

To: Matthew Green
10th floor, West Tower, City Hall
100 Queen Street West
Toronto, ON M5H 2N2

Dec. 1, 2021

(Sent by email to iec@toronto.ca)

From: Martin Green, PhD
Email: mgreen.phys@gmail.com

Re: **Item IE26.19: Pocket Plus Neighbourhood Climate Action**
Infrastructure and Environment Committee, Dec. 2, 2021

Dear Councillors,

The Pocket Change Plus initiative is an excellent opportunity for Toronto to begin the strategic transformation of existing communities that must occur to minimize cumulative future emissions of greenhouse gases (GHG) and the climate change they are causing. I am particularly supportive of the expansion of scope from the original focus on retrofits of houses. A scope that includes all buildings, facilities and green space within the geographic neighbourhood creates opportunities and benefits that would otherwise not be available.

Although I have no direct involvement in this initiative, I have communicated extensively with the project leaders about the ideas outlined below. I am a physicist with many years of research and development experience in the energy sector. Recently, I have invested many months effort delving into the science, and learning about, understanding, and analyzing potential application of worldwide innovations that can help us minimize our cumulative future GHG emissions.

My investigations have revealed that the present Canadian (and Toronto) strategy of using deep energy retrofits and cold climate air source heat pumps (CC-ASHPs) to eliminate the GHG emissions of existing houses faces significant barriers to success. Quite simply, the strategy cannot be scaled to a sufficiently high fraction of houses (for reasons discussed in my comments on Agenda Item IE26.16).

Green District Energy

The world does not have an energy problem; we are just not making wise use of solar energy that is a thousand times more abundant than we will ever need.

Through my research and analysis it has become evident that **sufficient heat to meet the annual needs of all Pocket Neighbourhood buildings could be collected using locally-installed solar thermal collectors.** (Thinking big, about 6 sq. km of solar thermal collectors, most on rooftops, could capture sufficient heat for all Toronto houses.) Heat collected when available – mostly in the summer – can be efficiently stored until needed deep in the ground, using borehole heat exchangers, and/or in large water tanks.

A modern, low-temperature district energy system (DES) uses water circulated in plastic pipes to move heat between sources, thermal storage facilities, and connected buildings. The same system can be used for both heating and cooling, with heat rejected from cooling of buildings being captured and added to the thermal storage.

Such an integrated district thermal energy system would be **best implemented using a utility model.** Just like the existing natural gas utility, a district energy utility would be available for use by all buildings, large and small. The major difference from natural gas is that all buildings could be prosumers – consuming heat when needed and rejecting heat into the DES when cooling is needed. Some buildings / facilities would be net consumers of heat on an annual basis, while others would be net producers of heat. Solar thermal collectors would be used only as needed to maintain an annual net balance. In practice, a mix of solar thermal and solar PV panels, or even combined PVT panels, would be installed. The electricity generated could be sufficient to power the entire DES.

Feasibility and Optimization

Implementation of a DES utility would be far less costly than performing deep energy retrofits on the existing Pocket Neighbourhood buildings and installing CC-ASHPs. It could be completed, and all houses connected, in just a few years. Shallow building retrofits that give the most cost-effective efficiency improvements would still be economically advantageous, but the low cost of green district energy would eliminate the need for more costly building retrofit measures and reduce the retrofit-related GHG emissions (embodied carbon). Comprehensive modeling and analysis should be done to determine the optimal blend of DES capacity, building retrofits that would reduce demand, and the most efficient combination of solar thermal and PV panels.

Pocket Neighbourhood and Beyond

I recommend that the Pocket Neighbourhood Plus project be supported, subject to the requirement that serious consideration be given to implementation of shallow retrofits and thermal district energy, as described above, instead of deep energy retrofits and conversion to CC-ASHPs.

The Pocket Neighbourhood Plus initiative should be viewed as a pilot / demonstration project that offers valuable learning opportunities. I strongly encourage collaboration with academic researchers (science / engineering) so that appropriate data can be collected and objectively analyzed. Learnings should inform and guide decisions on how best to achieve required GHG reductions in neighbourhoods across the city.

A DES implemented for the Pocket Neighbourhood would ideally be extended over time, and joined to other DESs to achieve a city-wide DES utility that all buildings could connect to. The result would be highly efficient use of pooled thermal energy with minimal need for electricity – a whole city heated and cooled by smart use of solar energy.

Sincerely,

A handwritten signature in blue ink that reads "M Q Green".

Martin Green
Ward 2