth of our team members. Today, our team is composed of talented individuals inspired by innovation and future-focused solutions. On our goal to provide a learning platform, we are expanding our reach to more students in the following months. We are thrilled to explore new avenues to engage in timely conversations around sustainable development, renewable energy, and smart technologies and promote the significance of our projects. From regional competitions to research conferences, we have set ambitious goals and are determined to achieve new milestones. Together, we will continue to push our boundaries and work collectively to bring the vision of smart cities to life.

Appendix

[1] **Sponsorship Package**

Sponsor Benefits

All sponsorship levels will increase your brand exposure and showcase your commitment to innovation. As a team sponsor, your company will be featured on our team website and on the second page of our annual report.

Higher sponsorship levels unlock unique opportunities to promote your organization. In addition to the listed benefits, this could include exclusive access to team member resumés, promotion of job opportunities, or the opportunity to present directly to team members.

Sponsorship Levels	Gold $1500+	Silver $1000+	Bronze $500+
Logo on team website	Large	Medium	Small
Logo in annual report	Large	Medium	Small
Post on social media	✓	✓	
Logo on team merchandise*	✓		
Logo on team banner*	✓		
Logo on competition deliverables	✓		

*Specific merchandise and banner purchases TBD.

Ready to Sponsor?

Option 1. Donate online at support.ubc.ca/smart-city.

Option 2. Send a cheque to:

> Attention: Ana Merino
> UBC Development – Faculty of Applied Science David Strangway Building 500 - 5950 University Blvd, Vancouver, BC V6T 1Z3

Please address cheques to the UBC Department of Civil Engineering, with UBC Smart City in the memo section.

Once complete, please send a high-quality company logo and company description to ubcsmartcity@gmail.com.