Executive Summary

Sustainability Scholar Project "Tracking Progress on Surrey's Community Energy & Emissions Plan"

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Scholar Project Objectives

The UBC Sustainability Scholar supported the Sustainability staff mentor's work towards City of Surrey's application of FCM's Partners for Climate Protection Community Milestone 5: Monitor Progress and Report Results.

To satisfy this Milestone, the City of Surrey is testing a new proprietary municipal GHG accounting and visualization tool, Delphi Trident , to track its emissions inventory and report on project impacts. The tool will supplement the Community Energy and Emissions Inventory (CEEI) reports and datasets currently prepared by the Province. Project objectives were refined as the Scholar's work unfolded, resulting in three main deliverables:

- Populate Surrey's community greenhouse gas (GHG) accounting tool with existing and new Community Energy & Emissions Inventory data
- Provide feedback, reports and briefings on the current use and desired improvements of the community GHG accounting tool to the City and the tool developer, the Delphi Group
- Prepare 2 page briefing documents summarizing four notable Surrey GHG reduction projects (for City internal use)

Beta-testing the Community GHG Inventory Tool

The new Delphi Trident beta municipal GHG accounting tool is derived from Delphi's proprietary Excel-based GHG assessment and visualization application widely-used by Canadian corporations. Surrey would like to assess the municipal version of the tool to track its own emissions and progress in reducing them, including easing reporting to meet FCM's Milestone 5.

Delphi's GHG assessment application has a number of valuable features, including allowing users to:

- quantify, report and visualize GHGs, energy use and associated costs on absolute and intensity bases
- analyze a range of business-as-usual and project scenarios
- graphically evaluate mitigation projects using a variety of metrics (e.g. marginal abatement cost curves)
- assess and report on a single facility, a business unit, the whole organization, and filtered by custom accounting categories

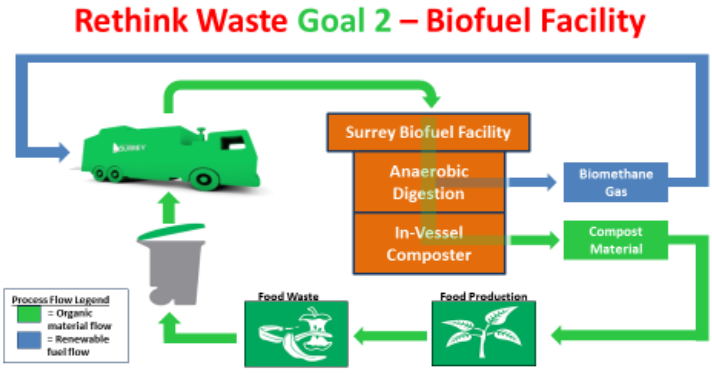
The Province of BC has provided 2007, 2010, 2012 and preliminary 2014 Community Energy & Emissions Inventory (CEEI) GHG emissions datasets to help local governments meet Climate Action Charter commitments to measure and report on community GHG emissions profiles. CEEI datasets and their associated emissions factors were used as the primary data to test the beta municipal GHG accounting tool.

The 2007 and 2010 CEEI emissions and emissions factors datasets were mapped to the early beta Excel application's data fields and cleaned of incompatible data entries. Several manual data entry approaches were tested, dependent inventory calculations were verified, and bugs and desired improvements noted. Notes on user experience and change recommendations were provided to the vendor in phone calls, emails and a working meeting.

The vendor provided a revised version of the beta tool, including key bug fixes and a new data import feature. This version was tested with the newly-released preliminary 2012 CEEI dataset and associated updates of its 2007 and 2010 datasets. The revised CEEI data structure was mapped to the new beta tool, datasets cleansed, and several data entry approaches tested, including the new data import feature. Notes on user experience and change recommendations were provided to City staff and the Delphi Group.

Surrey Biofuel GHG Reduction Project

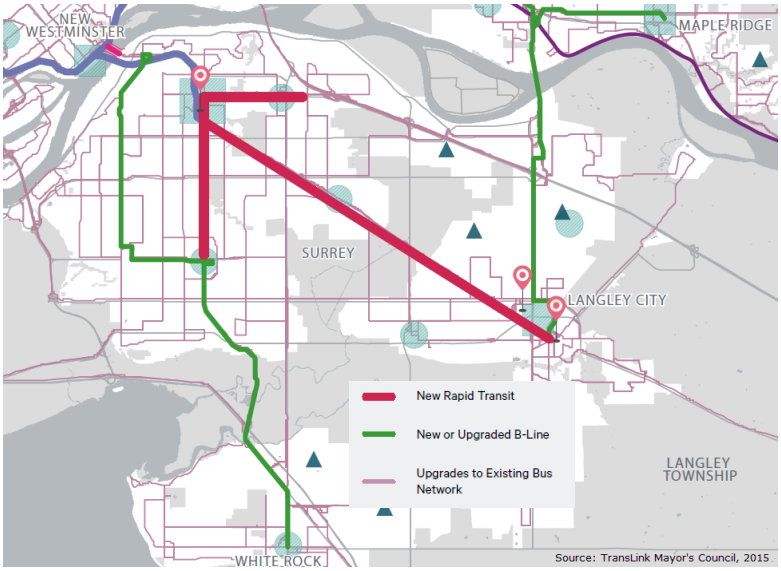
Surrey's Organic Waste Biofuel Processing Facility will be the first closed-loop fully-integrated organics waste management system in North America when it begins operation in early 2017. The Facility will have the capacity to divert a total of 115,000 metric tonnes/ year of organic waste from landfill, including all of the City's curbside organic waste, and industrial, commercial and institutional organic waste from nearby jurisdictions.



The Facility will use anaerobic digestion to generate renewable natural gas (RNG), and 40,000-50,000 tonnes/year of compost for sale locally. The RNG generated will fuel City vehicles (including the entire waste collection truck fleet. The Facility is currently in the final stages of construction, and will be operated by Orgaworld Surrey Ltd. under a Design-Build-Finance-Operate-Maintain public-private partnership contract. The facility will revert to Surrey at the end of the 25-year contract term.

The Facility is estimated to reduce landfill CO_2e emissions by 40,000 tonnes per year once it begins operation, more than the City's current corporate carbon footprint of ~16,000 tonnes per year.

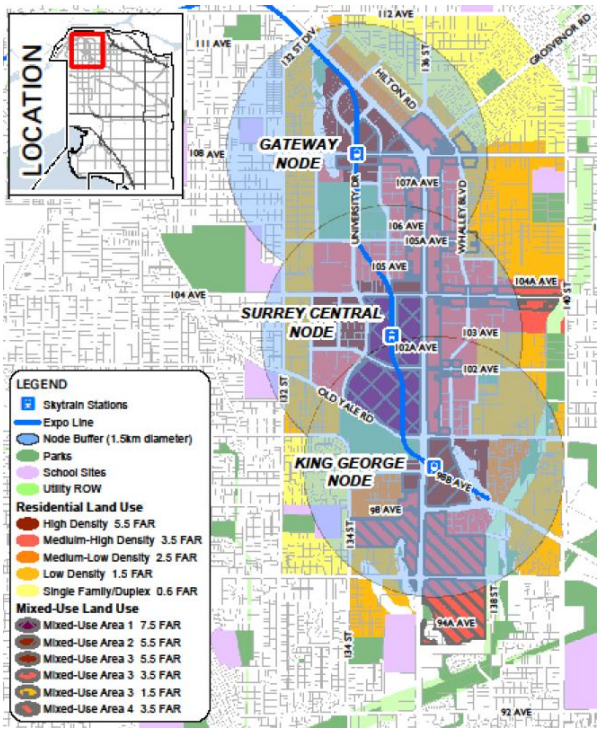
Surrey Rapid Transit Expansion GHG Reduction Project



Three new LRT lines connecting Surrey City Centre to Guildford, Newton and Langley Centre are proposed by TransLink's Mayors' Council on Regional Transportation. Also proposed are new or upgraded B-Line express bus services between Newton and White Rock. The proposed new LRT network in Surrey includes 27 kilometers of dedicated street-level rights of way with traffic signal priority, and 5-minute peak service with 19 multi-amenity stations. This proposal is estimated to cost approximately $2.28 billion, and is subject to future long-term agreements between TransLink, Ottawa and Victoria. If funding is secured in 2016, the new 104 Avenue and King George Boulevard LRT lines could commence service in 2022, and the new Fraser Highway LRT line in 2028. Total annual GHG emissions reductions are currently estimated at 18,200 tonnes / year in 2030, and 18,800 tonnes / year in 2045.

Surrey District Energy GHG Reduction Project

Surrey is coordinating development of its new district energy (DE) systems to serve buildings around the Gateway, Surrey Central and King George Skytrain stations. In these Service Areas, buildings are required to use hydronic hot water and heating systems, and to connect to the DE system now or in future. Each node's piping will eventually be merged into a unified DE network.



Surrey City Energy (SCE) is the municipally-owned DE utility created to improve energy efficiency and security, create jobs and reinvest energy costs locally. Life-cycle energy costs and growth in GHG emissions will be

reduced by adding a variety of renewable energy sources as the DE system expands, starting with surplus renewable ground-source heat from the new Surrey City Hall geoexchange system. Each node of the DE system currently has a high-efficiency natural gas boiler system to meets heating loads as sites are developed; the aim is to replace base-load natural gas with renewable natural gas and / or biomass for the entire DE system by 2024. The DE system will largely reduce anticipated GHG emissions growth due to future development; as such GHG reductions will depend on the actual future build-out rates within the Service Areas.

Surrey Traffic Management GHG Reduction Project

Surrey's Traffic Management Centre (TMC) has been recognized as a Canadian leader in actively improving traffic flow, reducing energy consumption and GHG emissions (Intelligent Communities Forum 2016). The TMC, located in City Hall, was launched in September 2014 to provide real-time traffic monitoring and control; it is currently linked by radio with more than 330 pan/tilt/zoom cameras, and remotely controls over 300 signals at key intersections.

The TMC supports several traffic management initiatives:

- Proactive central signal control to reduce congestion due to accidents and unusual traffic patterns
- Automatically-optimized signal operation on key routes during peak periods
- public camera feeds and Twitter traffic alerts

The TMC is currently piloting new automatic control approaches for traffic signals in "Adaptive Coordinated Corridors". Each year new signal control strategies are implemented on four to five highly-used routes. GPS-equipped vehicles first drive these routes repeatedly to create current speed/distance and time/distance graphs and reports at peak times. Computer models are then used to design new control strategies, which are assessed and improved with follow-up test drives, speed-distance graphs and CCTV cameras.

Surrey is also currently piloting automated real-time traffic signal control along parts of the 72 Ave Corridor, testing an algorithm that responds to TMC traffic data. It is also considering enhancing real-time traffic data collection by sensing mobile phone, tablet and laptop signals moving along major City corridors; a new Travel Time Information System is planned to inform drivers of route travel times.

While better TMC data, real-time traffic signal control and congestion information for drivers are likely to reduce GHG emissions, GHG modelling estimates based on such data are complex, present data challenges, and are likely to be highly uncertain. As a result, modelling estimates are likely to supplement rather than replace the "resident-based" traffic GHG estimation methodology currently used for CEEI datasets.