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

(Sent by email to iec@toronto.ca)

July 4, 2021

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

Re: Item IE23.1: **Net Zero Existing Buildings Strategy**
Infrastructure and Environment Committee, July 5, 2021

Dear Councillors,

1. Introduction

Toronto City Council's declaration of a Climate Emergency, in October 2019, was a welcome acknowledgement of the crucial need to achieve net zero greenhouse gas (GHG) emissions by 2050, or sooner. There is no denying that, as part of the required transformation, all buildings must be made more energy efficient and fossil fuels must be eliminated as an energy source, including for electricity generation. The Net Zero Existing Buildings (ExB) Strategy report illustrates the dominant contribution of Toronto's existing buildings to the GHG emissions that must be eliminated, and a potential approach to progressively reducing that contribution. The Impact Modeling and Assessment Technical Appendix shows how implementing various retrofit measures on different classes of buildings might achieve the required emissions reduction, and what some different emissions reduction scenarios might cost.

While the ExB Strategy provides some perspective on the scale, scope, complexity and cost of the challenge, it also has many shortcomings. The Recommendations, and Actions they support, if adopted, would help to stimulate the needed building retrofits. But **whether these initial Recommendations and Actions are necessary, sufficient and appropriate is far from evident**.

The following paragraphs provide analysis to support my concerns; and they identify significant elements of strategy that are absent from the ExB Strategy report. **In light of these expressed concerns with, and shortcomings of, the ExB Strategy, I cannot support approval of the Recommendations at this time.**

2. Macro-analysis

If no efficiency improvements are made to existing Toronto buildings, a federal carbon charge of $400 per tonne from now until 2050 (much greater than the carbon charge actually contemplated) would collect about $100 billion. By contrast, the estimated capital cost of the ExB Strategy's recommended emissions reduction scenario is about $300 billion for all buildings, including $73 billion for single family homes (SFH). Clearly, the federal carbon fund cannot cover this expense – so **lowering the cost to achieve economic advantage from retrofits should be a high priority goal**.

The average capital cost of proposed retrofits for single family homes works out to $166,600. With financing at 3 percent, annual payments would average **$8,400 per year for 30 years** – that's about three times the average residential property tax. Even with interest-free financing, payments would be twice larger than property taxes. Although the need for financial support and involvement of higher levels of Government is acknowledged, the ExB Strategy gives no analysis regarding feasibility and likelihood of success. **It seems unlikely that a high percentage of homeowners would be capable of such investments, but this issue has not been discussed.**

Comparison of the estimated capital costs and labour hours reveals the total cost per person-year of work to be $580,000. Assuming the average annual wage is $100,000 leaves 83 percent of this cost for materials and corporate profit – $138,000 per house. **Labour and greenhouse gases (embodied carbon) associated with the production, shipping, maintenance, installation and disposal of those materials have not been considered, but could significantly impair the ability to achieve net zero GHG.** It is also not evident that any of the cited case studies considered the adverse GHG impacts of embodied carbon emissions associated with the example retrofit / renovation projects.

The report assumes that products needed to perform the recommended retrofits will be readily available, including materials, manufacturing and transportation. Shortages of construction materials and skilled workers have become acute during the pandemic; a world-wide demand for building retrofits could create an even worse situation. **Significant work is needed to determine the need for products and skilled workers and to ensure they will be available, at reasonable cost, when needed. This is a significant gap in the Strategy.**

Cost estimates were determined largely by one large architectural firm – WSP. Details of the specifications are not given, nor is there evidence of independent validation. Data may

well have come from individual renovation / retrofit projects. **There is no analysis of the magnitude of cost reduction that might be achieved through innovation and economies of scale, such as bulk purchasing and neighbourhood-wide, assembly-line implementations.**

3. Core elements of Strategy

The ExB Strategy contemplates capital investments on the order of $300 billion for building retrofits. Note that this investment will be **comparable in scale to development of the entire TTC and Metrolinx transit networks, or to replacing all 20 of Ontario's nuclear power stations**. The strategy for an initiative driving such a huge investment should include multiple elements that have not been adequately addressed in the ExB Strategy report. These include:

3.1 Vision

This should be much more than "net zero GHG by 2050". How will the relationship between owners of buildings, City Government (and higher levels), and other stakeholders be transformed? Will natural gas still be available? To what extent will heating and cooling be delivered as services (like water)? Does "net zero GHG" include embodied carbon? Will Official Plan changes drive the protection (and creation) of complete, 15-minute communities by promoting increased density and local shops and services in all existing neighbourhoods, including the suburbs?

3.2 Goals

What will the important, identifiable accomplishments be that, when combined, will ensure the vision is achieved? For an example, I will suggest just one ambitious goal:

> **Research, innovation, analysis of full life-cycle GHG impacts and costs of individual retrofit decisions and the corresponding societal impacts, optimally efficient implementation, and rigorous performance and risk management processes will ensure that net zero GHG is achieved by 2050 and maintained thereafter, and that each individual investment has a net-positive financial payback.**

3.2 Governance

What organization(s), structures and processes will be established to ensure good decision making, accountability, control and behaviour? How will priorities, plans and objectives be set and resources allocated? How will performance and risks be

managed? What will be the governance relationships to Municipal, Provincial, Federal, for-profit and non-profit entities and to affected stakeholders (e.g., building owners)?

3.3 Research and innovation

The ExB Strategy report estimates that retrofit capital expenses, for all existing buildings, will be about $10 billion per year. For initiatives of this scale, significant effort should be devoted to optimizing the return on investment. A typical allocation to research, development, prototyping and iterative improvement might be 5 percent of total costs – $500 million per year – but this should be higher in the start-up years.

With such funding, a world-leading consortium of experts, and supporting staff and facilities, could be assembled to work with international peers, with the prime purpose of enabling and guiding sustainable, optimal reduction of GHG emissions associated with all buildings in an efficient and timely manner. This would include embodied emissions, future emissions associated with the operation and use of the buildings, and transportation-related emissions due to anticipated requirements for vehicular travel by building occupants. **The target should be to achieve true net zero GHG (including embodied carbon) and reduce overall costs by at least $100 billion.**

There is a great deal to learn from advanced research, practical experience, and work in progress in British Columbia, the European Union, UK, USA and elsewhere. This includes products and capabilities not yet available in Canada, large scale adoption of district energy systems (wind, solar, lake water, geothermal, nuclear), and industrial-scale retrofit projects.

3.4 Management processes

Strong management processes must ensure successful achievement of all aspects of the vision (whatever that is – see 3.1). Failure is not an option – there is no redo and no Planet B.

The ExB Strategy should acknowledge the need for, and allocate resources to select, implement and maintain, systems / methodologies for performance management, risk management, resource management, knowledge management, information management, program and project management, process management, quality assurance, and decision making. The scale, complexity and integration of these processes should be commensurate with the $100+ billion cost reductions that must be achieved.

4. Holistic transformation

The ExB Strategy – indeed the entire strategic effort to meet Toronto's commitment to net zero GHG by 2050 – should exhibit full participation and alignment with the strategies and plans of all City divisions.

Most important amongst these will be Planning and Transportation. Large parts of Toronto fall far short of the complete communities goal. Local shops and services – community plazas, medical buildings, etc. – that were established for neighbourhoods when they were built are quickly being displaced by large residential developments (condos, townhouses). This results in both long-time and new residents being more dependent on cars than ever. Much of the arterial road network was designed for exclusive use by motor vehicles. This makes establishing complete, 15-minute communities virtually impossible. Major planning and transportation strategy and policy changes will be needed to enable and encourage increased density in neighbourhoods, establishment and success of local shops and services, and thereby reduce per capita energy use and GHG production.

5. Conclusion

Retrofitting existing buildings to stop contributing to global warming is essential, but will be very difficult and costly. Success will require far more than the proposed administrative and policy mechanisms. A complete strategy must include elements (see section 3, above) to reliably reduce the costs while simultaneously achieving GHG reduction targets.

The Existing Buildings Strategy reveals the enormous scale of the challenge but fails to seek cost reduction, optimization and assurance of success through research, innovation and strong management processes. As proposed, the Strategy is simply not adequate or commensurate with the scale of contemplated investment.

Given the above concerns and shortcomings of the proposed Strategy, and considering that the Recommendations are designed to support the Strategy, I cannot support them. My key advice is that you should **direct staff to seek outside help to develop a more suitable strategy that addresses the issues I have raised**.

Sincerely,

Martin Green, PhD