

Smart City Challenge

CHALLENGE ONE: **ELECTRIC MOBILITY INNOVATION**

Alectra Utilities, City of Vaughan, Policy Planning and Environmental Sustainability and City of Vaughan, Transportation Planning

PROBLEM STATEMENT

How can we use data and connected technology to address barriers to electric vehicle (EV) adoption and empower individuals, communities and businesses with access to more affordable, reliable and environmentally responsible e-mobility solutions?

BACKGROUND CONTEXT

Mobility is a primary concern for cities striving to become smarter and more sustainable. Electric-mobility, or e-mobility, technologies are central not only to improving the sustainability of urban environments, but also to improving the quality of life, health and prosperity for citizens. Electric vehicles (EVs), including cars, commercial transportation vehicles and micro-mobility solutions, such as scooters and bikes, deliver important benefits including improved air quality, reduced noise pollution and reduced greenhouse gas emissions. As a result of these valuable benefits to communities and the urgent focus on climate change mitigation, the e-mobility market is experiencing rapid growth.

Adoption rates for EVs in Ontario are forecast to grow by 25 per cent each year between 2021 and 2030. In order to accommodate the mass adoption of e-mobility solutions, there is a need to develop smarter, integrated energy solutions for customers, and to prepare our energy grid for increased demand. A smart city approach to e-mobility requires both hardware and software solutions which would make it easier for customers and communities to adopt EVs and help prepare our energy system for greater and more predictable demands on the grid.

As more individuals and businesses adopt EVs, and as publicly accessible e-mobility solutions become

more common, demand for electricity will grow to unprecedented volumes. Our ability to support that demand depends on technological innovations that will modernize and enhance the capacity of our electric grid and facilitate harmonized use of electricity resources. For example, there is a need for solutions and tools that enable smart-charging networks that collect data from drivers in order to optimize energy consumption. There is also a need for distributed energy resource management systems to manage power flow within the grid and optimization of local grid load in order to enhance system resiliency and reliability.

While adoption of EVs is accelerating, some EV solutions and related infrastructure remain cost-prohibitive and complicated to access. Technological innovation can help break down barriers to EV adoption for individual customers, businesses and stakeholders. Potential solutions might enhance access to e-mobility solutions by helping potential customers make informed decisions about EV adoption. EV adoption solutions also involve ensuring new/existing adopters continue to have positive customer experiences. Examples would be innovative approaches to motivating behaviour change, such as offering rewards or gamifying adoption and EV experiences.

Recent changes to policy and regulation also threaten to slow progress towards e-mobility solutions. EV point-of-sale rebates and proposed amendments to the Ontario Building Code were reverted in 2018 and are often cited as barriers in EV adoption. Looking forward, the draft Clean Fuel Standard (CFS) regulations do not enable any credit generation for at-home unnetworked charging. Furthermore, rate optionality from the Ontario Energy Board has not yet extended far enough to incentivize overnight charging for would-be EV owners. Multi-partisan alignment on e-mobility, supported by data and technology, is necessary to build and maintain access to this emerging technology. Solutions should consider how data can be presented to stakeholders across the spectrum in order to develop broad consensus. They might also focus on facilitating collective action or resource sharing among residents and stakeholders to reduce friction involved in making a switch to e-mobility.

Finally, data is central to understanding EV charging behavior, user preferences and needs and barriers to adoption in order to develop EV charging networks in our communities. Utilities are particularly interested in understanding EV penetration/station location and impacts on the grid, power level and how e-mobility interacts with broader transportation needs (personal vehicles vs. public transport). Potential solutions might focus on how we can leverage data from EV drivers in a way that is safe, and which can inform future investments in critical infrastructure.

BRAINSTORMING QUESTIONS

- How can personal e-mobility be connected to broader issues (transportation, smart cities, resilience, etc.) to build the city of the future?
- How can we use data and connected technology to address barriers to EV adoption and empower individuals, communities and businesses to encourage environmental responsibility and access to more affordable e-mobility solutions that provide value?
- How can we use hardware and software solutions to prepare our grid for cleaner transportation options?
- How can we use technology to gather insights on consumer behaviour and distribution in order to predict and meet the demands of EV users?

FACTORS TO CONSIDER

Proposed solutions might strive to:

- incorporate a user interface that will be intuitive and accessible for both residential and commercial EV users.
- offer solutions for a target audience that might include individual consumers, businesses, residential or commercial property managers, fleet co-ordinators or others.
- allow frequent and rapid updates to information.
- present information in a concise and digestible manner.
- incorporate engaging content or design.
- enable multiple language options.
- include educational components that would increase awareness and knowledge of the technology over time.

Proposed hardware solutions might strive to:

- produce prototypes of the hardware and evidence of proof of concept.
- demonstrate access to the funds necessary to execute on immediate milestones.

- demonstrate ownership of the intellectual property that is essential to the presented solution.
- avoid repackaging solutions that already exist.
- include relevant EV technology, such as electric cars, fleets, public transportation vehicles, micro-mobility solutions or others.
- incorporate and consolidate existing infrastructure as much as possible with the consideration to maximize public right-of-way space.

CHALLENGE TWO: MUNICIPAL SERVICES ROUTE OPTIMIZATION

City of Vaughan, Public Works

PROBLEM STATEMENT

How might we use smart technology to improve municipal service delivery to increase operational efficiencies, reduce costs and ultimately enhance citizen experience?

BACKGROUND CONTEXT

The Public Works team at the City of Vaughan provides essential services and amenities for Vaughan residents to ensure public safety and high quality of life. Some of the services include winter maintenance, safe drinking water, clean parks, well-maintained roads, trees, shrub beds and safe cycling and walking pathways.

The City of Vaughan's Public Works portfolio accounts for roughly 18 per cent of the City's operating budget. Winter maintenance operations and parks maintenance are important City services that account for a large percentage of each year's budget. The City is committed to continuously improving service delivery and providing the community the best value for their tax dollar.

Smart City technologies can increase operational efficiencies by gathering and analyzing data to better predict and inform decisions on how the City deploys resources and provides services. Smart City transformation would see the City of Vaughan replace many current operational processes, which are often highly manual and performed on paper, with smart, data-informed processes that collect and analyze real-time data. This would allow for the City of Vaughan to optimize the delivery of key municipal services such as snow removal and parks maintenance, and adjust service delivery routes using data inputs such as weather conditions and the volume of use of specific parks, paths and garbage receptacles.

CHALLENGE AREA ONE: Winter Maintenance

The City provides residents with a high-level of snow removal services. Whether it's reducing ice on roads, removing snow or clearing it from paths, sidewalks and windrows, the City's crews strive to ensure residents and visitors can travel safely despite the weather.

The City of Vaughan is responsible for maintaining more than 2,000 kilometres of roadways and more than 1,000 kilometres of sidewalk. During the winter, the Transportation and Fleet Management Services department does their best to streamline snow removal services based on weather, the importance of various roadways and sidewalks and City resources. Regulations require that as soon as ice or snow forms on roads, all main roads must be salted within four hours, and residential roads and laneways must be salted within 12 hours. As soon as five centimetres of snow accumulates on the ground, plowing begins and must be completed within four hours of the end of the snowfall for main roads, 12 hours for residential roads and 12 hours for laneways.

With respect to sidewalks, the City provides winter maintenance for 40 routes or more than 1,000 kilometres of sidewalk (see [map](#) for a full list of maintained sidewalks). Each route has primary sidewalks – those along a bus route, in front of a school or house of worship – and secondary sidewalks, which are all the others. The City maintains sidewalks to bare pavement, which is the highest standard in the entire GTA. Legislation requires that snow accumulation be reduced to 8 centimetres within 48 hours of the end of snowfall. The City begins plowing when snow accumulation reaches 5 centimetres and targets bare pavement within 8 to 16 hours of the end of snowfall depending upon whether the sidewalks are primary or secondary.

How can the City of Vaughan use data to inform the scheduling of snow removal services to optimize routes, increase staff efficiencies and make the best use of resources? A smart solution which considers the importance of each transportation route, the standard for completion time for that route, as well as predicted snow events, would significantly streamline operations related to this important municipal service.

Important considerations:

- The City has three Road Weather Information System (RWIS) stations that help provide an understanding of road conditions across different micro-climates and have helped the City with salt management and operations.
- There are Automatic Vehicle Locator (AVL) units installed on snowplow machines; however, routes are not optimized based on weather conditions (i.e. ice or snow) and the City does not have data collected to be able to predict how long it will take for snow removal.
- The City implemented a salt usage optimization tool called Maintenance Decision Support System (MDSS) for winter maintenance decision making for roads and sidewalks. Using sensors, this artificial intelligence tool will take various factors into account – including weather models, Vaughan's micro-climates, traffic volumes, and road temperatures, moisture and conditions – to inform road winter maintenance decisions.
- If the City can reduce the number of routes or achieve faster clearing time it will result in significant savings and reduce standby operating costs.
- During each snow event, the City receives many inquiries from residents regarding when their street will be cleared. Currently, the City uses a "where's my plow" application to show residents where snowplows have passed, but this application does not communicate the estimated times to complete snow clearing. The City is interested in finding a way to automatically communicate estimated clearing time to improve citizen experience.

BRAINSTORMING QUESTIONS

- How can we gather data on which sidewalk routes are being used the most so the City can further optimize route design to prioritize residents' needs (i.e. parents with strollers, older adults)?
- How do we improve communication regarding current snow clearing status and estimate clearing times to residents?
- How can we use connected technology to gather data and information that can automate and optimize route plans for drivers, office staff and see reports of savings (in terms of time and costs)?

CHALLENGE AREA TWO:

Parks Maintenance

The City's Parks, Forestry and Horticulture Operations department is responsible for the maintenance of over 200 parks, 700 hectares in boulevards and open spaces and numerous trail systems throughout the city.

City amenities include 273 playgrounds, 18 splashpads, 59 tennis facility locations and 130 courts, 10 skate parks, 73 basketball courts, 58 baseball diamonds and 150 soccer fields. [See a full list of Vaughan's parks.](#)

With a large number of parks and amenities, the City maintains each facility in top shape by inspecting and repairing equipment, watering and cutting grass, garbage and waste collection and more. Services are scheduled regularly, and occasionally residents call or use an online reporting system to report issues. The Canadian Standards Association (CSA) sets the legislative requirements for children's play spaces and equipment to ensure safety standards are met and, during the summer, splashpads are inspected daily.

Currently, the City uses manual inspection sheets to track dates, location, status and the need for maintenance work, and all maintenance services are scheduled using a paper process which does not take into account variables such as volume of use or weather conditions. How can the City leverage smart technologies to collect data and information to make data-driven decisions regarding how parks and public spaces are maintained? Further, how might smart technologies identify patterns in the frequency of maintenance needs to aid in future planning related to parks, trails and public spaces?

BRAINSTORMING QUESTIONS

- How can we use smart technology solutions to gather data on the usage of City assets (i.e. parks, garbage bins etc.) to analyze current status and predict trends?
- How can we leverage existing data and information to identify trends and insights on operations?
- How can the City be notified of changing conditions (i.e. lights not working, broken equipment) in parks in real time?
- How can smart technology leverage usage data to better predict maintenance requirements and asset management needs?

FACTORS TO CONSIDER FOR BOTH CHALLENGES

- Solution should be able to collect and analyze data in real-time.
- Hardware solution must be suited for outdoor and extreme weather and be vandal-proof.
- Solutions that can maximize utilization of resources (staff time and cost).
- Winter maintenance solution should be able to communicate with current GPS/AVL systems.
- Can be used while working from home office, remotely or in the field.

CHALLENGE THREE:

AGE-FRIENDLY COMMUNITIES

Mackenzie Health, Mackenzie Innovation Institute and Vaughan Public Libraries

PROBLEM STATEMENT

How can we leverage smart city technologies to improve access to healthcare and enhance social participation opportunities for our aging population?

BACKGROUND CONTEXT

Vaughan and York Region's population is aging; the senior population is growing much faster than any other age group and will increasingly make up a larger share of the total population. Research shows that a third of Canadian seniors live with at least three chronic health conditions – 32 per cent take five or more medications regularly and 14 per cent face a mental health problem such as depression or anxiety. Further, it is estimated that up to 16 per cent of Canadian seniors experience social isolation, further impacting their health, mental well-being and their ability to connect with their communities.

Healthy, socially engaged seniors make a valuable contribution to our communities, and the health and wellness of seniors will be increasingly connected to the success of our changing communities. Older people play an important role in their local communities – they engage in paid or volunteer work, transmit experience and knowledge and help their families with caring responsibilities. These contributions can only be ensured if societies foster their health and participation.

Many smart city environments are designed to support an able-bodied working population, compounding the risk of excluding older people from the social and economic life of the city, especially when they lose functional abilities. Smart technologies are a valuable tool for social inclusion and healthy aging and should be leveraged to support and enhance quality of life for older adults, especially those with disabilities. Smart technologies might focus on aiding older adults by assisting them to live independently in their homes, enhancing their mobility and enjoyment of public spaces and by fostering connections with their communities.

Here are some of the opportunities to enhance quality of life for seniors and older adults:

CHALLENGE AREA ONE: ACCESS TO HEALTHCARE - CORTELLUCCI VAUGHAN HOSPITAL

How might we use technology to improve community healthcare services and reduce the frequency with which seniors must visit the hospital?

In current models of care, a significant number of hospital patients remain in hospital, even after recovering to a level for which care could most appropriately be provided outside the hospital. These patients require an Alternate Level of Care (ALC) in another setting, such as a long-term care (LTC) home. When people are in hospital unnecessarily, they are at an increased risk of mortality, functional decline and contracting an infectious disease, and they are more socially isolated. Each year, approximately 17 per cent of older Canadians aged 75 and above are admitted to acute care hospitals at least once. As Canada's population continues to age, we can leverage smart technologies to modernize healthcare services so older people don't have to leave their homes and visit hospitals for minor assistance.

There is an opportunity to use technology to provide rehab services and geriatric care to seniors in the community within their homes. For example, a potential solution might leverage a shared platform which integrates community care and visits to the hospital, and enables family physicians, geriatricians, patients and family members sharing information and maximizing the health and comfort of seniors receiving care. Many physical rehabilitation services, such as those required following a stroke or hip replacement, as well as geriatric care such as mental health services, basic checkups and dietary planning, can be provided to seniors in the

comfort of their own homes. Further, including all parties involved in a patient's care to monitor their needs and health information would ensure that seniors receive the care they need in the most efficient way possible.

There are also opportunities to use smart technologies and data collection tools, such as wearable devices, to enable remote monitoring of senior patients. For example, remote monitoring could help physicians and clinicians predict falls or when a patient might enter 'crisis mode' or develop more critical health issues. The data collected through remote monitoring could also be valuable beyond healthcare applications, helping governments and other stakeholders to plan future services, monitor the health and wellness of specific communities or improve the safety of various built environments.

Digital platforms and smart technologies can support the transformation of age-friendly communities to enhance seniors' access to care that fits their needs and support healthy, active lifestyles, ultimately enabling them to age in place and minimizing their need to access hospitals.

BRAINSTORMING QUESTIONS

- How can we use smart city technologies to provide community care and healthcare services to seniors in their homes, enhancing their ability to age in place?
- How might we leverage digital platforms to enable sharing of important health information between family physicians, geriatricians, other care providers and family members?
- How can we collect data to inform the creation and delivery of healthcare services and supports to ensure that seniors are adequately cared for?
- How can we use wearable technologies to encourage and support physical activity among seniors to enhance quality of life as they age?
- How can we track and monitor the personal daily routines and activities of seniors, including leisure activities, interaction with family members or friends, daily mood and health indicators to inform support services?

FACTORS TO CONSIDER

- While there are already software and hardware solutions that exist to address remote monitoring and other health service areas, a major drawback is an inability or the lack of integration into healthcare providers' electronic health record systems.
- Do not limit your solution to only the ideas presented above (i.e. rehab services, fall risk alert, etc.). The examples provided are intended to set out

a context of using smart technologies.

- Physicians and clinical providers are often apprehensive to manage multiple platforms to provide care delivery for patients.
- While smart technologies are extremely useful to collect data and help drive analytics, be mindful of privacy regulations and policies when it comes to personal health information and data.
- A holistic solution should not only focus on health outcomes alone, but it will motivate and have an impact on other aspects of an individual (i.e. social life).
- Smart technologies often come at a cost; when developing your solution, be mindful of financial and payment models.
- In many cases, care for aging populations is often managed by community care providers, which may be important stakeholders in your solution.

CHALLENGE AREA TWO: SOCIAL ISOLATION - VAUGHAN PUBLIC LIBRARIES

Research shows that an estimated 30 per cent of Canadian seniors are at risk of becoming socially isolated. According to the International Federation on Ageing, “the number one emerging issue facing seniors in Canada is keeping older people socially connected and active.” Social isolation and exclusion are related to serious negative health effects and reduced quality of life for seniors and can prevent seniors from accessing the healthcare and social services they need to thrive.

Public libraries play a significant role in meeting the educational, informational, cultural, recreational and social needs of older adults. Over the years, Vaughan Public Libraries have developed diverse programs and services to meet the evolving needs of older adults. Such programs and services offer life-long learning opportunities for older adults, along with opportunities to develop and sustain community connections.

As libraries are transformed by technological advancements and as services grow increasingly digital, how can we leverage smart technologies to help local libraries reach beyond the walls of their buildings to engage senior citizens? Smart technology solutions may focus on one of the following themes:

Leveraging technology to foster connections

Some seniors are quick to learn new technological skills but aren't keen to fully adopt the new technologies and many have concerns that technology takes away from social connections. How might we encourage seniors to fully adopt new technologies? How might we deliver programming to demographic groups who use different types of technology to foster social connections between them?

Access to library services

Due to mobility and transportation issues, many seniors struggle to visit their local libraries in person. Vaughan Public Libraries has successfully piloted satellite library popups at local community centres to bring library programs and services closer to seniors and found that many were eager to participate. How can we make library services more accessible to home-bound people, keeping in mind the technological preferences and abilities of some seniors?

There are some language and cultural challenges which also act as barriers to access of library services. How might we use smart technologies to encourage cultural communities who are not frequently accessing library services to do so? How can we ensure that all communities feel comfortable accessing library services and ensure that they know their privacy is being respected?

Seniors as sources of knowledge and history

Seniors and older adults have a wealth of knowledge, skills and experience that are of great value and importance to our communities. Smart technologies can be leveraged to foster connections between older and younger people to support the exchange of information and experiences.

For example, how might we use technology to aggregate personal histories, which currently exist in mediums such as photos, records and personal memories, and to digitize them so that they can be accessed, analyzed and understood by the broader community? Additionally, how can we ensure that older adults are invited to share their memories and experiences to influence the future development of our city?

BRAINSTORMING QUESTIONS

- How can we use smart technology to ensure that seniors access opportunities to interact with their friends, family, community and people belonging to other generations to promote social connections, knowledge sharing and community bonds?
- How can we use smart technology to ensure that Vaughan Public Libraries' programs and services are accessible to and inclusive of older people with varying needs and capabilities, such as those from diverse cultural backgrounds or who struggle to travel to library locations?

FACTORS TO CONSIDER

- Solutions should recognize that seniors have a wide range of skills and abilities.
- Solutions should strive to understand and meet the age-related needs of seniors.
- Solutions should respect the decisions and lifestyle choices of seniors.
- Solutions should strive to protect those seniors who are vulnerable.
- Solution design should ensure that information is easy to find and easy to understand.
- Solutions should be scalable, user-friendly and offer a seamless user experience.

CHALLENGE FOUR: INTELLIGENT PLACEMAKING

City of Vaughan, Vaughan Metropolitan Centre Program

PROBLEM STATEMENT

How might we collect and leverage user data to make intelligent decisions about the design, creation and activation of public spaces in the Vaughan Metropolitan Centre?

BACKGROUND CONTEXT

The Vaughan Metropolitan Centre (VMC) is an emerging downtown poised to be the financial, innovation and cultural centre of Vaughan. This hub at Highways 400 and 407 is growing faster than expected. It's on track for a population of 63,000 residents, 1.5 million square feet of office space and 750,000 square feet of new retail space by 2031.

Transit Square is designed as a central destination in the Vaughan Metropolitan Centre, and a key part of the mobility hub built around the TTC subway station. Public open spaces, such as TTC Plaza and Transit Square, are infrastructure for social, cultural, environmental, transportation and economic functions in the city. They provide common and democratic spaces for daily life, as well as a platform for special moments and experiences. Transit Square offers programming opportunities for food vendors, farmers markets, small concerts and other seasonal events to draw visitors from across Vaughan and beyond. The public realm is designed for the experience of people, and to encourage a culture of walking and outdoor activities through all seasons.

Transit Square and TTC Plaza combine to form an Urban Square of about 0.4 hectares. This is one node in what will eventually be a network of parks and open spaces, including the future Urban Park immediately to the west and Edgeley Pond and Park one block to the east. The City is currently undertaking the VMC Parks and Wayfinding Master Plan to guide the implementation of the park network.

In order to ensure that public spaces serve the needs and desires of the residents who use them, it is important for cities, developers and other stakeholders to understand how public spaces are used. By collecting data on the people who visit, we can analyze and better understand how factors such as weather, accessibility and design impact public enjoyment of shared areas such as squares, parks and transit hubs. This data can then be leveraged

to make intelligent decisions about the design of current and future spaces to ensure that they facilitate opportunities for programming, social interactions, health and wellness and arts and culture. We might also collect data to consider the needs of people of different ages, including children and seniors, and how an increasing number of dog-owners might utilize and impact public spaces.

The value of collecting this data must also be balanced with the responsibility to ensure the privacy and security of residents. Solutions that offer stakeholders tools for measuring and analyzing how visitors use public spaces must also ensure that data is protected.

BRAINSTORMING QUESTIONS

- How might we collect anonymous data that reveals how people of different ages and abilities and people who own dogs use and enjoy public spaces?
- How might we leverage technology to collect and analyze data that reveals how weather events such as rain and snow affect the public's use and enjoyment of shared spaces?
- How might we use technology to encourage social interaction within our public spaces to increase community connections and to promote wellness, arts and culture?

FACTORS TO CONSIDER

- Limited camera, access point and connectivity on City property that covers existing public square.
- Solution should be able to aggregate and analyze data in real time.
- Hardware solution must be suited for outdoor and extreme weather and be vandal-proof.
- The solution should be scalable, be connected into a broader network, and ideally be able to connect into other departments.
- Solution should maintain the privacy and anonymity of citizens visiting public spaces.

