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Sent: Friday, December 01, 2017 9:05 AM
To: LaPointe, Amber
Subject: Grow Bold: Issues Related to Net Energy

Hello Amber and All Members of Council and Planning Staff,

I will explore Burlington's proposed Official Plan for 2017-2040 from the perspective of Resilience Planning, where the emphasis rests on redesigning the city to respond to the highly-intertwined crises of Global Financial Instability and Climate Destabilisation (Climate Change) and Resource Depletion.

With respect to the last crisis of the three that I listed, Resilience Planning entails redesigning to dramatically reduce our energy use, by roughly 80 to 90% over fifty years, to go deeper than simply switching from non-renewable to renewable energy sources.

It involves addressing the issue of net energy, which has been notably declining over the last fifty years, especially when it comes to conventional crude oil or petroleum. This has meant that, roughly over the last fifteen years, we have become increasingly reliant on unconventional sources of energy, such as:

- Alberta Tar Sands, which comprises bitumen.
- Shale oil, to which we more accurately refer as "light tight oil", a grade of oil closer to natural gas liquids in terms of lightness and lower level of energy intensity, i.e. how much power it packs.

Net Energy:

- How much energy we still have available after we deduct for amount of energy used in extracting (drilling, mining) and processing (refining, upgrading) an energy source into useable energy.

For a description of Net Energy and Its Implications for Our Society, with the emphasis on Howard T. Odum's pioneering work in this field:

<http://www.resilience.org/stories/2013-10-06/energy-ecology-and-economics-revisited/>

Why Crude Oil or Petroleum?

- It forms a key energy source in the effort to turn other energy sources into useable energy such as renewable energy(wind, solar) and even nuclear power.
- It has one of the highest levels of net energy, albeit one that has been declining dramatically during the last seventy years. We can explore this issue through the commonly used formula for calculating net energy, Energy-returned-on-energy-invested (EROI).
- Back in the 1930's and 1940's, in places, we used one unit of energy in the process of extracting and refining crude oil to get 100 units of energy in return.
- At present, for crude oil, an investment of one unit of energy yields generally between 10 to 17 units of energy in return.
- With respect to Alberta Tar Sands and US Light Tight Oil, an investment of one unit of energy yields six units of energy in return.

Charles Hall has done extensive work on EROI and this posting below offers a sample of it:

https://ac.els-cdn.com/S0301421513003856/1-s2.0-S0301421513003856-main.pdf?_tid=72e7a888-d691-11e7-a8e3-00000aab0f26&acdnat=1512130773_56807dbd1ec8a30078c9ce94b76fab7c

Implications of Net Energy for Grow Bold and the need to shift away from automobile-oriented settlements of the Postwar Period.

On 29 August 2016, Bloomberg News published a rather concerning report about the low level of conventional or crude oil deposits being discovered in the last several years.

- Despite the energy companies' having **doubled** their expenditures on exploration in the 2004-2014 period
- They only received a 15% increase in newly-discovered petroleum deposits in that time period.
- Since 2014, with the drop in oil prices, energy companies have fallen into poor financial situations, where they are operating at a loss and, hence, they are spending markedly less on exploration and development.
- At present, we are finding **one** barrel for every **twelve** barrels that we are using each

year. By 2025, we will likely experience significant shortfalls in supply to meet the demands of a Global Economy.

<https://www.bloomberg.com/news/articles/2016-08-29/oil-discoveries-at-a-70-year-low-signal-a-supply-shortfall-ahead>

While Grow Bold does not explicitly address the issue of net energy, it offers an opening or a space in which to address the challenges that we face with declining net energy.

With respect to declining net energy, my crucial concern lies in that we refrain from constructing high-rise buildings in the effort to meet density targets for intensification, to develop more-compact urban areas within our current configuration of sprawling low-density (with scatterings of high-rise structures) settlement.

To appreciate why it is important to refrain from using high-rise buildings in intensifying urban areas:

High-rise buildings, 20 storeys or more in height, are **more energy-intensive than** low-rise buildings, 4 to 6 storeys in height, in their operation, let alone construction as well as the extraction and manufacture of building materials in terms of "embodied energy".

- High-rise buildings use **two-and-a-half** times more electricity than low-rise buildings.
- Natural gas use, for heating and cooling buildings, increases with height by **40%**.

We can meet targets for intensification, more-compact and interesting and inviting urban areas, by building low-rise structures, 4 to 6 storeys in height.

- Can build them in the form of low-rise slabs whose fronts run along streets with courtyards in the middle.
- Offer densities comparable to tall buildings.

I refer you to Professor Philip Steadman's recent comparison study looking at 681 buildings across Britain. He teaches at UCL's (University College of London, England) Bartlett School of Energy, Environment and Resources. This study was released publicly on 29 June 2017 under the title of "UCL-Energy 'High-Rise Buildings: Energy and Density' research project results".

I have posted the link below.

<https://www.ucl.ac.uk/bartlett/energy/news/2017/jun/ucl-energy-high-rise-buildings-energy-and-density-research-project-results>

For longer-term net energy considerations:

If we build new structures in the Downtown Core of Burlington extending up Brant St. to

Fairview, it is crucial to construct them in the form of 4 to 6 storey buildings, to enhance the coziness of the existing main street and surrounding neighbourhoods.

Within a five to twenty year horizon, when net energy impacts will supposedly kick in:

- To shift the emphasis to the Mobility Hubs along the Lakeshore West GO Train line and Development Corridors along Plains, Fairview and Appleby.
- Easier to develop these roads as major transit routes, with higher-order transit in the future, integrated with Burlington's three GO station, which will benefit from much-needed electrification of GO rail corridor. Electric rail is more energy efficient than diesel rail and automobiles.

Through the process of **Retrofitting** in Mobility Hubs and Development Corridors:

- Take existing shopping malls and retail strips
- Convert them to mixed-use development that looks like town centres, with retail of varying sizes being on the ground floor.
- Offering a variety of housing options in the form of low-rise apartments and townhouses
- With a wide variety of services being accessible by a wide range of transport modes such as walking and cycling.
- Fostering a reduced need for parking, especially in the longer term.

<http://www.yesmagazine.org/issues/life-after-oil/retrofitting-suburbia-communities-innovate-their-way-out-of-sprawl-20160425>

<https://www.cnu.org/publicsquare/2017/02/15/great-idea-building-better-suburbs-through-retrofit>

I will finish off by paraphrasing what Brian Kaller said in 2009 about the kind of future that we face with declining net energy, if we redesign to dramatically reduce our energy use. He has a blog called "Restoring Mayberry".

The future will likely not be Star Trek, a technological utopia, or Mad Max, a horrific post-apocalyptic world, but rather it will be likely Mayberry, Andy Griffith's comedy about small-town life.