City Council
Meeting Agenda
Consolidated as of May 24, 2019

Monday, May 27, 2019 – 6:30 p.m.
Council Chambers, Guelph City Hall, 1 Carden Street

Please turn off or place on non-audible all electronic devices during the meeting.

Please note that an electronic version of this agenda is available on guelph.ca/agendas.

Guelph City Council and Committee of the Whole meetings are streamed live on guelph.ca/live.

Changes to the original agenda have been highlighted.

Open Meeting – 6:30 p.m.

O Canada
Silent Reflection
First Nations Acknowledgement
Disclosure of Pecuniary Interest and General Nature Thereof

Confirmation of Minutes: (Councillor Downer)
That the minutes of the open Council Meetings held April 8 and 23, 2019, and the open Committee of the Whole Meeting held May 6, 2019, be confirmed as recorded and without being read.

Committee of the Whole Consent Report:

The following resolutions have been prepared to facilitate Council's consideration of various matters and are suggested for consideration. If Council wishes to address a specific report in isolation of the Committee of the Whole Consent Report, please identify the item. It will be extracted and dealt with separately as part of the Items for Discussion.

IDE-2019-21 Sign By-Law Variances - 950 Paisley Road

Recommendation:

1. That the request for variances from Table 1, Row 1 of Sign By-law Number (1996)-15245, as amended, to permit three (3) interchangeable building signs, each with an area of 1.99m², to be located 1m from the ground at 950 Paisley Road, be approved.

2. That the request for variances from Table 2, Row 12 of Sign By-law Number (1996)-15245, as amended, to permit 2 menu boards; one with a height of 3.64m above the adjacent roadway and a distance of 3m from the nearest road allowance; and one with a height of 3.96m above the adjacent roadway, a sign face area of 3.6m² and a distance of 3.5m from the nearest road allowance at 950 Paisley Road, be approved.

IDE-2019-48 Sign By-law Variances - 630 Scottsdale Drive

Recommendation:

That the request for variances from Sign By-law Number (1996)-15245, as amended, to permit an illuminated building sign with an area of 3.07m^2 to be a height of .61m above the ground surface at 630 Scottsdale Drive, be approved.

IDE-2019-45 New Outdoor Swimming Pool and Hot Tub By-Law (Council Memo)

Recommendation:

That Council approve the recommended Outdoor Swimming Pool and Hot Tub By-law included as Attachment-1 to Report Number IDE-2019-45 titled "New Outdoor Swimming Pool and Hot Tub By-law".

IDE-2019-43 2018 Building Permit Revenue and Expenditures, Building Services OBC Stabilization Reserve Fund and Annual Setting of Building Permit Fees

Recommendation:

1. That Council approve the recommended building permit fees, included as Attachment 2, report IDE-2019-43 titled "2018 Building Permit Revenue and Expenditures, Building Services OBC Stabilization Reserve Fund and Annual Setting of Building Permit Fees" dated May 6, 2019, effective June 1, 2019.

2. That Council approve adjusting the Building Services OBC Stabilization Reserve Fund target to be within the range of 100 to 150 per cent of prior year budget operating expenditures and that Appendix A of the General Reserve and Reserve Fund Policy be updated accordingly.

3. That Council approve the recommended automatic fee indexing methodology for 2020 and subsequent years, as described in report IDE-2019-43.

CS-2019-11 2018 Year-end Operating Variance Report and Surplus Allocation

Recommendation:

1. That the tax supported surplus of $3,255,971 be allocated to the reserves and reserve funds as follows:

Tax Rate Operating Contingency Reserve (180)	$816,000
Environment and Utility Contingency Reserve (198)	$400,000
Police Operating Contingency Reserve (115)	$39,000
Infrastructure Renewal Reserve Fund (150)	$2,000,971
Total	**$3,255,971**

2. That the Water Services surplus of $578,081 be allocated to the Water Capital Reserve Fund (152).

3. That the Wastewater Services surplus of $2,787,381 be allocated to the Wastewater Capital Reserve Fund (153).

4. That the Stormwater Services surplus of $313,835 be allocated to the Stormwater Capital Reserve Fund (165).

5. That the Ontario Building Code (OBC) deficit of $608,582 be funded from the Building Services OBC Stabilization Reserve Fund (188).

6. That the Court Services surplus of $88,950 be allocated to the Court Contingency Reserve (211).

CS-2019-12 2018 Year-end Capital Variance Report

Recommendation:

That report CS-2019-12, 2018 Year-end Capital Variance Report, dated May 6, 2019, be received.

CS-2019-13 2018 General Reserve and Reserve Fund Report

Recommendation:

That the City's General Reserve and Reserve Fund Policy be amended to reflect the addition of the Ontario Municipal Commuter Cycling Reserve Fund (350) as at December 31, 2018.

CS-2019-56 Dividend Allocation Policy

Recommendation:

1. That the one-time special dividend to be declared by Guelph Municipal Holdings Inc. (GMHI) be allocated as follows:

    a. 45 per cent, to a maximum of $6 million, be directed to the City Building Reserve Fund; and
    b. 10 per cent, to a maximum of $1.3 million, be directed to the Community Investment Program; and
    c. $700 thousand be directed to support the Community Energy Initiative; and
    d. The remaining funds be directed to the Infrastructure Renewal Reserve Fund.

2. That any net new ongoing dividend revenues from the City's municipal services corporations be directed to the City's Infrastructure Renewal Reserve Fund and be approved until such time that sustainable tax supported capital funding levels are achieved.

3. That a strategy, to redirect the base operating dividend revenue ($1.9 million in 2019) from the City's municipal services corporations into the Infrastructure Renewal Reserve Fund, be approved.

Items for Discussion:

The following items have been extracted from the Committee of the Whole Consent Report and the Council Consent Agenda and will be considered separately. These items have been extracted either at the request of a member of Council or because they include a presentation and/or delegations.

IDE-2019-52 **Solid Waste Management Master Plan Advisory Committee** (Council Memo)

Delegations:
Joe Hruska, Canadian Plastics Industry Association (presentation)

Recommendation:

1. That the terms of reference for the Solid Waste Management Master Plan Public Advisory Committee included as Attachment 1 to IDE-2019-52, dated May 6, 2019, be approved.

2. That staff partner with the University of Guelph IdeasCongress (ICON) Program to explore viable solutions to reduce single use plastics across Guelph, and report back to Council with updates or further recommendations as part of Solid Waste Management Master Plan update.

3. That the following be referred to and considered as part of the Solid Waste Master Plan process and scope of activity:

    a) That staff investigate any required changes to the current agreements between the City and/or vendors/leaseholders resulting from the sale of single use plastics.

    b) That staff facilitate further engagement internally on reducing or eliminating single use plastics through the Solid Waste Management Master Plan process.

    c) That staff explore the issue of single-use plastics and packaging as an opportunity to leverage the Civic Accelerator, to help realize further options to reduce waste in the City of Guelph.

IDE-2019-47 **Community Energy Initiative Update: Pathway to Net Zero Carbon**

Delegations:
Susan Watson

Correspondence:
Arni Mikelsons

Recommendation:

That staff pursue a service agreement with Our Energy Guelph (OEG) to act as the City's Community Energy Initiative (CEI) delivery partner.

IDE-2019-44 **Corporate 100% Renewable Energy Target by 2050**

Delegations:
Mark Berardine
Morgan Hannah
Sian Matwey
John Lawson
Bill McLellan
Susan Watson
Paul Costello, Council of Canadians
Pamela Richardson
Matt Saunders
Steve Dyck
Joe Brook
Horeen Hassan, Central Students Association, University of Guelph
Doug Prest
Susan Carey
Donna Jennison
Shauna McCabe
Charles Castillo
Michael Dube
Evan Ferrari, eMERGE Guelph
Diane Hurst
Jax Thornton
Michele Vernet
Norah Chaloner

Correspondence:
Sally Ludwig and Christine Mills
Paul Scapinello
Pamela Richardson

Recommendation:

1. That the Corporate 100% Renewable Energy Target (100RE Target) definition be received, adopted and reviewed every 5 years.

2. That staff be directed to develop a capital reserve fund strategy to support the Corporate energy optimization projects through the 2020 capital budget process.

3. That the capital and operating costs to enable progress towards the 100RE Target be referred to the 2020 budget process.

4. That staff provide a Corporate Energy Progress Report on an annual basis.

5. That staff through their annual reporting to Council, provide Council with further opportunities and initiatives to realize the 2050, 100% renewable energy target sooner.

IDE-2019-60 Funding Requests from the Affordable Housing Reserve to Support Applications to the National Housing Co-Investment Fund

Presentation:
Melissa Aldunate, Manager, Policy Planning and Urban Design

Delegations:
David Wormald, St. Joseph's Health Centre Guelph (presentation)
Pete Waters, Rockwater on Janefield

Correspondence:
Pete Waters, Rockwater on Janefield

Recommendation:

1. That a financial incentive in the amount of $924,000 be provided to Rockwater on Janefield Inc. for an affordable housing project as generally describe in IDE Report 2019-60 subject to CMHC approval of their application to the National Housing Co-Investment Fund and entering into an agreement with the City.

2. That staff be directed to prepare a Municipal Capital Facilities By-law to authorize the financial incentives for Rockwater on Janefield Inc.

3. That staff be directed to enter into an agreement with Rockwater on Janefield Inc., to implement the municipal incentives, to the satisfaction of the DCAO of Public Services, the City Solicitor and the Chief Financial Officer.

4. That the Mayor be authorized to provide a letter of support for the Rockwater on Janefield Inc. proposal to satisfy the National Housing Co-Investment Fund application requirements.

5. That a financial incentive in the amount of $364,000 be provided to St. Joseph's Housing Corporation for an affordable housing project as generally described in IDE Report 2019-60 subject to CMHC approval of their application to the National Housing Co-Investment Fund and entering into an

agreement with the City.

6. That staff be directed to enter into an agreement with St. Joseph's Housing Corporation, to implement the municipal incentives, to the satisfaction of the DCAO of Public Services, the City Solicitor and the Chief Financial Officer.

7. That the Mayor be authorize to provide a letter of support for the St. Joseph's Housing Corporation proposal to satisfy the National Housing Co-Investment Fund application requirements.

8. That the Mayor and Clerk be authorized to execute the Municipal Incentives Agreements.

Motion to Oppose Bill 108, More Homes, More Choice Act, 2019

Councillor Allt and Councillor Downer will speak to this item.

WHEREAS the legislation that abolished the OMB and replaced it with LPAT received unanimous – all party support; and

WHEREAS All parties recognized that local governments should have the authority to uphold their provincially approved Official Plans; to uphold their community driven planning; and

WHEREAS Bill 108 will once again allow an unelected, unaccountable body make decisions on how our communities evolve and grow; and

WHEREAS On August 21, 2018 Minister Clark once again signed the MOU with the Association of Municipalities of Ontario and entered into "...a legally binding agreement recognizing Ontario Municipalities as a mature, accountable order of government."; and

WHEREAS This MOU is "enshrined in law as part of the Municipal Act". And recognizes that as "...public policy issues are complex and thus require coordinated responses...the Province endorses the principle of regular consultation between Ontario and municipalities in relation to matters of mutual interest"; and

WHEREAS By signing this agreement, the Province made "...a commitment to cooperating with its municipal governments in considering new legislation or regulations that will have a municipal impact"; and

WHEREAS Bill 108 will impact 15 different Acts - Cannabis Control Act, 2017, Conservation Authorities Act, Development Charges Act, Education Act, Endangered Species Act, 2007, Environmental Assessment Act, Environmental Protection Act, Labour Relations Act, 1995, Local Planning Appeal Tribunal Act, 2017, Municipal Act, 2001, Occupational Health and Safety Act, Ontario Heritage Act, Ontario Water Resources Act, Planning Act, Workplace Safety and Insurance Act, 1997.

Now Therefore Be it Hereby Resolved That the City of Guelph oppose Bill 108 which in its current state will have negative consequences on community building and proper planning; and

Be it further resolved that the City of Guelph call upon the Government of Ontario to halt the legislative advancement of Bill 108 to enable fulsome consultation with Municipalities to ensure that its objectives for sound decision making for housing growth that meets local needs will be reasonably achieved; and

Be It Further Resolved That a copy of this Motion be sent to the Honourable Doug Ford, Premier of Ontario, The Honourable Christine Elliott, Deputy Premier, the Honourable Steve Clark, Minister of Municipal Affairs, the Honourable Andrea Horwath, Leader of the New Democratic Party, and all MPPs in the Province of Ontario; and

Be It Further Resolved That a copy of this Motion be sent to the Association of Municipalities of Ontario (AMO) and all Ontario municipalities for their consideration.

Special Resolutions

Councillor Gordon's motion for reconsideration for which notice was given May 6, 2019, in relation to the May 28, 2018, resolution being:

1. That the Corporation of the City of Guelph will strive to achieve one hundred percent of its energy needs through renewable sources by 2050.

2. That Staff be directed to report back to the next term of Council on the most effective way for the Corporation to work towards achieving this goal, including information on, but not limited to, the impact on capital budget planning, potential resource needs, and a recommended process for the review of new program and policy development initiatives.

In light of new information on the urgency of reducing greenhouse gas emissions that are responsible for the escalation of Climate Change, that the following resolution of May 28, 2018 be reconsidered:

1. That the Corporation of the City of Guelph will strive to achieve one hundred percent of its energy needs through renewable sources by 2050.

2. That Staff be directed to report back to the next term of Council on the most effective way for the Corporation to work towards achieving this goal, including information on, but not limited to, the impact on capital budget planning, potential resource needs, and a recommended process for the review of new program and policy development initiatives.

If successful reconsideration motions are passed, the following replacement motions will be put on the floor:

1. That the target date for the City of Guelph to achieve Net Zero status be set at 2035.

2. That the target date for the City of Guelph to meet 100% of its corporate energy needs through renewables be set at 2035.

3. That staff be directed to report back to Committee of the Whole by Q2 of 2020 on the most effective way for the Corporation to work towards achieving this goal, including information on, but not limited to, the impact on capital budget planning, potential resource needs, and a recommended process and timeline for the review of new program and policy development initiatives.

By-laws

Resolution to adopt the By-laws (Councillor Gibson).

By-law Number (2019)-20408	A By-law respecting outdoor swimming pools and hot tubs and to repeal By-law Number (1994)-14660.
By-law Number (2019)-20409	A By-law to amend By-law Number (2002)-17017 – the Traffic By-law (Through Highways in Schedule V, Traffic Control Signals in Schedule VI, Lane Designation in Schedule VII, Pedestrian Crossovers in Schedule X, No Parking in Schedule XV, No Stopping in Schedule XVI and Restricted Parking in Schedule XVII).
By-law Number (2019)-20410	A By-law to confirm the proceedings of meetings of Guelph City Council held May 16, 23 and 27, 2019.

Mayor's Announcements

Please provide any announcements, to the Mayor in writing, by 12 noon on the day of the Council meeting.

Adjournment

Council Memo

Date	May 27, 2019
To	**City Council**
From	Jennifer Rose, General Manager
Service Area:	Infrastructure, Development and Enterprise Services
Department	**Environmental Services**
Subject	**IDE–2019-52 Solid Waste Management Master Plan Advisory Committee**

In response to questions raised at the COW meeting on Monday, May 6, 2019 regarding the inclusion of a user fee study for solid waste services in the scope of the Solid Waste Management Master Plan, staff offers the following clarification.

The solid waste user fee study was a recommendation of the 2014 Solid Waste Management Master Plan (SWMMP) endorsed by Council. This study was to have been included in the implementation of the previous master plan, however, it was put on hold during the Solid Waste Resource Business Service Review underway at that time. The project was deferred to the SWMMP review starting in 2019.

A user pay funding model is one of many waste management reduction and diversion policies that can be scanned as part of an environmental strategic planning process to determine how different funding models support diversion targets.

An environmental scan will be conducted to determine how different funding models support diversion targets. The plan will research best management practices across a broad range and varying degrees of user pay policies, projects and programs. While many options are originally explored, the public consultation process will allow the City to obtain feedback on the proposed approaches and amend recommendations to Council based on community input and concerns.

Further in-depth study would take place after the completion of the master plan, if approved by Council, and would be included for consideration in future budgets. If a solid waste user fee study was approved through Council during the budget process, a fulsome engagement strategy would be part of the scope for that project.

With respect to the changing legislative landscape under the Waste Free Ontario Act, the inclusion of this high level scan in the Solid Waste Management Master Plan will provide the City with information to promote diversion for those items not included in the “Full Producer Responsibility Scenario” (recyclables which still end up in the grey cart, organics, furniture, construction and demolition waste, and waste generated from the IC&I sector).

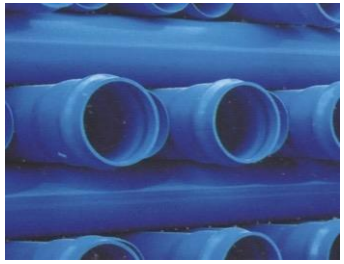
Jennifer Rose, B.Sc., M.A.,
General Manager

Infrastructure, Development and Enterprise Services
Environmental Services
City of Guelph

T 519-822-1260 x 3599
E jennifer.rose@guelph.ca

cc: Scott Stewart, DCAO, IDE



City of Guelph

Moving Guelph Towards Zero Plastic Waste
Agenda IDE-2019-52

Joe Hruska
V.P. Sustainability
May 27, 2019

Association canadienne de l'Industrie des plastiques
since • depuis 1943
Canadian Plastics Industry Association

Todays Presentation

Achieving Zero Plastic Waste

- About CPIA
- Plastics Value To Society
- Managing Plastics – Unmet Need
- Industry Commitment
- Guelph Solid Waste Management Master Plan – Developing Effective Policy

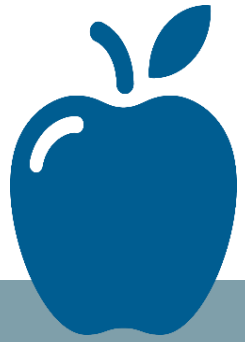
Canadian Plastics Industry Association

The national voice for, and leader in plastics sustainability in Canada since 1943

- 2,600 companies
- 82,000 employees
- $24.3 billion industry (shipments)
- Conventional & Bioplastics Sectors
- Members across Canada & throughout the value chain

- Important to ON, QC and Canadian economy
- Driven by technology, science & innovation

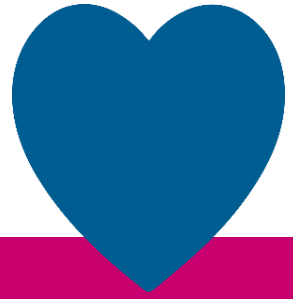
The Value of Plastics



Plastics packaged foods last longer, reducing wastage and CO_2

Use of plastic pipes facilitates clean drinking water supplies

Plastic use in vehicles has reduced CO_2 emissions from transport



Plastic enables life saving medical devices like surgical equipment and drips – plastics save lives

Example – reduces food waste

Fresh for 14 days

40%+ thrown out; plastics keep food fresh longer

Grapes in-store wastage
DOWN by 20%

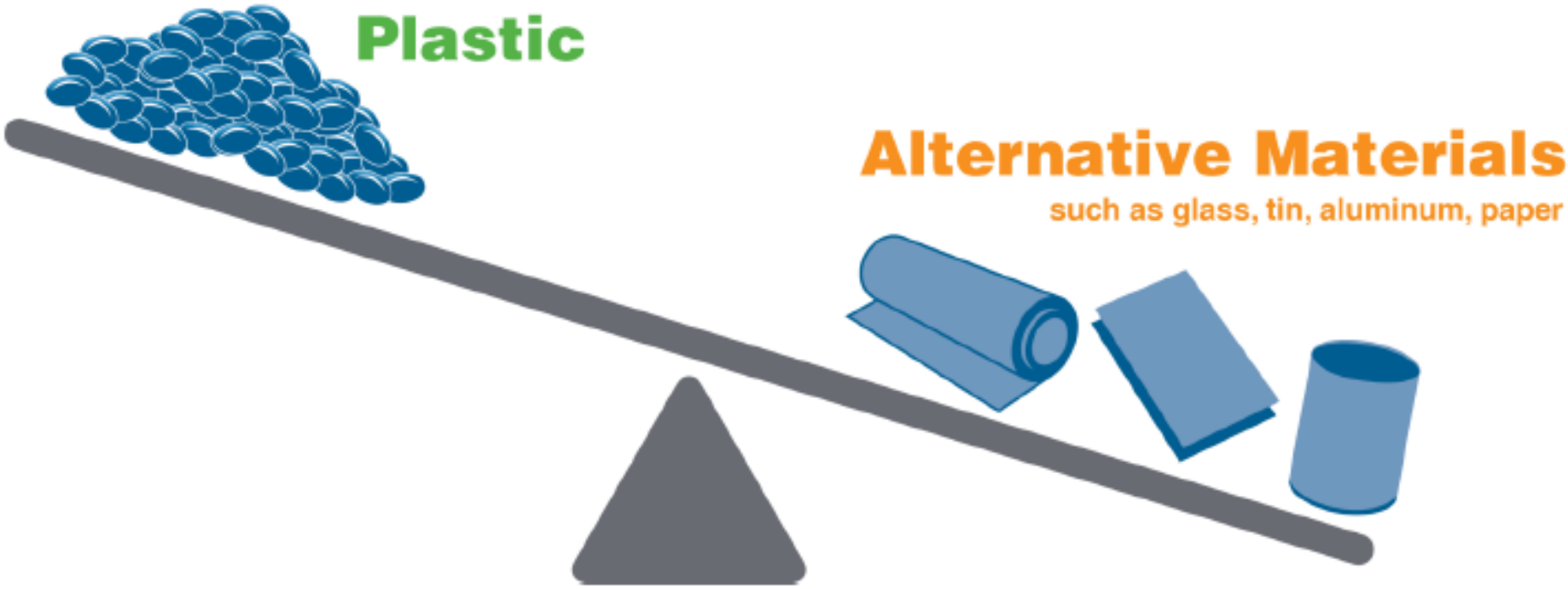
New potatoes
in-store wastage
DOWN to <1%

Bunches of identical bananas stored for 7 days loose and in a modified atmosphere bag

Source: Packaging in Perspective, Advisory Committee on Packaging, Supported by INCPEN
http://www.thefactsabout.co.uk/files/98201010542packaginginperspective.pdf

Plastics' contributions – providing many benefits

Plastics reduce environmental, economic & social costs

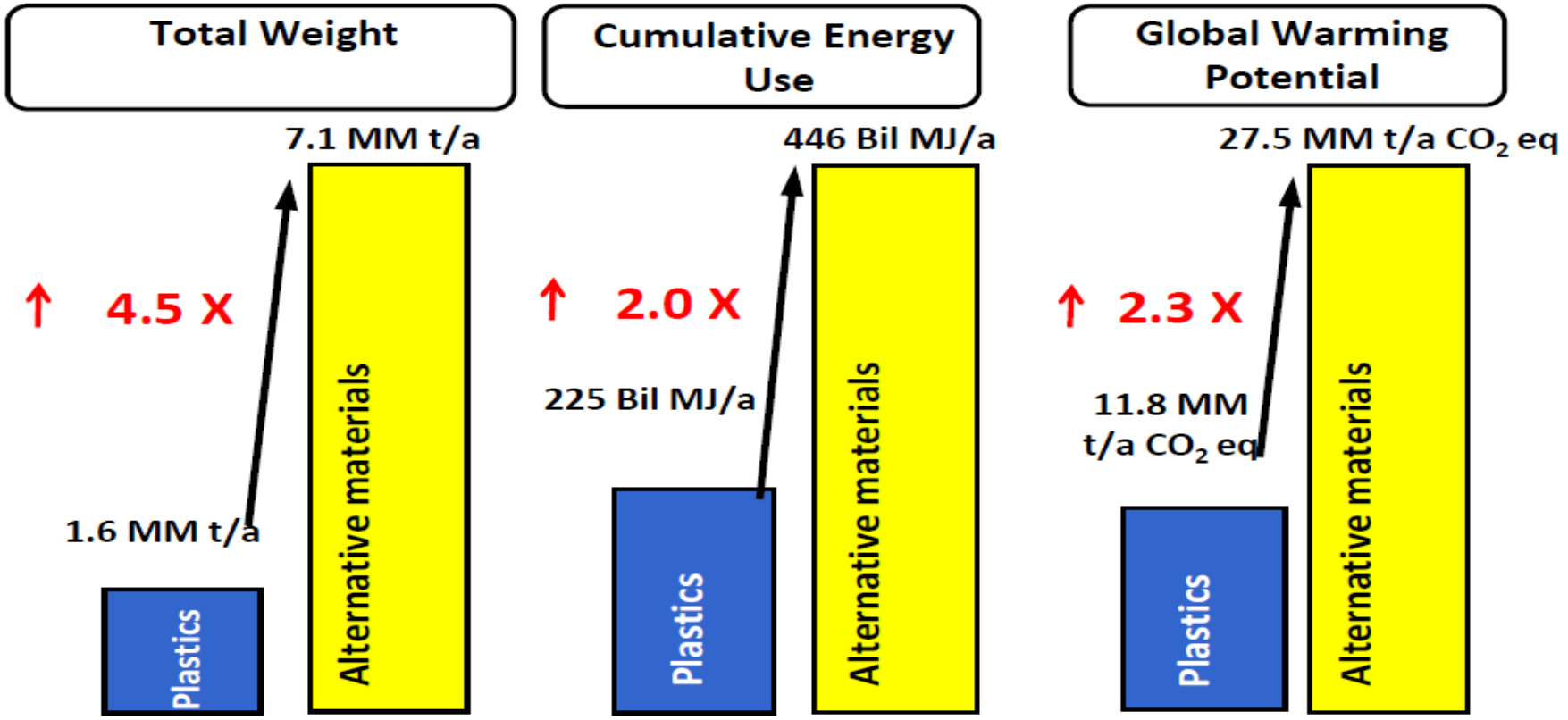


The environmental cost of plastic in consumer goods is **3.8X less** than alternative materials

Source: Trucost Study

Plastics vs. Alternatives

Plastic Packaging Reduces Mass, Energy Use and GHG Emissions

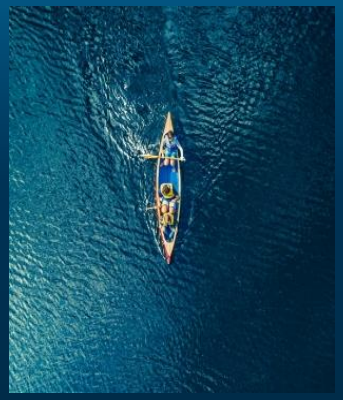


Source: Impact of Plastics Packaging on Life Cycle Energy Consumption & Greenhouse Gas Emissions in the United States and Canada, Franklin Associates, January 2014

Plastic waste resources do not belong in the environment

- Managing waste & plastic resources an unmet need

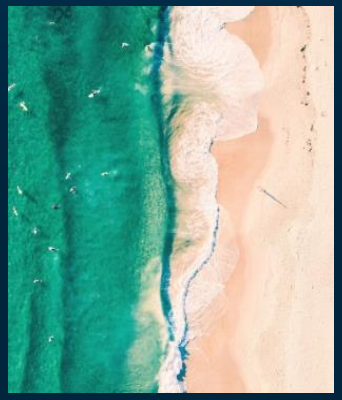
About 200 MMT of plastic landfilled or ending up as litter



Improper waste management leads to significant leakage into oceans and seas (~8 MMT per year)

By 2025, the ocean could contain 1 ton of plastic for every 3 tons of finfish

Plastic waste production is expected to double in the next 15 years



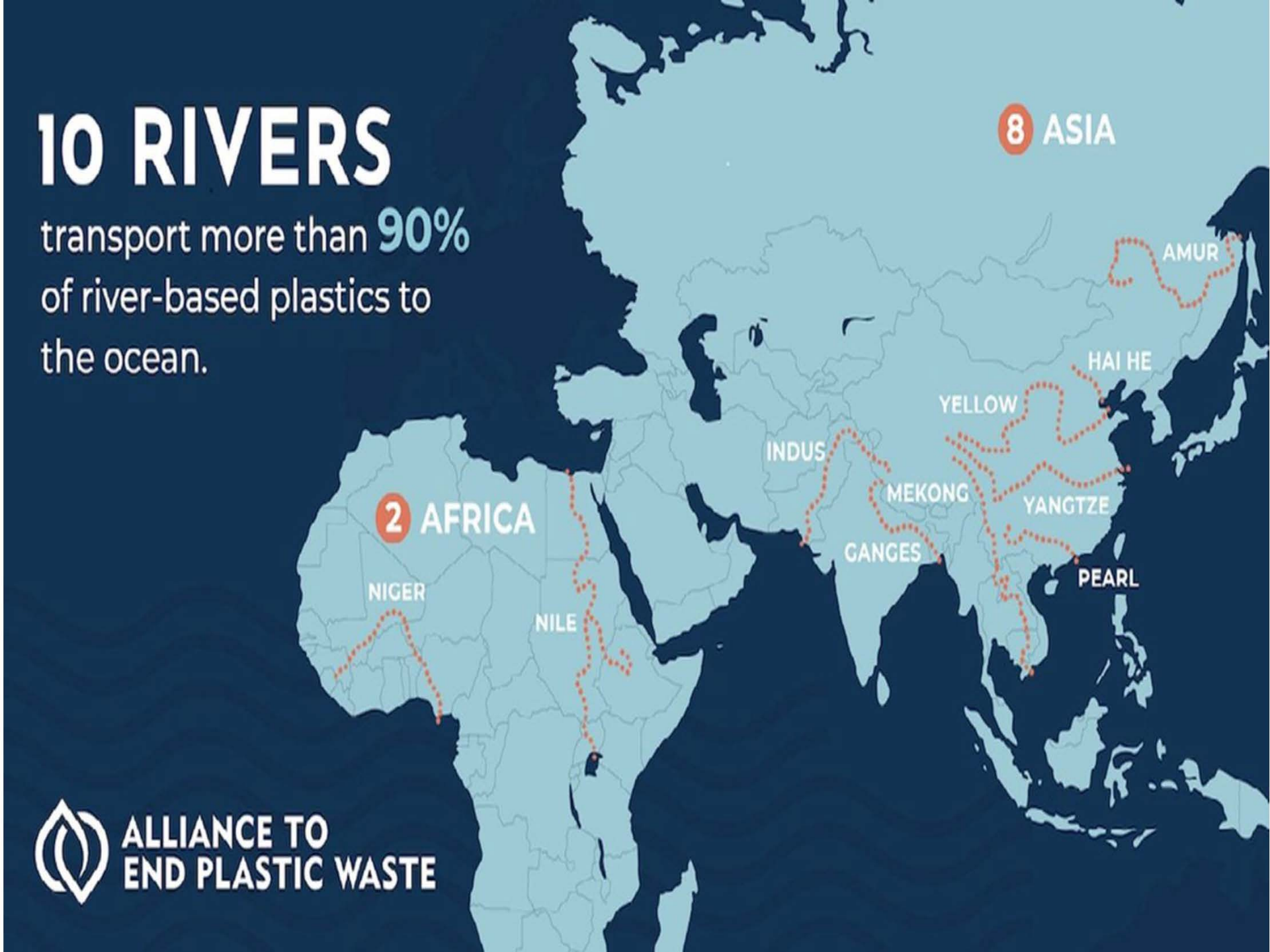
There is untapped value in post-use plastic that can be used to incentivize collection and reprocessing

ALLIANCE TO END PLASTIC WASTE

Where does ocean waste begin?

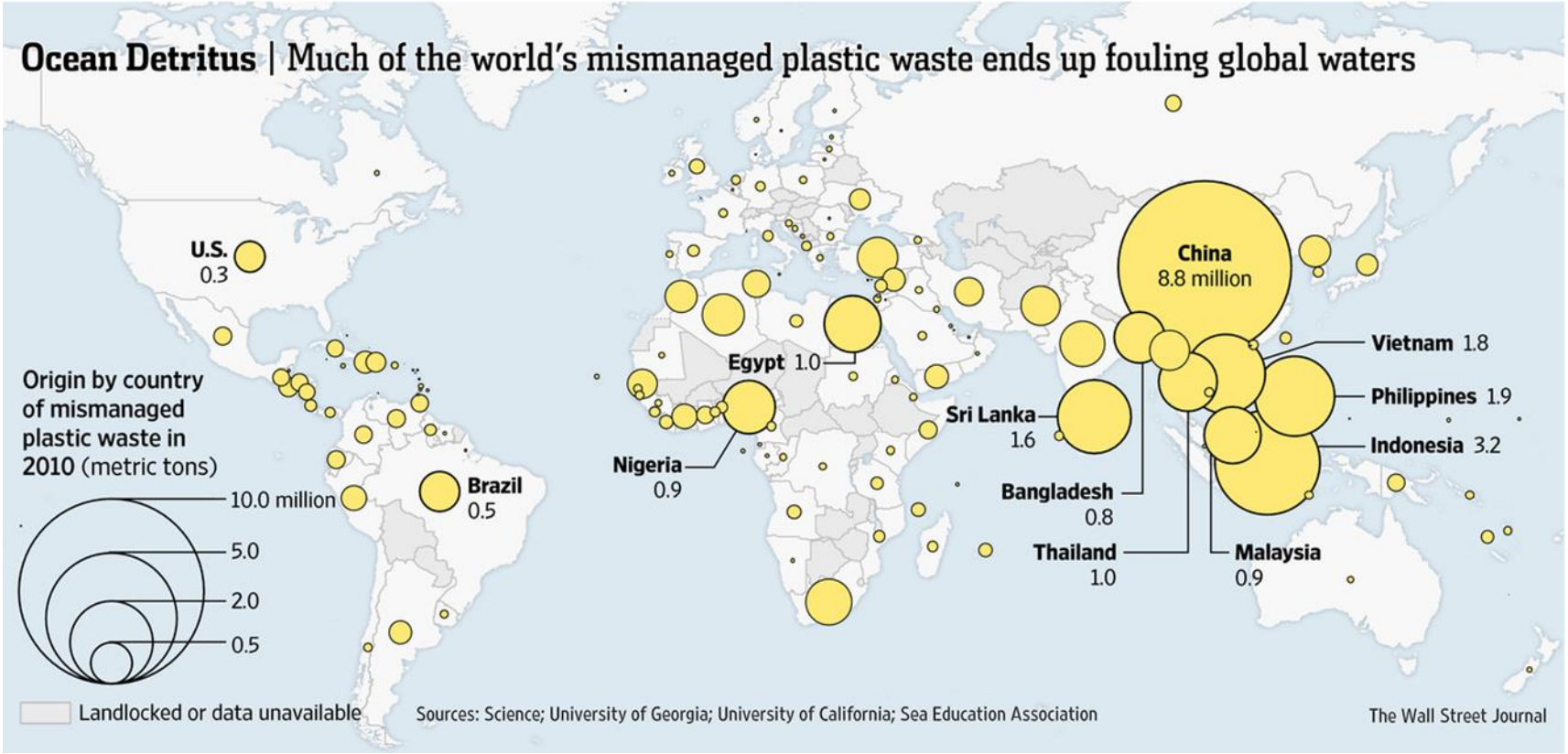
10 RIVERS

transport more than **90%** of river-based plastics to the ocean.



ALLIANCE TO END PLASTIC WASTE

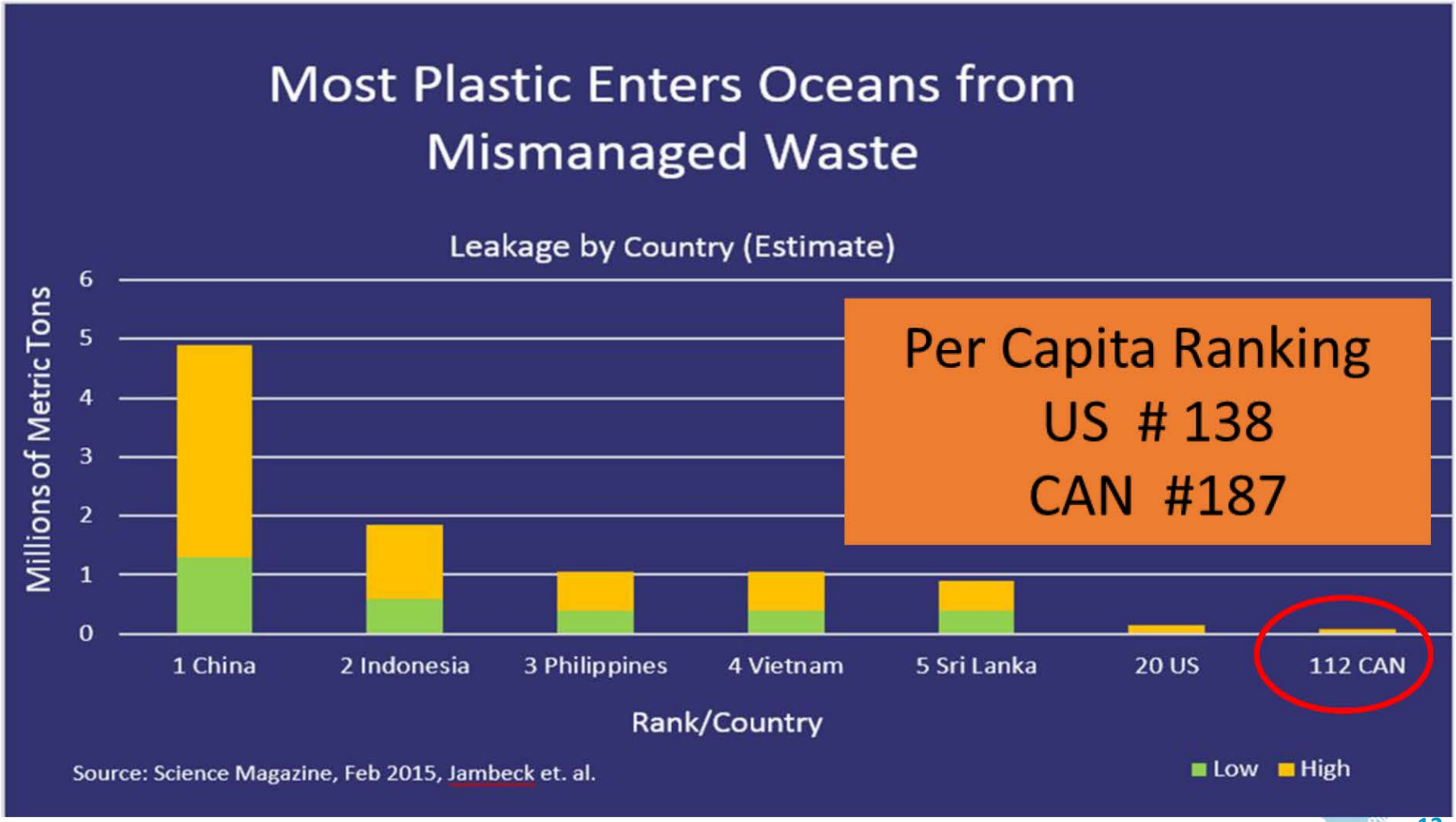
Commitment to End Ocean Waste Alliance



The Alliance to End Plastic Waste – 30+ companies – some CPIA members

- Focus on hotspots - $1.5B on initiatives
- Working in partnerships, sharing expertise, four pillars

Where does Canada Rank Globally on Ocean Waste?



From: Plastics Sustainability Coalition; July 2018

G7 Plastics Charter – opportunity for positive change; CPIA commitment

G7 Commitment:

- Work with G7 countries' on global plastic commitment

Canada's Plastics Recovery Targets

Canada's plastics industry has established consensus, ambitious goals for plastics recovery:

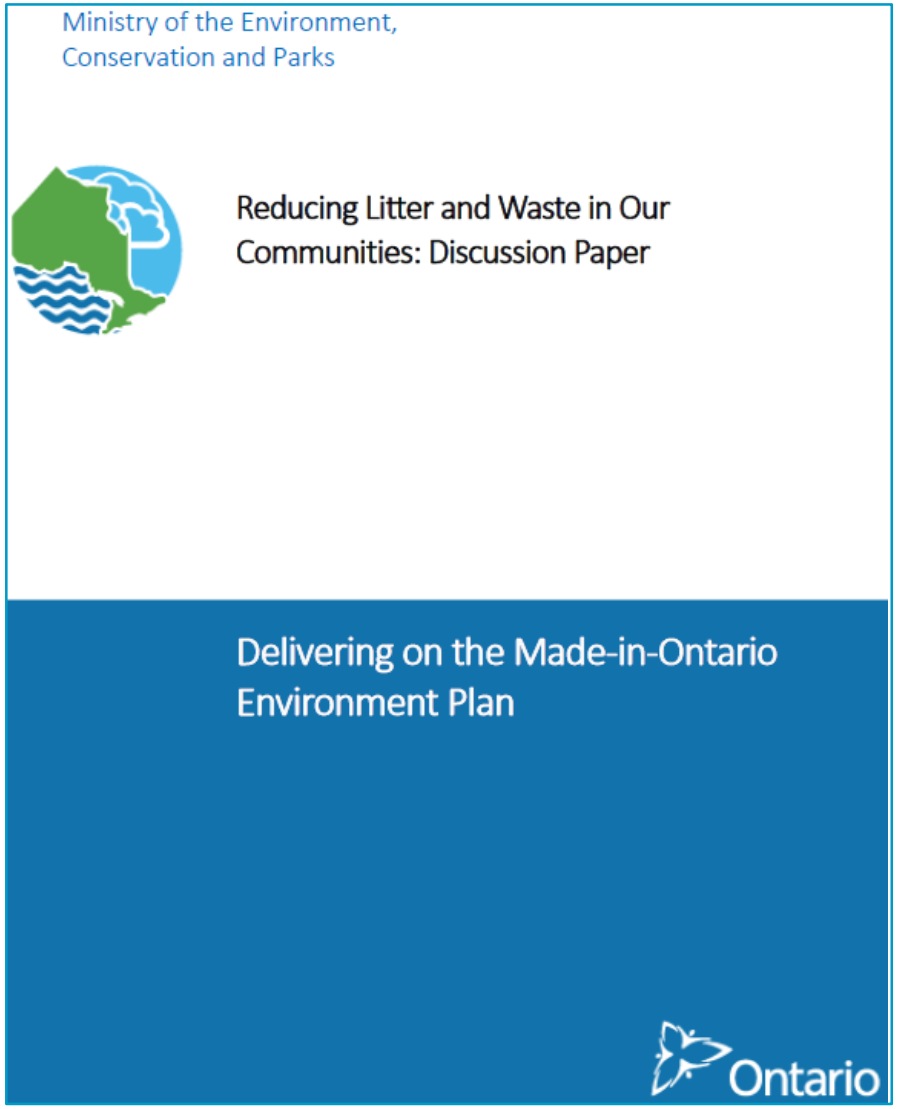
Association canadienne de l'industrie des plastiques
since • depuis 1943
Canadian Plastics Industry Association

Managing waste in Canada – CCME Zero Plastic Waste Strategy

- Plastics working with Federal & Provincial and stakeholders on a Zero Plastic Waste Strategy.
- Goal is to retain societal benefits of plastics due to its importance to sustainable development goals
- Late June announcement expected federally

Ontario Litter and Waste Reduction Strategy

- Ontario moving ahead with reducing litter and waste.
- Plastics working with the province to achieve “zero plastics resources to landfill”
- First province to propose a resource recovery and circular economy framework 4 R’s approach
- Manage all plastics resources and whole waste stream to achieve societal goal of zero waste to landfill



Danger of symbolic actions

68% say ban - 'emotion based'

Plastic Bag Bans Are Based on Hype, Not

When asked best way to reduce plastic waste, most favourable answer was recycling, not bans

- Government better waste management – 12%
- Better education – 15%
- Ban certain plastic products – 22%
- **Recover & reuse plastic products 45%**

https://www.themainewire.com/2014/11/plastic-bag-bans-based-hype-science/

Guelph Waste Plans – needs science and facts

1. **Key Recommendation:**

Key Principle:

- Decisions made in the name of the environment should be based on science and fact – collaboration is key to the facts

<u>The City is committed to developing good policy based on the science and facts.</u>

1. **City establish an expert advisory group (CPIA & other Sustianbility experts) to advise the City & Solid Waste Management Plan Advisory Committee on plastics and waste resources management to move closer to zero waste.**

Guelph – needs science & fact

2. Policy Development for Zero Waste (not just plastics)

- This is not a plastic system - must take a holistic view and considered a resource recovery system if we are to aim for “Zero Waste” – air, water & land
- The Guelph long term waste plans if based on uninformed actions will increase the City’s costs to manage waste and negatively impact the environment, economy and social sustainability goals.

Recommendation:

- **The City take a holistic approach to manage all waste and litter with a goal to reduce and approach Zero Waste Goals.**
- **Examine a Resource Recovery Framework that uses complimentary approaches of Circular Economy and Sustainable Material Management**

Guelph Motion – needs science & fact

3. Policy Development – Regulatory Options

- Restrictions on all recyclables to landfill from residential, industrial, commercial and institutional waste streams to increase diversion.
- Must be implemented with care to ensure market capacity exists.

Recommendation:

- **Implement a waste & landfill restriction on recyclables from all waste generators to boost diversion and provide a critical mass of recyclable feedstocks for manufacturing and the circular economy**

Guelph – Support Circular Plastics Economy

4. Procurement and Recycled Content

- If we are to support waste resource diversion and a circular economy, materials collected need markets to accept them for manufacturing
- Approx. 84% of plastics collected in Canada are recycled in North America with the balance exported until the China Sword program prohibited the import of recyclables - **Reports on Access to Residential Recycling of Plastics** https://www.plastics.ca/PlasticTopics/RecyclingPlastics/BestPracticesCaseStudies

Recommendation:

- **The City implement procurement guidelines for recycled content for plastics and other products to support the development of markets for materials collected.**

Questions

We welcome your thoughts and suggestions…

CPIA website: www.plastics.ca

Joe Hruska

VP Sustainability

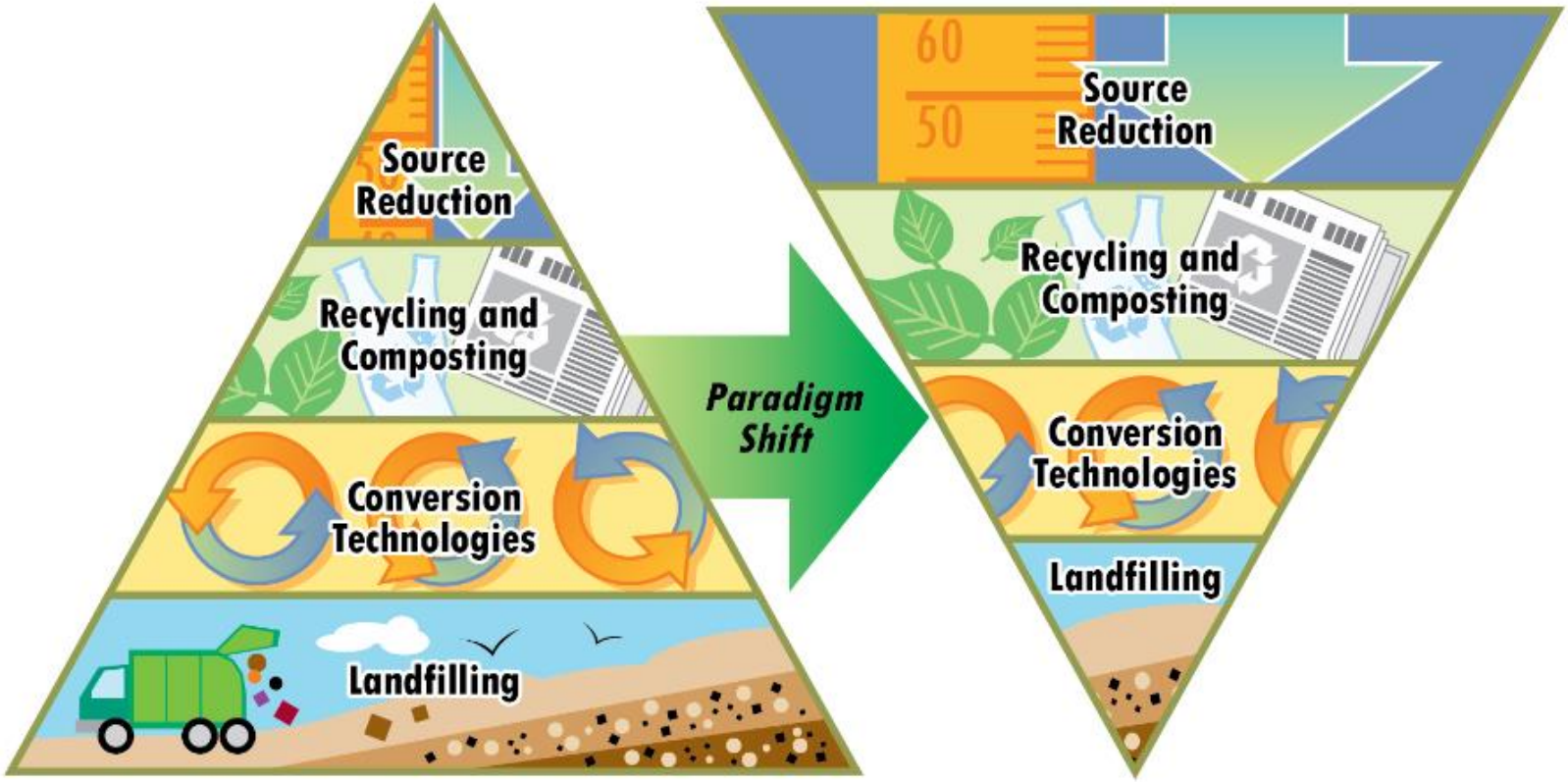
jhruska@plastics.ca

416-930-1796

@JoeHruskaCPIA

Association canadienne de l'industrie des plastiques
since • depuis 1943
Canadian Plastics Industry Association

Time for Greater Collaboration



Reproduced from Waste Advantage Magazine, August 15, 2014

Arni Mikelsons
Guelph, ON

City Clerk's Office
City of Guelph
1 Carden Street
Guelph, ON N1H 3A1

Re: Our Energy Guelph Report and Funding (IDE Report)

May 21, 2019

Dear Mayor and Councillors:

The City of Guelph is about to take an important step in combatting climate change through the acceptance of the recommendations of the Our Energy Guelph taskforce.

First of all, I would like to congratulate the taskforce on their success thus far, as they have embarked on a significant body of work. However I would also like to raise some very serious concerns about their proposal that is in front of Council. My concerns stem from having been involved in the founding of several non-profit organizations, not the least of which is the Toronto Environmental Alliance. I have an intimate understanding of what is involved in not only the creation of organizations such as this, but in the timeline needed to achieve a certain level of professionalism and scope when it comes to tasks. This understanding is strengthened by being the founder of Northern Village, a B-Corp that services non-profits and charities.

Our Energy Guelph completed its review of the Community Energy Initiative in May 2018 and the main recommendation was to have the City as a whole be Net Zero by 2050 – a very laudable goal.

Additionally, the City hired a consultant who developed a 25-point plan to address climate change, its causes and identified steps that can be pre-emptively taken to tackle it. The goals they set are action-focused, prime to be immediately addressed, and are extremely relevant.

For instance:

- Ensure that all new developments will be Net Zero (Item 1)
- Encourage energy retrofits to achieve thermal and electrical savings (Items 3-6)
- Devise a strategy to significantly increase car charging stations (Item 22)
- Installing District Energy in downtown (Item 11)

The City of Guelph is showing its commitment to these important goals by committing $700K to fund its Community Energy Initiative and it is being recommended that this be funded from the dividend coming from the merger of Guelph Hydro and Alectra. This is a very significant step.

Having an organization to help coordinate all these efforts as a non-profit makes sense. It is also a responsible and sound step to have stable funding to be able to undertake such an effort. However, rushing into an agreement with an organization that does not have a track record does not seem like a wise action on the part of the City. It is precedent-setting and the public needs to know that their investment is sound.

The City should carefully consider the organization that it wants to enter into an agreement with to address these vital issues. At minimum, the organization should have the following:

- A respected and diverse Board of Directors
- A proven track record of projects and events (more than one) that have been successfully delivered in the energy space
- Demonstrate that they have worked and have ongoing relationships with other organizations in Guelph, and ideally additional relationships with other regional, national and international organizations
- Be able to contribute budget, or have the potential to fundraise from other sources
- Document all of the above and present said documentation to Council in the form of a business plan to make assurances that it is making a wise investment.

Unfortunately, Our Energy Guelph does not meet this standard - yet. On May 6th they provided an update on their progress and actions this past year. To their credit they have started incorporation, have a preliminary Board of Directors, held an event in conjunction with the University, with a couple other activities. On the basis of these actions, they are requesting almost $700K over 5 years, including up to $175K in the first year. I do not believe that they are ready for this level of funding.

Further the City should be asking that the organization provide a precise business plan detailing how this organization sees itself implementing the 25-point plan. This plan should answer the following:

- Who are the major players? And what Is their role in the community?
- How is the organization going to fit among the other players? Is it a supportive role? Or a competitive role?
- What are the expected reductions in greenhouse gas emissions in 1, 3 and 5 years? What are the expectations of the City to help in those goals?
- What are the other realistic (potential) funders?
- How will they report progress to Council?

Once again, Our Energy Guelph falls short at this point. In their update they state “One of the first tasks of our permanent Board of Directors will be to set a budget, considering the typical salary and benefits of a full-time non-profit ED with this sort of a scope of responsibilities; occupancy and administrative costs; and allocations for hosting meetings, travel, conferences, and professional development.”

Is the City really going to give $700K to an organization that doesn’t even have a budget?

Now, I am not trying to take away from the successes of Our Energy Guelph and the admirable goals that it is trying to achieve. It also seems that there is not another existing organization that could undertake such an endeavour with the City. However, entering into a relationship with an organization in its formative stages, with such vast unknowns in terms of setup, is a cause for concern. As a resident and business owner, I do think that there are other options that should be considered before moving forward.

One option is that Our Energy Guelph takes its time and assembles a plan that meets the required conditions outline above, acknowledging that this is not an easy task. After all they would be undertaking the task of creating an organization by committee, which makes things more difficult. In particular, I do not believe that the City should be using its CEI action plan budget to aid an outside organization in its creation.

A second option would be to find an existing organization that could undertake the project within its current mandate. Unfortunately, I do not think that any one organization has this capability. The Chamber of Commerce would have the business connections, Innovation Guelph has a mentorship infrastructure and connections to investments and e-Merge Guelph has delivered on energy projects in the community for many years. But unfortunately, none of these organizations have the full package. Pursuing this option may not ultimately be fruitful, as it would entail going through the RFP process to evaluate between these different organizations that do not have the mandate to undertake such an effort.

The final option is to have one of these organizations be a host or a mentor to the newly formed Our Energy Guelph. Our Energy Guelph could search out the best fit among the organizations mentioned above (or other organizations) and present a plan to the city that involves them entering into a service agreement with said organization. This agreement would last until such a time that they are up and running at the capacity of a mature organization and would thus be able to take on the service agreement themselves. This way, Our Energy Guelph could leverage the organizational capacity of the host organization to get moving quicker. This was the way that Innovation Guelph was originally set up, with city support, with the host organization being the Chamber of Commerce, and as such gave them time and space to get the legalities sorted, establish a board of directors, set organizational Bylaws, decide who the members would be, etc.,

I do want to see the success of Our Energy Guelph, and hope this is helpful in your deliberations.

Yours truly,

Arni Mikelsons

-

Dear Mayor Guthrie and Guelph City Councilors,

Is there anyone – outside of the fossil fuel industry, perhaps – who *doesn't* believe that the climate crisis is an emergency? Evidence for climate disruption is mounting daily -- unprecedented flooding, violent storms, wildfires and record high temperatures above the arctic circle. Research shows that impacts will be greater and more costly the longer we wait to cut emissions significantly.

Respected scientists have declared disruption of Earth's climate to be an *existential threat* in the newest report to the UN (May 6, 2019) . What does that mean? It means that humanity's *continued existence* on this planet is under threat. Already (again according to a recent U.N. report) there are, for the first time in human history, more climate refugees than political ones, and that number will only continue to increase, ever more rapidly.

The City of Guelph is doing a lot to adopt more sustainable policies, but the target date at 2050 for our net-zero and 100% renewable goals is too little, too late. To argue that Guelph doesn't need to declare a climate emergency because it's "already doing a lot" is to imply that, because of this great work, we will somehow be exempt from the disastrous effects of climate disruption. That is patently not true. Climate change is not going to play favourites; it's a global crisis, and no place is immune.

And if that isn't an emergency, then what is?

We urge you as our Mayor and City Councillors to acknowledge the urgent dangers of climate disruption and declare a global climate emergency. Our city needs to consider climate implications in all policy and planning decisions. The forward-thinking Community Energy Initiative and Corporate Energy Plan are important steps taken; let's recognize how much more is needed, and build on those.

Respectfully yours,
Sally Ludwig and Christine Mills

***

As a homeowner in Ward 1 with a young family, I believe that it would irresponsible to not accelerate the target of the climate emergency goal to the year 2035. We're long past the point of placing blame for the current dire climate. Now is the time for doing all we can to try and ensure there will be survivable climate for our children.

Paul Scapinello

City of Guelph - Council Meeting - May 27, 2019

Item IDE-2019-44

Author: Pamela Richardson

WRITTEN SUBMISSION for delegation

Is Guelph actually a leader in the environmental movement? If so, prove it!

Guelph can demonstrate leadership by declaring a climate emergency, and then acting to deal with this emergency.

Let Guelph show solidarity with other municipalities across Canada.

If Guelph wants to be a leader in Ontario and Canada as an environmentally responsible municipality, essential steps include declaring a climate emergency and also bringing forward the City's goals for 100% renewable energy.

Research indicates that the impacts of fossil fuels are both local and non-local to Guelph. The impacts includes serious damage to human health, food production, air, water, soil, flora, fauna, and the global ecosystem. There is damage and risk at every step of this energy process, from exploration, extraction, processing, handling of the waste products of processing, storage, transportation, use (burning), and finally the handling of the waste products of burning. In addition to the damage, every step of the energy process uses valuable resources for the manufacture, transportation and maintenance of equipment, which also have serious negative impacts on human health and the environment.

Regarding non-local effects, even if Guelph doesn't extract or process oil, coal or gas within the City limits, how could Guelph morally and ethically tolerate contributing to continued damage elsewhere by continuing to buy these energy sources?? In addition, Guelph is indeed impacted both directly and non-directly by non-local damage, because, for example, air and water circulate, and demand rises for food and water and other resources thus affecting prices in Guelph. Climate change is not localized to just the areas extracting, processing and burning these carbon-based energy sources. Guelph is already being affected.

Regarding local effects, Guelph does transport, store and burn fossil fuels within the city limits, and that has damaging local effects.

It is your responsibility as City Council to take prompt action regarding the local impacts of both fossil fuel use and climate change, because these are affecting your neighbours, your constituents, your children and their schoolmates.

Let us consider three possible scenarios for climate change, as follows:
1. The climate returns to the 'normal' of the last 100 years, and remains stable.
2. The global climate is warming.
3. The global climate is warming briefly, and then cooling significantly.

I think that most people would agree that scenario number one is highly unlikely.

If scenario number two is the global reality, then there will be increased energy demands for cooling buildings. In addition, there will be serious and expensive impacts on human health, agriculture, transportation, industry, and global ecosystems which support all life on Earth.

If scenario number three is the global reality, then there will be increased energy demands for heating buildings. Again, there will be serious and expensive impact on human health, agriculture, transportation, industry and global ecosystems.

In any of these three possible scenarios, it would be foolhardy to continue the use of coal, oil, and gas.

In addition to changing the source of our energy in Guelph, it is very important that we reduce the energy demands of buildings, transportation, industry and agriculture. We can do this with a combination of methods, including architecture and technology, both new and ancient.

It is also vitally important to increase the resilience of our energy system in Guelph and beyond. Guelph needs to transition to a modular and localized energy system. A centralized electrical grid is extremely vulnerable to disruption. When the electrical grid is down, nothing in our modern technological society operates. Without electricity, suddenly commerce, education, and industry grind to a halt. Stores and banks close even during brief interruptions in electrical supply. Emergency services are impacted. Hospitals struggle on back-up generators. The supply chain breaks down, and stores run out of food very quickly. Consider, for a moment the incredible disruption in Puerto Rico which lost its electrical grid for many months after the major hurricane. Consider also what is currently happening in Venezuela with serious disruptions in electrical service, and the huge economic and social impacts. How many months could Guelph survive without any electricity? How could Guelph even meet basic human needs for food and water for more than a few days without an electrical supply?

We already know that centralized electrical grids are vulnerable to many factors, including cyberwarfare by rival governments, conventional warfare, hacking by malicious individuals or factions, extreme weather events, earthquakes, PEMF attacks (Pulsed Electro-Magnetic Frequency), and CME (Coronal Mass Ejection- a vast energy burst from the sun, such as the 'Carrington Event' in the late 1800s). For some of these factors, such as extreme weather events and CME, it's not a matter of if but when these will occur.

Guelph can start to increase its resilience now, by quickly moving towards modular localized energy production, using renewable resources. The technology already exists, and has been significantly reduced in price over the last decade. There is good research on the costs and benefits of many renewable resources, as well as some of the human health and environmental hazards. There is enough information available for Guelph to make responsible and progressive decisions now.

Many residents of Guelph, as well as people globally, know that renewable, non-polluting and free energy sources have existed for some 120 years, since Tesla started working with what is now commonly called Zero Point Energy. We also know that Tesla's work was shut down by the oil, coal and gas industrialists, particularly JP Morgan, for their selfish interests in corporate profits. We know that the military-industrial complex (MIC) of the United States confiscated Tesla's research, and then weaponized it, and prevented any benefits of Zero Point Energy being known or available to the public.

Brave scientists since Tesla who have investigated zero point energy have included Eric Dollard, Dr. Constantine Meyl, Vassilatos, Trinkhaus, and Steinmetz. Unfortunately, the intense influence of the fossil fuel industry on governments at all levels in most countries has prevented this technology being made public or available. Thus, the use of oil, coal and gas has continued for the last 120 years, which has resulted in global pollution, disastrous impacts on human health and agriculture, and rampant destruction of ecosystems. The use of oil, coal and gas is absolutely unnecessary! It is imperative for the survival of humanity and the earth that genocide and ecocide through the use of oil, coal and gas be stopped now.

Some people believe that nuclear energy power plants are good, because there are low atmospheric pollutants from regular operations. However many researchers have pointed out that nuclear energy is not a good choice, because in fact there is a huge pollution problem which lasts thousands of years from radioactive waste. In addition, nuclear energy plants are very vulnerable to extreme weather events such as hurricanes, earthquakes, cyber attack, Conventional warfare and cyber warfare, PEMF attacks, CME events, and any factors which disrupt the electrical system at or supplying the plant. Electricity is required for keeping the nuclear plants stable. Some nuclear plants have been purchasing a large supply of generators and barrels of fossil fuel, but this would only last a short time in the event of an electrical grid outage. Some researchers have revealed that there are still huge amounts of radiation being released daily from the Fukushima nuclear plant, even though that happened over eight years ago! That radiation has spread throughout the Pacific Ocean and beyond, and has been raining down on all of North America affecting the air, soil and water, impacting humans, flora, and fauna. According to some researchers, the global radiation impacts of the Fukushima disaster have been deliberately concealed by many governments, including Japan, Canada and the USA, starting shortly after the disaster when the huge impacts first started being revealed. In addition, the world is still dealing with the radiation damage from Chernobyl. Keep in mind that Chernobyl and Fukushima were just two of the many nuclear power plants around the world, yet the impact of their disasters has been profoundly damaging globally.

Conclusion

As a concerned resident of Guelph, I urge and implore the City of Guelph to take the following actions:

1. declare a climate emergency
2. transition as quickly as possible to 100% renewable energy sources, by 2035 or sooner
3. develop a localized modular energy system
4. develop programs to reduce the energy requirements of all sectors such as residential, industrial, transportation and agriculture.

Thank you.

The Hidden Costs of Fossil Fuels

AUTHOR: Union of Concerned Scientists (UCSUSA.org)
DATE: August 30, 2016 (date of last revision)

The true costs of coal, natural gas, and other fossil fuels aren't always obvious—but their impacts can be disastrous.

Contents

We've all paid a utility bill or purchased gasoline. Those represent the *direct* costs of fossil fuels; money paid out of pocket for energy from coal, natural gas, and oil.

But those expenses don't reflect the total cost of fossil fuels to each of us individually or to society as a whole. Known as externalities, the *hidden* costs of fossil fuels aren't represented in their market price, despite serious impacts to our health and environment.

Externalities are sometimes easy to see, such as pollution and land degradation, and sometimes less obvious, such as the costs of asthma and cancer, or the impacts of sea level rise. Many consequences are far removed from our daily lives and may only affect a minority or marginalized subset of the population.

> ***What are fossil fuels?***
>
> *Fossil fuels are rock-like, gas, or liquid resources that are burned to generate power. They include coal, natural gas, and oil, and are used as an energy source in the electricity and transportation sectors. They're also a leading source of the world's global warming pollution.*

Costs accrue at every point of the fossil fuel supply chain. Extraction processes can generate air and water pollution, and harm local communities. Transporting fuels from the mine or well can cause air pollution and lead to serious accidents and spills. When the fuels are burned, they emit toxins and global warming emissions. Even the *waste* products are hazardous to public health and the environment.

Understanding these impacts is critical for evaluating the true cost of fossil fuels—and for informing our choices around the future of energy production.

EXTRACTING FOSSIL FUELS

There are two main methods for removing fossil fuels from the ground: **mining** and **drilling**. Mining is used to extract solid fossil fuels, such as coal, by digging, scraping, or otherwise exposing buried resources. Drilling methods help extract liquid or gaseous fossil fuels that can be forced to flow to the surface, such as conventional oil and natural gas. Both processes carry serious health and environmental impacts.

Coal mining

Over the past several decades, there has been a gradual shift from **underground coal mining** to **surface mining** in the United States. Surface mining, which is only effective for shallow deposits, often employs highly invasive techniques, including area strip mining and mountaintop removal.

Underground mining

The most obvious and severe cost of underground coal mining is the threat it poses to the health and safety of coal miners. Many coal miners are injured, sometimes fatally, on the job each year; according to the Mine Safety and Health Administration, fatalities at underground coal mine sites in the United States totaled 77 from 2010 to 2013, including a 2010 explosion at the Upper Big Branch coal mine in West Virginia that killed 29 miners [1, 2].

In addition to job site accidents, coal mining can lead to chronic health disorders. Black lung disease (pneumoconiosis) continues to be a common ailment among coal miners. The disease was responsible for the deaths of approximately 10,000 former miners between 1990 and 2000, and continues today [3].

Adverse impacts to the environment are another significant cost of underground coal mining. Mines can collapse or gradually subside, affecting surface and subsurface water flows. Mine fires also occur, particularly in abandoned mines. And acid mine drainage at underground coal mines can be a long term environmental management issue; according to the US Environmental Protection Agency (EPA), if active and abandoned coal mines are not properly managed, water can sometimes flow through the mine and become highly acidic and rich in heavy metals. The resulting drainage water is detrimental to human, plant, and animal life [4].

Surface mining

Surface mining involves removing the overlaying soil to access the coal below, devastating local environments. Mountaintop removal, a particularly destructive form of surface mining, involves stripping all trees and other vegetation from peaks and hilltops, and then blasting away hundreds of feet of the earth below with explosives.

More than 500 mountaintop removal sites exist throughout the Appalachia region, impacting nearly 1.4 million acres of land [5].

The process results in both short- and long-term environmental impacts. In the short term, huge volumes of excess rock and soil are typically dumped into adjacent valleys and streams, altering their ecosystems and diverting the natural flow of streams.

In the long term, coal removal sites are left with poor soil that typically only supports exotic grasses. Buried valleys are similarly slow to rebound. The EPA reports that as of 2010, mountaintop removal coal extraction had buried nearly 2,000 miles of Appalachian headwater streams, some of the most biologically diverse streams in the country [6].

Surface mining can also directly impact the health and safety of surrounding communities. Mudslides, landslides, and flashfloods may become more common. And depending on the chemical makeup of the coal deposit, mines can pollute local drinking water sources with toxic chemicals like selenium, arsenic, manganese, lead, iron, and hydrogen sulfide [7].

A Harvard University study, which assessed the life cycle costs and public health effects of coal from 1997 to 2005, found a link to lung, cardiovascular, and kidney diseases—such as diabetes and hypertension—and an elevated occurrence of low birth rate and preterm births associated with surface mining practices. The total cost? An estimated $74.6 billion *every year*, equivalent to4.36 cents per kilowatt-hour of electricity produced—about one-third of the average electricity rate for a typical US home [8].

Oil and gas drilling

The environmental and health costs of onshore and offshore oil and gas drilling are also significant, and often unseen. The impacts of unconventional extraction methods, such as natural gas hydraulic fracturing (commonly called fracking) have received much attention, but all methods of oil and gas extraction carry hidden costs.

Water impact

When oil and gas are extracted, water that had been trapped in the geologic formation is brought to the surface. This "produced water" can carry with it naturally-occurring dissolved solids, heavy metals, hydrocarbons, and radioactive materials in concentrations that make it unsuitable for human consumption and difficult to dispose of safely [9].

When hydraulic fracturing methods are used, the total amount of waste water is amplified by the large volume of water and chemicals involved in the process. Drilling and fracking shale gas formations (like the Marcellus Shale) typically requires 3 to 6 million gallons of water per well, and an additional 15,000-60,000 gallons of chemicals, many of which are undisclosed to Federal regulators [10, 11]. One government-sponsored report found that, from 2005 to 2009, 14 oil and gas companies used 780 million gallons of hydraulic fracturing products containing 750 chemicals and other components [12]. Another study identified 632 chemicals contained in fracking products used in shale gas extraction.

Researchers could track only 353 chemicals from that larger list and found that 25 percent of those chemicals cause cancer or other mutations, and about half could severely damage neurological, cardiovascular, endocrine, and immune systems [13].

Land use

A large amount of land is disturbed by the drilling wells, access roads, processing facilities, and pipelines associated with oil and gas drilling operations. In particular, noise and habitat fragmentation can harm wildlife populations. For example: one study found an 82 percent decline in the population of Powder River Basin sage grouse between 2001 and 2005, which was directly linked to the area's coal bed methane production [14].

The advent of horizontal drilling technology, used extensively in unconventional gas production, has greatly reduced the surface footprint of drilling operations by allowing multiple wells to be drilled from a single well pad. However, much of the development of the US shale gas resources is occurring in locations where oil and gas production has not previously taken place (in some cases in wilderness areas), requiring extensive infrastructure development and land degradation [15].

Global warming emissions

Natural gas's climate emissions are not only generated when it's burned as a fuel at power plants or in our homes. The *full* global warming impact of natural gas also includes methane emissions from drilling wells and pipeline transportation.

Methane, the main component of natural gas, is a much more potent greenhouse gas than carbon dioxide—some 34 times more effective at trapping heat over a 100-year timescale and 86 times more effective over a 20-year timescale [16]. Preliminary studies and field measurements show that these so-called "fugitive" emissions range from 1 to 9 percent of total natural gas lifecycle emissions. Methane losses must be kept below 3.2 percent for natural gas power plants to have lower lifecycle greenhouse gas emissions than coal [17].

Oil drilling can also produce methane. Although it can be captured and used as an energy source, the gas is often either vented (released) or flared (burned). Vented methane contributes greatly to global warming, and poses a serious safety hazard. Flaring the gas converts it from methane to carbon dioxide, which reduces its impact but still releases additional greenhouse gases to into the atmosphere. The World Bank estimates that 5.3 trillion cubic feet of natural gas, the equivalent of 25 percent of total US consumption, is flared annually worldwide, generating some 400 million tons of unnecessary carbon dioxide emissions [18].

Offshore drilling

Offshore oil and gas drilling poses many of the same risks as onshore drilling; however, these risks are amplified due to the remote location of offshore drilling sites and the complicated engineering required. In 2010, an explosion at the Deepwater Horizon offshore oil rig in the Gulf of Mexico killed 11 workers and led to the release of approximately 4.9 million barrels of oil over 87 days [19]. The accident was unique in terms of its scale, but environmental and safety incidents are common in the offshore oil and gas industries. Between 2008 and 2012, offshore drilling rigs experienced 34 fatalities, 1,436 injuries, and 60 oils spills of more than 50 barrels each [20].

Unconventional sources

As easily-accessed sources of oil dry up, so-called "new" sources of oil are introducing new problems. For example, tar sands—an extremely viscous oil with the consistency of peanut butter—requires significantly more energy to mine and refine, emitting up to three times more greenhouse gas emissions than conventional oil in the process. These and other additional emissions mean that the dirtiest sources of oil can add as much as an extra ton of pollution per year for the average car.

TRANSPORTING FOSSIL FUELS

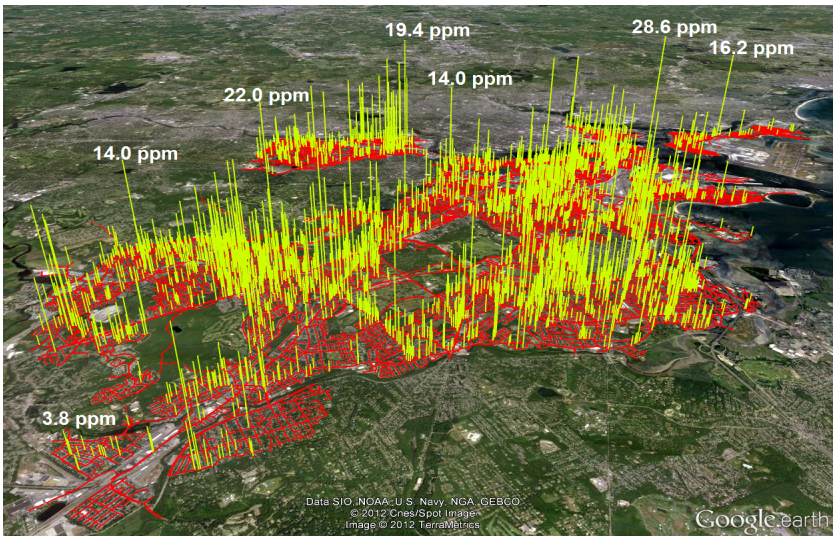
Depending on where fossil fuels are extracted and used, the resource itself may need to travel across long distances—but transporting fuel can generate its own pollution, and increase the potential for catastrophic accidents.

Coal

In most cases, coal is transported from mines to power plants. In 2014, approximately 68 percent of the coal used for electric power in the US was transported by rail: 13 percent was transported on river barge and another 11 percent by truck [21]. Train cars, barges, and trucks all run on diesel fuel, a major source of nitrogen dioxide and soot, which carry substantial human health risks [22]. Transporting coal can also produce coal dust, which presents serious cardiovascular and respiratory risks for communities near transportation routes [23].

Natural gas

Natural gas is transported over long distances by transmission pipelines, while distribution pipelines deliver gas locally to homes and businesses. But natural gas is also highly flammable, making the process of transporting it from wellhead to homes and businesses dangerous. Between 2008 and 2015, there were 5,065 significant safety incidents related to natural gas pipeline transmission and distribution, leading to 108 fatalities and 531 injuries [24].



A map of Boston's methane emissions, leaked from aging pipes.

In addition to safety concerns, natural gas leaks from transmission and distribution pipelines are a significant source of methane emissions. A recent study, which mapped urban pipeline leaks in Boston, found 3,356 separate leaks under the city streets. The study noted that Boston is not unique; other cities, like New York and Washington DC, have aging natural gas distribution infrastructures, and similar methane leaks are likely widespread [25].

Large leaks from natural gas infrastructure also occur. Beginning in 2015, the Southern California Gas Company's Aliso Canyon natural gas storage facility was the site of the largest methane leak in US history, with a total of 94,500 *tons* of methane was released between October 23, 2015 and February 11, 2016 [26, 27].

Large leaks from natural gas infrastructure also occur. Beginning in 2015, the Southern California Gas Company's Aliso Canyon natural gas storage facility was the site of the largest methane leak in US history, with a total of 94,500 *tons* of methane was released between October 23, 2015 and February 11, 2016 [26, 27].

Liquefied Natural Gas (LNG) is natural gas that has been cooled and condensed into a liquid form. As of 2016, there were 13 LNG import/export terminals in the United States [28]. The growth in LNG shipments has provoked safety concerns, particularly where LNG terminals are situated near densely settled areas. In the wake of the Sept. 11, 2001, terrorist attacks, LNG deliveries have faced tight security & stricter regulations as policy makers have debated the risks of an attack on LNG facilities or ships [29].

Oil

Oil is transported across the ocean in supertankers, and it is moved over land by pipeline, rail, and truck. In every case, the risk of oil spills poses a serious environmental threat.

The infamous 1989 Exxon Valdez oil spill released 262,000 barrels of oil into the Prince Williams Sound in Alaska, but was only the 35th largest marine oil tanker spill since 1967. While major oil spills have decreased, they still occur: three large oil spills released more than 5,000 barrels of oil each in 2013 alone [30, 31].

Spills and leaks from onshore oil pipelines also continue to be a major risk. Examples of recent pipeline spills in the US include the 2010 Enbridge spill that released approximately 20,100 barrels into Michigan's Kalamazoo River and the 2011 ExxonMobil spill that released some 1,000 barrels of oil into Montana's Yellowstone River [32, 33].

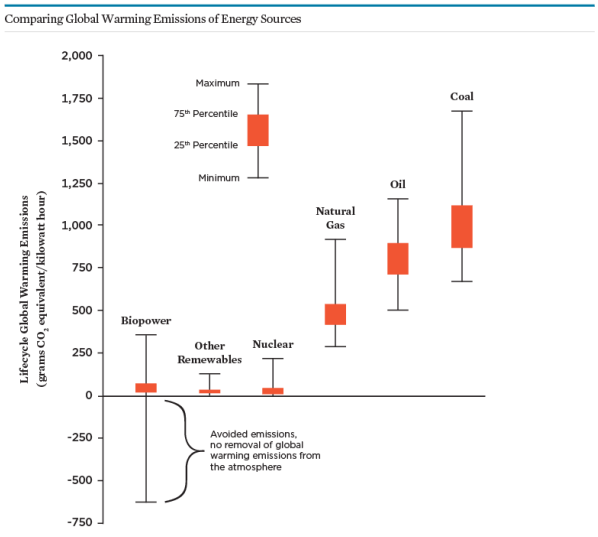
BURNING FOSSIL FUELS

Some of the most significant hidden costs of fossil fuels are from the air emissions that occur when they are burned. Unlike the extraction and transport stages, in which coal, oil, and natural gas can have very different types of impacts, *all* fossil fuels emit carbon dioxide and other harmful air pollutants when burned. These emissions lead to a wide variety of public health and environmental costs that are borne at the local, regional, national, and global levels.

Global warming emissions

Of the many environmental and public health risks associated with burning fossil fuels, the most serious in terms of its universal and potentially irreversible consequences is global warming. In 2014, approximately 78 percent of US global warming emissions were energy-related emissions of carbon dioxide. Of this, approximately 42 percent was from oil and other liquids, 32 percent from coal, and 27 percent from natural gas [34].

Non-fossil fuel energy generation technologies, like wind, solar, and geothermal, contributed less than 1 percent of the total energy related global warming emissions. Even when considering the full lifecycle carbon emissions of all energy sources, coal, oil, and natural gas clearly stand out with significantly higher greenhouse gas emissions [35].



The use of fossil fuels in transportation contributes almost 30 percent of all US global warming emissions, rivalling—and likely to surpass—the power sector [36].

Air pollution

Burning fossil fuels emits a number of air pollutants that are harmful to both the environment and public health.

Sulfur dioxide (SO_2) emissions, primarily the result of burning coal, contribute to acid rain and the formation of harmful particulate matter. In addition, SO_2 emissions can exacerbate respiratory ailments, including asthma, nasal congestion, and pulmonary inflammation [37]. In 2014, fossil fuel combustion at power plants accounted for 64 percent of US SO_2 emissions [38].

Nitrogen oxides (NOx) emissions, a byproduct of all fossil fuel combustion, contribute to acid rain and ground-level ozone (smog), which can burn lung tissue and can make people more susceptible to asthma, bronchitis, and other chronic respiratory diseases. Fossil fuel-powered transportation is the primary contributor to US NOx emissions [39].

Acid rain is formed when sulfur dioxide and nitrogen oxides mix with water, oxygen, and other chemicals in the atmosphere, leading to rain and other precipitation that is mildly acidic. Acidic precipitation increases the acidity of lakes and streams, which can be harmful to fish and other aquatic organisms. It can also damage trees and weaken forest ecosystems [40].

Particulate matter (soot) emissions produce haze and can cause chronic bronchitis, aggravated asthma, and elevated occurrence of premature death. In 2010, it is estimated that fine particle pollution from US coal plants resulted in 13,200 deaths, 9,700 hospitalizations, and 20,000 heart attacks. The impacts are particularly severe among the young, the elderly, and those who suffer from respiratory disease. The total health cost was estimated to be more than $100 billion per year [41].

Coal-fired power plants are the largest source of **mercury** emissions to the air in the United States [42, 43]. As airborne mercury settles onto the ground, it washes into bodies of water where it accumulates in fish, and subsequently passes through the food chain to birds and other animals. The consumption of mercury-laden fish by pregnant women has been associated with neurological and neurobehavioral effects in infants. Young children are also at risk [44].

A number of studies have sought to quantify the health costs associated with fossil fuel-related air pollution. The National Academy of Sciences assessed the costs of SO_2, NOx, and particulate matter air pollution from coal and reported an annual cost of $62 billion for 2005 —approximately 3.2 cents per kilowatt-hour (kWh) [45]. A separate study estimated that the pollution costs from coal combustion, including the effects of volatile organic compounds (VOCs) and ozone, was approximately $187 billion annually, or 9.3 cents per kWh [46].

A 2013 study also assessed the economic impacts of fossil fuel use, including illnesses, premature mortality, workdays lost, and direct costs to the healthcare system associated with emissions of particulates, NOx, and SO_2. This study found an average economic cost (or "public health added cost") of 32 cents per kWh for coal, 13 cents per kWh for oil, and 2 cents per kWh for natural gas [47]. While cost estimates vary depending on each study's scope and assumptions, together they demonstrate the significant and real economic costs that unpriced air emissions impose on society.

Fossil fuel transportation emissions represent the largest single source of toxic air pollution in the U.S., accounting for over a third of carbon monoxide (CO) and NOx emissions.

Water use

Across the United States, the demand for electricity is colliding with the need for healthy and abundant freshwater. Nationwide, fossil fuel and nuclear power plants have been found to withdraw as much water as all farms and more than *four times* as much as all residences. More than 80 percent of this power plant cooling water originates in lakes and rivers, directly impacting local ecosystems and often competing with other uses, such as agriculture and recreation. As of 2008, about 20 percent of U.S. watersheds were experiencing water-supply stress. Power plants substantially contributed to the water stress in one-fifth of these watersheds [48].

Power plants that return water to nearby rivers, lakes, or the ocean can harm wildlife through what is known as "thermal pollution." Thermal pollution occurs due to the degradation of water quality resulting from changes in water temperature. Some power plants have large impacts on the temperature of nearby water sources, particularly coal plants with once-through cooling systems. For a typical 600-megawatt once-through system, 70 to 180 billion gallons of water cycle through the power plant before being released back into a nearby source. This water is much hotter (by up to 25°F) than when the water was initially withdrawn. Because this heated water contains lower levels of dissolved oxygen, its reintroduction to aquatic ecosystems can stress native wildlife, increasing heart rates in fish and decreasing fish fertility.

FOSSIL FUEL WASTE

Although fossil fuels contain large amounts of energy, they're rarely found in a pure, unadulterated state. Instead, they are typically refined and purified into a usable form, leaving excess waste material that requires disposal. The handling and disposal of this waste results in costly environmental and community health challenges.

Coal waste

Coal is known for being a dirty fuel, not just because of its high carbon content compared with other fossil fuels but also because it contains a large amount of toxic heavy metals and other chemicals.

If the coal contains high levels of sulfur—as does most coal from the eastern US—it must be cleaned and refined before it's burned in a power plant. This process involves crushing and washing the coal to remove waste materials. The purified coal is then transported to its final destination, leaving behind coal slurry, a watery waste that contains arsenic, mercury, chromium, cadmium, and other heavy metals. As much as 50 percent of pre-processed coal materials can end up as highly toxic waste [49].

Others harmful materials remain as excess waste when the coal is burned. After combustion, the material left behind is known as coal ash, consisting of fly ash and bottom ash. **Fly ash** is the material that is

captured by pollution control equipment in the coal plant's smokestacks. If the plant does not have pollution control equipment, this waste is emitted directly as air pollution. **Bottom ash** is the substance that remains at the bottom of the furnace. Both fly ash and bottom ash contain large amounts of toxic heavy metals and require careful—and costly—disposal.

Coal slurry (pre-combustion waste) and coal ash (post-combustion waste) are stored in large reservoir impoundments. There are over a thousand coal slurry impoundments and coal ash waste sites in the US, many of which contain hundreds of millions of gallons of waste [50, 51].

If the reservoirs are unlined (as are at least 42 percent of US coal combustion waste ponds and landfills) or if lined reservoirs are not properly maintained, harmful chemicals can leach into surface and groundwater supplies. The presence of toxic heavy metals in drinking water has been found to cause cancer, birth defects, reproductive disorders, neurological damage, learning disabilities, and kidney disease [52].

The EPA has identified 53 coal ash ponds that are classified as a "high hazard", meaning that a failure at one of these impoundments would cause serious property damage, injuries, illness, and death [53]. Over the last several decades, there have been several dozen spills at such reservoirs in Appalachia, including the 2000 Martin County Coal Company spill, the 2008 Tennessee Valley Authority spill, and the 2014 Duke Energy Dan River Spill [54].

Oil and gas wastewater

When oil and gas are extracted, water previously trapped within geologic formations is brought to the surface. This "produced water" can carry with it dissolved solids, heavy metals, hydrocarbons, and naturally occurring radioactive materials in quantities that make it unsuitable for human consumption and difficult to dispose of safely [55]. Extraction companies often temporarily store this water in open-air pits with impermeable liners to avoid seepage, but heavy rain can cause these pits to overflow. Covered holding tanks offer a more secure temporary storage option [56].

Oil and gas wastewater can also impact aquatic wildlife. Oil and grease leaked into water systems can adhere to fish and waterfowl and destroy algae and plankton, disrupting the primary food sources of fragile aquatic ecosystems. And heavy metals in the wastewater can be toxic to fish, even in low concentrations, and may be passed through the food chain, adversely affecting humans and larger animals [57].

THE FUTURE OF ENERGY

Burning coal, oil, and natural gas has serious and long-standing negative impacts on public health, local communities and ecosystems, and the global climate. Yet the majority of fossil fuel impacts are far removed from the fuels and electricity we purchase, hidden within public and private health expenditures, military budgets, emergency relief funds, and the degradation of sensitive ecosystems. We don't pay for the cost of cancer, or the loss of fragile wetlands, when we pay our electricity bill—but the costs are real.

Renewable energy—such as wind and solar power—carries far fewer negative impacts at increasingly competitive prices. The Union of Concerned Scientists has worked for decades on transforming the electricity and transportation sectors, and is committed to policies and practices that encourage clean energy.

References

[1] Mine Safety and Health Administration (MSHA). 2013. Coal daily fatality report – year end 2013. Arlington, VA: U.S. Department of Labor. Online at http://www.msha.gov/stats/charts/coal2013yearend.asp, accessed on May 3, 2016.

[2] Mine Safety and Health Administration (MHSA). 2011. US Labor Department's MSHA cites corporate cuylture as root cause of Upper Big Branch Mine disaster. Press release, December 6. Washington, DC: U.S. Department of Labor. Online at http://www.msha.gov/MEDIA/PRESS/2011/NR111206.asp, accessed on May 3, 2016.

[3] Epstein, P.R.,J. J. Buonocore, K. Eckerle, M. Hendryx, B. M. Stout III, R. Heinberg, R. W. Clapp, B. May, N. L. Reinhart, M. M. Ahern, S. K. Doshi, and L. Glustrom. 2011. Full cost accounting for the life cycle of coal in "Ecological Economics Reviews." *Ann. N.Y. Acad. Sci*. 1219: 73–98.

[4] Environmental Protection Agency (EPA). 2015. Abandoned mine drainage. Washington, DC. Online at https://www.epa.gov/polluted-runoff-nonpoint-source-pollution/abandoned-mine-drainage, accessed on May 3, 2016.

[5] Epstein, P.R.,J. J. Buonocore, K. Eckerle, M. Hendryx, B. M. Stout III, R. Heinberg, R. W. Clapp, B. May, N. L. Reinhart, M. M. Ahern, S. K. Doshi, and L. Glustrom. 2011. Full cost accounting for the life cycle of coal in "Ecological Economics Reviews." *Ann. N.Y. Acad. Sci*. 1219: 73–98.

[6] Environmental Protection Agency (EPA). 2010. Memorandum: Improving EPA review of Appalachian surface coal mining operations under the Clean Water Act, National Environmental Policy Act, and the Environmental Justice Executive Order. Washington, DC. Online at: http://www.uky.edu/CommInfoStudies/IRJCI/MTRguidance.pdf, accessed on May 3, 2016.

[7] Holzman, D. C. 2011. Mountaintop removal mining: Digging into community health concerns. *Environmental Health Perspectives*.119(11): a476–a483. Online here, accessed on May 3, 2016.

[8] Epstein, P.R.,J. J. Buonocore, K. Eckerle, M. Hendryx, B. M. Stout III, R. Heinberg, R. W. Clapp, B. May, N. L. Reinhart, M. M. Ahern, S. K. Doshi, and L. Glustrom. 2011. Full cost accounting for the life cycle of coal in "Ecological Economics Reviews." Ann. N.Y. Acad. Sci. 1219: 73–98.

[9] Environmental Protection Agency (EPA). 2015. TENORM: Oil and gas production wastes. Washington, DC. Online at https://www.epa.gov/radiation/tenorm-oil-and-gas-production-wastes, accessed on May 3, 2016.

[10] National Energy Technology Laboratory (NETL). Modern shale gas development in the United States: An update. Pittsburgh, PA: U.S. Department of Energy. Online at http://www.netl.doe.gov/File%20Library/Research/Oil-Gas/shale-gas-primer-update-2013.pdf, accessed on May 3, 2016.

[11] Environmental Protection Agency (EPA). 2011. Plan to study the potential impacts of hydraulic fracturing on drinking water resources, EPA/600/R-11/122. Washington, DC. Online at https://www.epa.gov/sites/production/files/documents/hf_study_plan_110211_final_508.pdf, accessed on May 3, 2016.

[12] U.S. House of Representatives, Committee on Energy and Commerce, Minority Staff. 2011. Chemicals used in hydraulic fracturing. Prepared by committee staff for Henry A. Waxman, Edward J. Markey, and Diana DeGette. Online here, accessed on May 3, 2016.

[13] Colborn, T., C. Kwiatkowski, K. Schultz, and M. Bachran. 2011. Natural gas operations from a public health perspective. Human and Ecological Risk Assessment: An International Journal 17(5):1039–1056. Online at here, accessed on May 3, 2016.

[14] Taylor, R. L. et al. 2012. Viability analyses for conservation of sage-grouse populations. Prepared for the U.S. Bureau of Land Management. Online at http://www.powderriverbasin.org/assets/Uploads/files/cbm-studies/PVA-Sage-Grouse-FinalReport.pdf, accessed on May 3, 2016.

[15] Allred, B.W., W.K. Smith, D. Twidwell, J.H. Haggerty, S.W. Running, D.E. Naugle, and S.D. Fuhlendorf. 2015. Ecosystem services lost to oil and gas in North America. *Science* 348(6233): 401-402.

[16] Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change http://www.climatechange2013.org/images/report/WG1AR5_Chapter08_FINAL.pdf, accessed on May 3, 2016.

[17] Alvarez, R.A., S.W. Pacala, J.J. Winebrake, W.L. Chameides, and S.P. Hamburg. Greater focus needed on methane leakage from natural gas. PNAS 109(17): 6435-6440.

[18] Global Gas Flaring Reduction Partnership (GGFR). Global Gas Flaring Reduction Partnership (GGFR): Improving energy efficiency & mitigating impact on climate change. Washington, DC: The World Bank. Online here, accessed on May 3, 2016.

[19] On-Scene Coordinator (OSC). 2011. On scene coordinator report: Deepwater Horizon Oil Spill. Washington, DC: National Response Team. Online at http://www.uscg.mil/foia/docs/dwh/fosc_dwh_report.pdf, accessed on May 3, 2016.

[20] Bureau of Safety and Environmental Enforcement (BSEE). 2015. Incident statistics summaries. Washington, DC: U.S. Department of the Interior. Online at http://www.bsee.gov/Inspection-and-Enforcement/Accidents-and-Incidents/Listing-and-Status-of-Accident-Investigations, accessed on May 3, 2016.

[21] Energy Information Administration (EIA). Annual coal distribution report. Washington, DC: U.S. Department of Energy. Online at: http://www.eia.gov/coal/distribution/annual/, accessed on May 3, 2016.

[22] Massachusetts Department of Environmental Protection (MassDEP). Health & Environmental Effects of Diesel Pollution." Boston, MA. Online at: http://www.mass.gov/eea/agencies/massdep/air/grants/health-and-environmental-effects-of-diesel-pollution.html, accessed on May 3, 2016.

[23] Epstein, P.R.,J. J. Buonocore, K. Eckerle, M. Hendryx, B. M. Stout III, R. Heinberg, R. W. Clapp, B. May, N. L. Reinhart, M. M. Ahern, S. K. Doshi, and L. Glustrom. 2011. Full cost accounting for the life cycle of coal in "Ecological Economics Reviews." Ann. N.Y. Acad. Sci. 1219: 73–98.

[24] Pipeline and Hazardous Materials Safety Administration. Pipeline incident 20 year trend. Washington, DC: U.S. Department of Transportation. Online at https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages, accessed on May 3, 2016.

[25] Boston University (BU). 2012. Study details natural gas leaks in Boston. Boston, MA. November 20. Online at http://www.bu.edu/cas/2012/11/20/thousands-of-natural-gas-leaks-discovered-in-boston/, accessed on May 3, 2016.

[26] Babson, D. 2016. It's the largest methane leak in U.S. history. Who's responsible? *The Equation*. Cambridge, MA: Union of Concerned Scientists. Online athttp://blog.ucsusa.org/david-babson/porter-ranch-methane-leak-responsible, accessed July 10, 2016.

[27] California Air Resources Board (CARB). 2016. Aliso Canyon natural gas leak. Sacramento, CA: California Environmental Protection Agency. Online at http://www.arb.ca.gov/research/aliso_canyon_natural_gas_leak.htm, accessed on July 10, 2016.

[28] Federal Energy Regulatory Commission (FERC). 2016. North American LNG import/export terminals, existing. Washington, DC: U.S. Department of Energy. Online at http://www.ferc.gov/industries/gas/indus-act/lng/lng-existing.pdf, accessed on May 3, 2016.

[29] Kaplan, Eben. 2006. Liquefied natural gas: A potential terrorist target? Washington, DC: Council on Foreign Relations. Online at http://www.cfr.org/natural-gas/liquefied-natural-gas-potential-terrorist-target/p9810, accessed on May 3, 2016.

[30] International Tankers Owners Pollution Federation (ITOPF). 2013. Oil tanker spill statistics 2013. London, UK. Online at http://www.itopf.com/fileadmin/data/Documents/Company_Lit/OilSpillstats_2013.pdf, accessed on May 3, 2016.

[31] International Tankers Owners Pollution Federation (ITOPF). 2015. Oil tanker spill statistics 2015. London, UK. http://www.itopf.com/knowledge-resources/data-statistics/statistics/, accessed on May 3, 2016.

[32] Environmental Protection Agency (EPA). 2015. EPA's response to the Enbridge oil spill. Washington, DC. Online at http://www.epa.gov/enbridgespill/index.html, accessed on May 3, 2016.

[33] Environmental Protection Agency (EPA). 2011. EPA update on Yellowstone River oil spill (Silvertip Pipeline). Press release, July 20. Online here, accessed on May 3, 2016.

[34] Energy Information Administration (EIA). 2015. U.S. energy-related carbon dioxide emissions, 2014. Washinton, DC: U.S. Department of Energy. Online at http://www.eia.gov/environment/emissions/carbon/, accessed on July 10, 2016.

[35] IPCC, 2011: Summary for Policymakers. In: IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, C. von Stechow (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Online at http://www.ipcc.ch/report/srren/, accessed on May 3, 2016.

[36] Energy Information Administration (EIA). 2016. Monthly energy review. Washington, DC: U.S. Department of Energy. Online at: http://www.eia.gov/totalenergy/data/monthly/, accessed on July 10

[37] Epstein, P.R.,J. J. Buonocore, K. Eckerle, M. Hendryx, B. M. Stout III, R. Heinberg, R. W. Clapp, B. May, N. L. Reinhart, M. M. Ahern, S. K. Doshi, and L. Glustrom. 2011. Full cost accounting for the life cycle of coal in "Ecological Economics Reviews." Ann. N.Y. Acad. Sci. 1219: 73–98.

[38] Environmental Protection Agency (EPA). 2016. Air pollution emissions trends data. Washington, DC. Online at: https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data, accessed on July 10, 2016.

[39] Environmental Protection Agency (EPA). 2016. Nitrogen oxides (NOx) control regulations. Washington, DC. Online at: http://www.epa.gov/region1/airquality/nox.html, accessed on May 3, 2016.

[40] Environmental Protection Agency (EPA). 2016. Acid rain. Washington, DC. Online at: http://www.epa.gov/acidrain/, accessed on May 3, 2016.

[41]Schneider, C., and J. Banks. 2010. The toll of coal: An updated assessment of death and disease from America's dirtiest energy source. Boston, MA: Clean Air Task Force. Online at at: http://www.catf.us/resources/publications/files/The_Toll_from_Coal.pdf, accessed on May 3, 2016.

[42] Environmental Protection Agency. 2016. Cleaner power plants. Washington, DC. Online at https://www3.epa.gov/mats/powerplants.html, accessed on May 3, 2016.

[43] Environmental Protection Agency (EPA). 2010. Memorandum: Improving EPA review of Appalachian surface coal mining operations under the Clean Water Act, National Environmental Policy Act, and the Environmental Justice Executive Order. Washington, DC. Online at: http://www.uky.edu/CommInfoStudies/IRJCI/MTRguidance.pdf, accessed on May 3, 2016.

[44] Epstein, P.R.,J. J. Buonocore, K. Eckerle, M. Hendryx, B. M. Stout III, R. Heinberg, R. W. Clapp, B. May, N. L. Reinhart, M. M. Ahern, S. K. Doshi, and L. Glustrom. 2011. Full cost accounting for the life cycle of coal in "Ecological Economics Reviews." Ann. N.Y. Acad. Sci. 1219: 73–98.

[45] National Research Council. 2010. Hidden costs of energy: Unpriced consequences of energy production and use. Washington, DC: The National Academies Press. Online at http://www.nap.edu/catalog/12794/hidden-costs-of-energy-unpriced-consequences-of-energy-production-and, accessed on May 3, 2016.

[46] Epstein, P.R.,J. J. Buonocore, K. Eckerle, M. Hendryx, B. M. Stout III, R. Heinberg, R. W. Clapp, B. May, N. L. Reinhart, M. M. Ahern, S. K. Doshi, and L. Glustrom. 2011. Full cost accounting for the life cycle of coal in "Ecological Economics Reviews." Ann. N.Y. Acad. Sci. 1219: 73–98.

[47] Machol, Rizk. "Economic value of U.S. fossil fuel electricity health impacts." Environment International 52 (2013) 75–80.

[48] Freshwater Use by U.S. Power Plants: Electricity's Thirst For a Precious Resource. Union of Concerned Scientists. 2011. Available at: http://www.ucsusa.org/assets/documents/clean_energy/ew3/ew3-freshwater-use-by-us-power-plants-exec-sum.pdf

[49] National Research Council. 2010. Hidden costs of energy: Unpriced consequences of energy production and use. Washington, DC: The National Academies Press. Online at http://www.nap.edu/catalog/12794/hidden-costs-of-energy-unpriced-consequences-of-energy-production-and, accessed on May 3, 2016.

[50] Eilperin, J., and S. Mufson. 2013. Many coal sludge impoundments have weak walls, federal study says. *Washington Post*, April 24. Online at http://www.washingtonpost.com/national/health-science/many-coal-sludge-impoundments-have-weak-walls-federal-study-says/2013/04/24/76c5be2a-acf9-11e2-a8b9-2a63d75b5459_story.html, accessed on May 3, 2016.

[51] Environmental Protection Agency (EPA). 2015. Final rule: Disposal of coal combustion residuals from electric utilities. Washington, DC. Online at https://www.epa.gov/coalash/coal-ash-rule, access on May 3, 2016.

[52] Epstein, Paul R., et al. "Full cost accounting for the life cycle of coal." Annals of the New York Academy of Sciences 1219.1 (2011): 73-98. Available here: http://onlinelibrary.wiley.com/doi/10.1111/j.1749-6632.2010.05890.x/pdf

[53] Environmental Protection Agency (EPA). 2015. Final rule: Disposal of coal combustion residuals from electric utilities. Washington, DC. Online at https://www.epa.gov/coalash/coal-ash-rule, access on May 3, 2016.

[54] Epstein, P.R.,J. J. Buonocore, K. Eckerle, M. Hendryx, B. M. Stout III, R. Heinberg, R. W. Clapp, B. May, N. L. Reinhart, M. M. Ahern, S. K. Doshi, and L. Glustrom. 2011. Full cost accounting for the life cycle of coal in "Ecological Economics Reviews." Ann. N.Y. Acad. Sci. 1219: 73–98.

[55] National Research Council. 2010. Hidden costs of energy: Unpriced consequences of energy production and use. Washington, DC: The National Academies Press. Online at http://www.nap.edu/catalog/12794/hidden-costs-of-energy-unpriced-consequences-of-energy-production-and, accessed on May 3, 2016.

[56] Zoback, M., S. Kitasei, and B. Copithorne. 2010. Beneath the surface: A survey of environmental risks from shale gas development. Washington, DC: WorldWatch Institute. Online at http://www.worldwatch.org/node/6474, accessed on May 3, 2016.

[57] National Research Council. 2010. Hidden costs of energy: Unpriced consequences of energy production and use. Washington, DC: The National Academies Press. Online at http://www.nap.edu/catalog/12794/hidden-costs-of-energy-unpriced-consequences-of-energy-production-and, accessed on May 3, 2016.

(NOTE: by editor- May 2019 - some of the links to documents on USA government websites, particularly the EPA,may no longer be functional due to deletion of much material by the Trump administration) – the original article provided here was written in 2016, predating the Trump administration

Benefits of Renewable Energy Use

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Contents

Wind turbines and solar panels are an increasingly common sight. But why? What are the benefits of renewable energies—and how do they improve our health, environment, and economy?

This page explores the many positive impacts of clean energy, including the benefits of wind, solar, geothermal, hydroelectric, and biomass. For more information on their negative impacts—including effective solutions to avoid, minimize, or mitigate—see our page on The Environmental Impacts of Renewable Energy Technologies.

Less global warming

Human activity is overloading our atmosphere with carbon dioxide and other global warming emissions. These gases act like a blanket, trapping heat. The result is a web of significant and harmful impacts, from stronger, more frequent storms, to drought, sea level rise, and extinction.

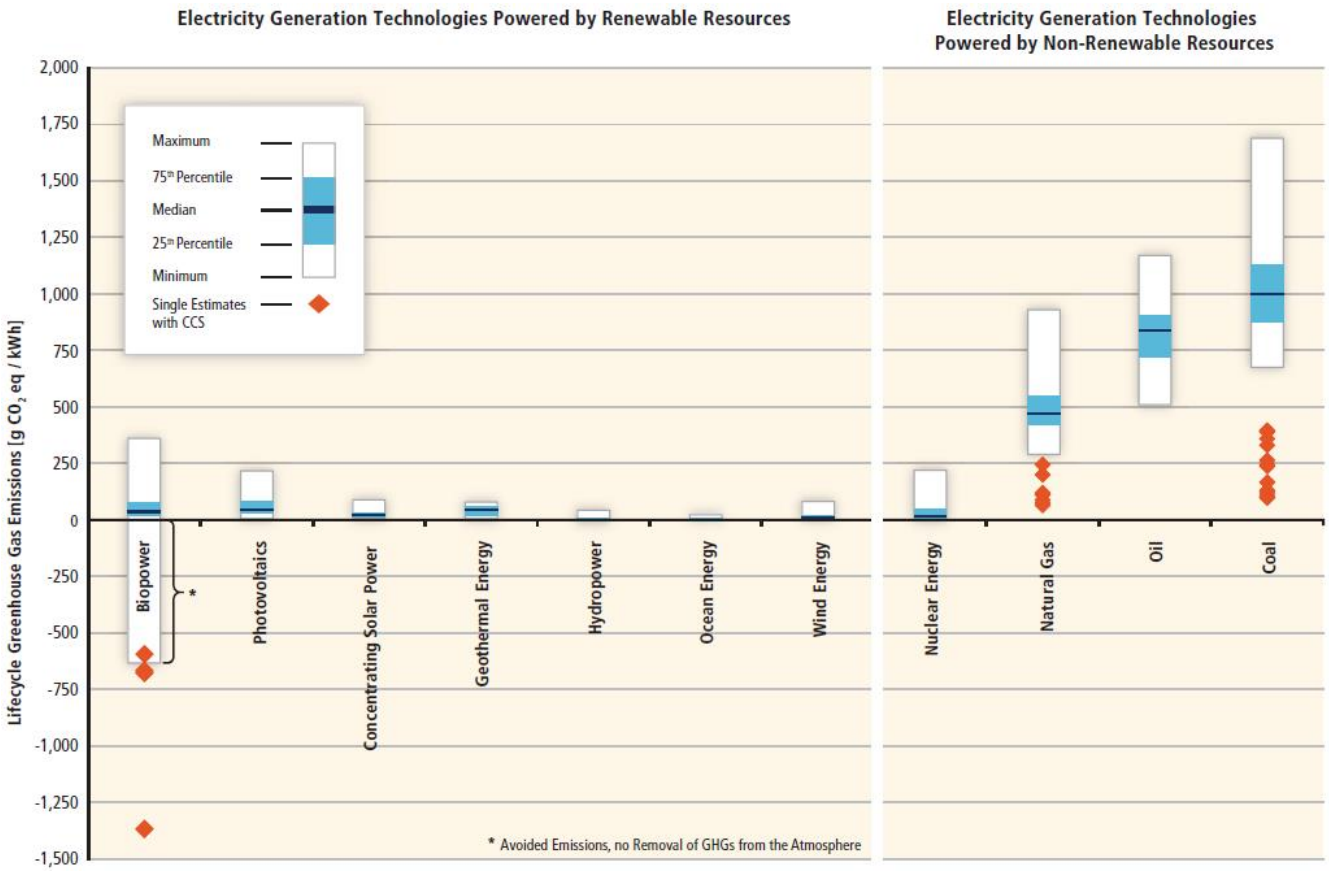
In the United States, about 29 percent of global warming emissions come from our electricity sector. Most of those emissions come from fossil fuels like coal and natural gas [1, 2].

> ***What is CO2e?***
>
> *Carbon dioxide (CO2) is the most prevalent greenhouse gas, but other air pollutants—such as methane—also cause global warming. Different energy sources produce different amounts of these pollutants. To make comparisons easier, we use a* ***carbon dioxide equivalent****, or CO2e—the amount of carbon dioxide required to produce an equivalent amount of warming.*

In contrast, most renewable energy sources produce little to no global warming emissions. Even when including "life cycle" emissions of clean energy (ie, the emissions from each stage of a technology's life—manufacturing, installation, operation, decommissioning), the global warming emissions associated with renewable energy are minimal [3].

The comparison becomes clear when you look at the numbers. Burning natural gas for electricity releases between 0.6 and 2 pounds of carbon dioxide equivalent per kilowatt-hour (CO2E/kWh); coal emits between 1.4 and 3.6 pounds of CO2E/kWh. Wind, on the other hand, is responsible for only 0.02 to 0.04 pounds of CO2E/kWh on a life-cycle basis; solar 0.07 to 0.2; geothermal 0.1 to 0.2; and hydroelectric between 0.1 and 0.5.

Renewable electricity generation from biomass can have a wide range of global warming emissions depending on the resource and whether or not it is sustainably sourced and harvested.



Increasing the supply of renewable energy would allow us to replace carbon-intensive energy sources and significantly reduce US global warming emissions.

For example, a 2009 UCS analysis found that a 25 percent by 2025 national renewable electricity standard would lower power plant CO2 emissions 277 million metric tons annually by 2025—the equivalent of the annual output from 70 typical (600 MW) new coal plants [4].

In addition, a ground-breaking study by the US Department of Energy's National Renewable Energy Laboratory (NREL) explored the feasibility of generating 80 percent of the country's electricity from renewable sources by 2050. They found that renewable energy could help reduce the electricity sector's emissions by approximately *81 percent* [5].

Improved public health

The air and water pollution emitted by coal and natural gas plants is linked with breathing problems, neurological damage, heart attacks, cancer, premature death, and a host of other serious problems. The pollution affects everyone: one Harvard University study estimated the life cycle costs and public health effects of coal to be an estimated **$74.6 billion every year**. That's equivalent to 4.36 cents per kilowatt-hour of electricity produced—about one-third of the average electricity rate for a typical US home [6].

Most of these negative health impacts come from air and water pollution that clean energy technologies simply don't produce. Wind, solar, and hydroelectric systems generate electricity with no associated air pollution emissions. Geothermal and biomass systems emit *some* air pollutants, though total air emissions are generally much lower than those of coal- and natural gas-fired power plants.

In addition, wind and solar energy require essentially no water to operate and thus do not pollute water resources or strain supplies by competing with agriculture, drinking water, or other important water needs. In contrast, fossil fuels can have a significant impact on water resources: both coal mining and natural gas drilling can pollute sources of drinking water, and all thermal power plants, including those powered by coal, gas, and oil, withdraw and consume water for cooling.

Biomass and geothermal power plants, like coal- and natural gas-fired power plants, may require water for cooling. Hydroelectric power plants can disrupt river ecosystems both upstream and downstream from the dam. However, NREL's 80-percent-by-2050 renewable energy study, which included biomass and geothermal, found that total water consumption and withdrawal would decrease significantly in a future with high renewables [7].

Inexhaustible energy

Strong winds, sunny skies, abundant plant matter, heat from the earth, and fast-moving water can each provide a vast and constantly replenished supply of energy. A relatively small fraction of US electricity currently comes from these sources, but that could change: studies have repeatedly shown that renewable energy can provide a significant share of future electricity needs, even after accounting for potential constraints [9].

In fact, a major government-sponsored study found that clean energy could contribute somewhere between three and 80 times its 2013 levels, depending on assumptions [8 - see references below for link]. And the previously mentioned NREL study found that renewable energy could comfortably provide up to 80 percent of US electricity by 2050.

Jobs and other economic benefits

Compared with fossil fuel technologies, which are typically mechanized and capital intensive, the renewable energy industry is more labor intensive. Solar panels need humans to install them; wind farms need technicians for maintenance.

This means that, on average, more jobs are created for each unit of electricity generated from

renewable sources than from fossil fuels.

Renewable energy already supports thousands of jobs in the United States. In 2016, the wind energy industry directly employed over 100,000 full-time-equivalent employees in a variety of capacities, including manufacturing, project development, construction and turbine installation, operations and maintenance, transportation and logistics, and financial, legal, and consulting services [10]. More than 500 factories in the United States manufacture parts for wind turbines, and wind power project installations in 2016 alone represented $13.0 billion in investments [11].

Other renewable energy technologies employ even more workers. In 2016, the solar industry employed more than 260,000 people, including jobs in solar installation, manufacturing, and sales, a 25% increase over 2015 [12]. The hydroelectric power industry employed approximately 66,000 people in 2017 [13]; the geothermal industry employed 5,800 people [14].

Increased support for renewable energy could create even more jobs. The 2009 Union of Concerned Scientists study of a 25-percent-by-2025 renewable energy standard found that such a policy would create more than three times as many jobs (more than 200,000) as producing an equivalent amount of electricity from fossil fuels [15].

In contrast, the entire coal industry employed 160,000 people in 2016 [26].

In addition to the jobs *directly* created in the renewable energy industry, growth in clean energy can create positive economic “ripple” effects. For example, industries in the renewable energy supply chain will benefit, and unrelated local businesses will benefit from increased household and business incomes [16].

Local governments also benefit from clean energy, most often in the form of property and income taxes and other payments from renewable energy project owners. Owners of the land on which wind projects are built often receive lease payments ranging from $3,000 to $6,000 per megawatt of installed capacity, as well as payments for power line easements and road rights-of-way. They may also earn royalties based on the project’s annual revenues. Farmers and rural landowners can generate new sources of supplemental income by producing feedstocks for biomass power facilities.

UCS analysis found that a 25-by-2025 national renewable electricity standard would stimulate $263.4 billion in new capital investment for renewable energy technologies, $13.5 billion in new landowner income from? biomass production and/or wind land lease payments, and $11.5 billion in new property tax revenue for local communities [17].

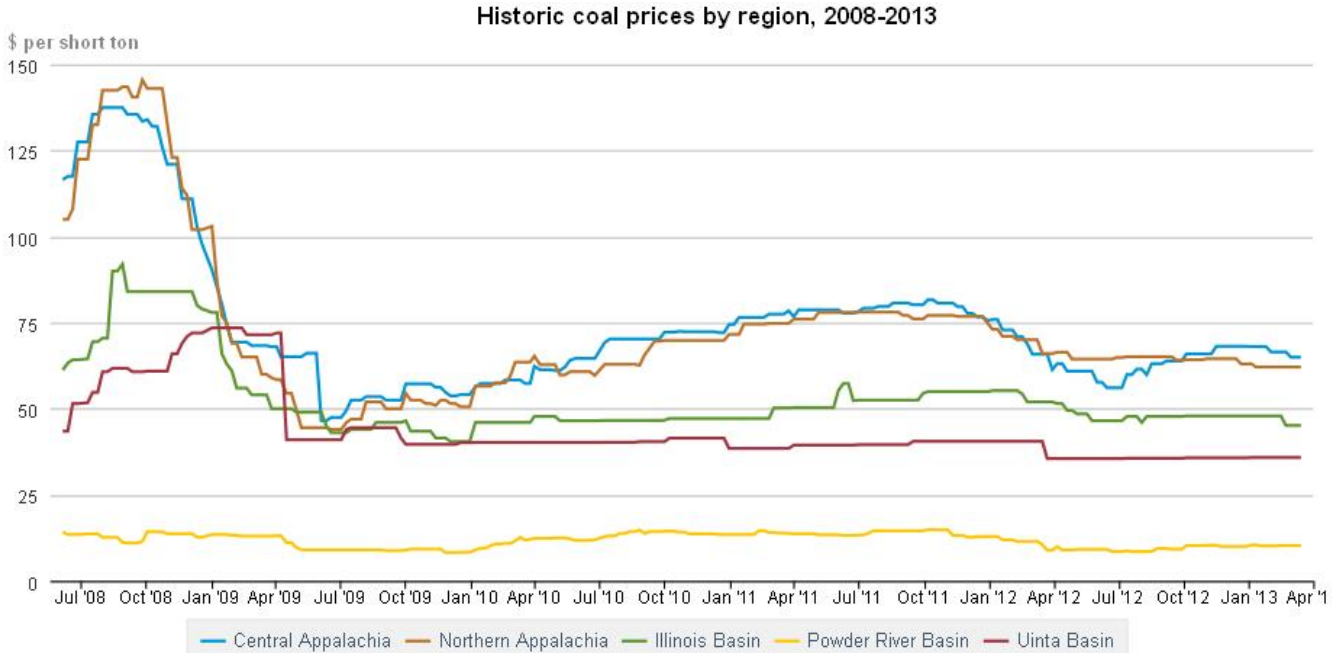
Stable energy prices

Renewable energy is providing affordable electricity across the country right now, and can help stabilize energy prices in the future.

Although renewable facilities require upfront investments to build, they can then operate at very low cost (for most clean energy technologies, the “fuel” is free). As a result, renewable energy prices can be very stable over time.

Moreover, the costs of renewable energy technologies have declined steadily, and are projected to drop even more. For example, the average price to install solar dropped more than 70 percent between 2010 and 2017 [20]. The cost of generating electricity from wind dropped 66 percent between 2009 and 2016 [21]. Costs will likely decline even further as markets mature and companies increasingly take advantage of economies of scale.

In contrast, fossil fuel prices can vary dramatically and are prone to substantial price swings. For example, there was a rapid increase in US coal prices due to rising global demand before 2008, then a rapid fall after 2008 when global demands declined [23]. Likewise, natural gas prices have fluctuated greatly since 2000 [25].



Using more renewable energy can lower the prices of and demand for natural gas and coal by increasing competition and diversifying our energy supplies. And an increased reliance on renewable energy can help protect consumers when fossil fuel prices spike.

Reliability and resilience

Wind and solar are less prone to large-scale failure because they are distributed and modular. **Distributed** systems are spread out over a large geographical area, so a severe weather event in one location will not cut off power to an entire region. **Modular** systems are composed of numerous individual wind turbines or solar arrays. Even if some of the equipment in the system is damaged, the rest can typically continue to operate.

For example, Hurricane Sandy damaged fossil fuel-dominated electric generation and distribution systems in New York and New Jersey and left millions of people without power. In contrast, renewable energy projects in the Northeast weathered Hurricane Sandy with minimal damage or disruption [25].

Water scarcity is another risk for non-renewable power plants. Coal, nuclear, and many natural gas plants depend on having sufficient water for cooling, which means that severe droughts and heat waves can put electricity generation at risk. Wind and solar photovoltaic systems do not require water to generate electricity and can operate reliably in conditions that may otherwise require closing a fossil fuel-powered plant. (For more information, see How it Works: Water for Electricity.)

The risk of disruptive events will also increase in the future as droughts, heat waves, more intense storms, and increasingly severe wildfires become more frequent due to global warming—increasing the need for resilient, clean technologies.

References:

[1] Environmental Protection Agency. 2017. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015.

[2] Energy Information Agency (EIA). 2017. How much of the U.S. carbon dioxide emissions are associated with electricity generation?

[3] Intergovernmental Panel on Climate Change (IPCC). 2011. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. Prepared by Working Group III of the Intergovernmental Panel on Climate Change [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, C. von Stechow (eds)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1075 pp. (Chapter 9).

[4] Union of Concerned Scientists (UCS). 2009. Clean Power Green Jobs.

[5] National Renewable Energy Laboratory (NREL). 2012. Renewable Electricity Futures Study. Volume 1, pg. 210.

[6] Epstein, P.R.,J. J. Buonocore, K. Eckerle, M. Hendryx, B. M. Stout III, R. Heinberg, R. W. Clapp, B. May, N. L. Reinhart, M. M. Ahern, S. K. Doshi, and L. Glustrom. 2011. Full cost accounting for the life cycle of coal in “Ecological Economics Reviews.” Ann. N.Y. Acad. Sci. 1219: 73–98.

[7] Renewable Electricity Futures Study. 2012.

[8] NREL. 2016. Estimating Renewable Energy Economic Potential in the United States: Methodology and Initial Results.

[9] Renewable Electricity Futures Study. 2012.

IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. Prepared by Working Group III of the Intergovernmental Panel on Climate Change. 2011.

UCS. 2009. Climate 2030: A national blueprint for a clean energy economy.

[10] American Wind Energy Association (AWEA). 2017. AWEA U.S. Wind Industry Annual Market Report: Year Ending 2016. Washington, D.C.: American Wind Energy Association.

[11] Wiser, Ryan, and Mark Bolinger. 2017. 2016 Wind Technologies Market Report. U.S. Department of Energy.

[12] The Solar Foundation. 2017. National Solar Jobs Census 2016.

[13] Navigant Consulting. 2009. Job Creation Opportunities in Hydropower.

[14] Geothermal Energy Association. 2010. Green Jobs through Geothermal Energy.

[15] UCS. 2009. Clean Power Green Jobs.

[16] Environmental Protection Agency. 2010. Assessing the Multiple Benefits of Clean Energy: A Resource for States. Chapter 5.

[17] UCS. 2009. Clean Power Green Jobs.

[18] Deyette, J., and B. Freese. 2010. Burning coal, burning cash: Ranking the states that import the most coal. Cambridge, MA: Union of Concerned Scientists.

[20] SEIA. 2017. Solar Market Insight Report 2017 Q2.

[21] AWEA. 2017. AWEA U.S. Wind Industry Annual Market Report: Year Ending 2016. Washington, D.C.: American Wind Energy Association.

[22] UCS. 2009. Clean Power Green Jobs.

[23] UCS. 2011. A Risky Proposition: The financial hazards of new investments in coal plants.

[24] EIA. 2013. U.S. Natural Gas Wellhead Price.

[25] Unger, David J. 2012. Are renewables stormproof? Hurricane Sandy tests solar, wind. The Christian Science Monitor. November 19.

[26] Department of Energy. 2017 U.S. Energy and Employment Report

St. Joseph's

HOUSING CORPORATION

Providing Connections, Conversations and Communities

St. Joseph's Housing Corporation

Silver Maple Seniors Community

St. Joseph's Housing Corporation (SJHC)

- SJHC is a non-profit charitable organization founded in 2009 and is a registered charity under the Tax Act.

- The Corporation's mandate is to provide and operate non-profit seniors' residential accommodation along with associated services.

- The Board of Directors is comprised of eight Directors:
  - two elected Directors at large, who live or work in Wellington County,
  - three Directors appointed by the Board of St. Joseph's Health Centre Foundation Guelph,
  - and three Directors appointed by the Board of St. Joseph's Health Centre Guelph.

The Residences of St. Joseph's

- In 2011, The Housing Corporation built an 80-unit affordable housing apartment building for seniors - The Residences of St. Joseph's

- Over the past 8 years there has consistently been a long waitlist for The Residences of St. Joseph's.
  - The waitlist as of March 2019 is at 147 applicants for a 1 bedroom apartments

Project Overview

- The Corporation has submitted an application for the *Silver Maples Seniors Community* Project to the Canada Mortgage and Housing Corporation (CMHC) for National Housing Co-Investment Funding.

- The Project combines a mix of affordable rental and market rental units (115 seniors rental units in total).

- The mixed-income, mixed-use approach ensures the development will have ongoing financial viability.

Silver Maple Seniors Community

- Senior's apartment building targeted towards seniors with a mix of affordable and market rental rate units
  - 87 apartment units with a minimum of 56% being affordable (65 units)
  - 100% of units designed to full accessibility standards

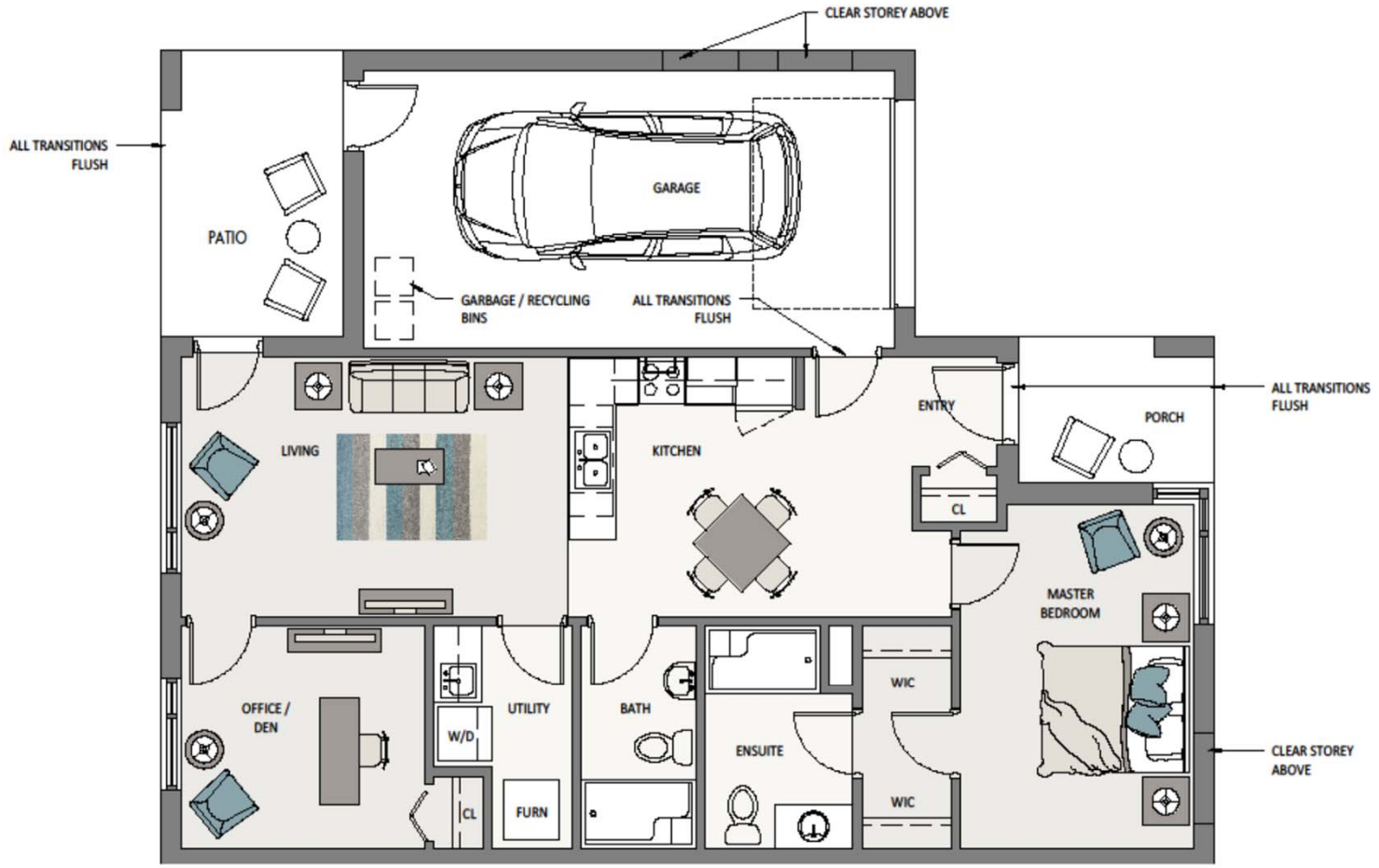
- Seniors' townhomes rental units
  - 28 single storey townhomes designed to full accessibility standards (with no steps in any of the units)

Project Location

Seniors Apartment Building

Example Townhome Units

Architectural Floor Plan



Glos | Associates Inc.
ARCHITECTURAL + ENGINEERING CONSULTANTS

TYPICAL FLOOR PLAN

GUELPH TOWNHOUSES

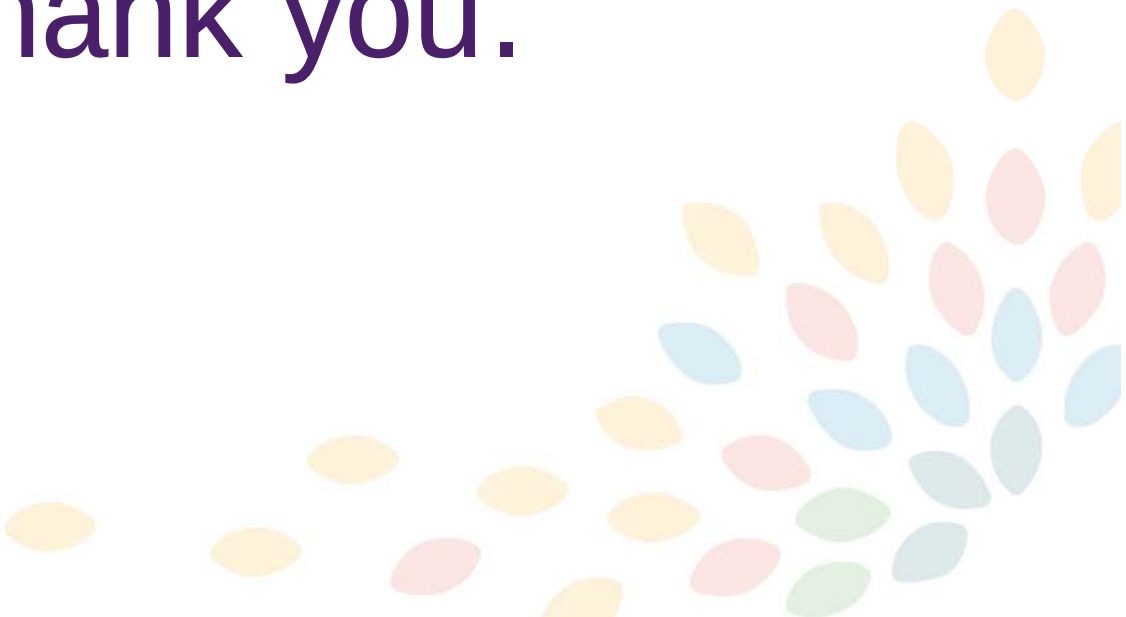
National Housing Co-Investment Fund

The Housing Corporation is requesting support equivalent to the City development charges for the affordable housing units of *$960,600*.

- The total project budget of *$35.3 Million* has been submitted to CMHC in application for funding through the National Housing Co- Investment Fund (NHCF)

- NHCF Projects must have support from another level of government to ensure coordination of investments, and to make federal investment go further

Thank you.



SUMMARY

Project DCR		1.47	90% PGI	Yes
Project LTC		100%	20% of Units at Median HHI	Yes
Total Loan		56,885,051	90% of HHI	Yes
			80% of HHI	Yes
Eligibility Criteria	Yes		70% of HHI	Yes
Social Outcome Score	Up to 100% LTC			

Eligibility and Social Outcome

Eligibility Requirements

Viability			Check
Viability Assessment Results	DCR calculated from your completed Viability Assessment (Project must meet a minimum DCR of 1.1 times)	1.47	Yes
Affordability			
Other Government Programs Supporting Affordable Rental Housing	Has your project been approved under other government programs / initiatives (federal, provincial, territoral, or municipal) that provides support for development of affordable rental housing and will the affordable rent levels be maintain for a minimum of 10 years? (If "yes", you do not need to answer the eligibility criteria questions on Duration and Depth below).	No	
Duration	Affordability will be maintained for a minimum of 10 years	Yes	
Depth	Will your project's gross achievable residential rental income be 90%, or less, of Potential Gross Income, and 20% of units have rents that represent no more that 30% of household median income for your Municipality?	Yes	
Accessibility	Will 10% of units in your project meet or exceed the local accessibility requirements as prescribed by your Municipality or Province/Territory, or in absence of the aforementioned, the accessibility requirements of the 2015 National Building Code?	Yes	
	Will access to your project and to its common areas be barrier free?	Yes	
Energy Efficiency	Will your project achieve a minimum 15% decrease in energy use and greenhouse gas emissions relative to the 2015 model building codes (i.e., 2015 National Energy Code for Buildings or the 2015 National Building Code)?	Yes	
Have you met the qualification criteria?	(If the result is "Yes", proceed to Prioritization Scoring section below)	**Yes**	

Prioritization Scoring

		Points		Select Score	Total Points
Affordability					
Affordability - duration	10 Years (Eligibility Requirement)	0			
	More than 10 years and up to 15 years	1			
	More than 15 years and up to 20 years	2		3	3
	More than 20 years	3			
affordability (in the rent amount)	Rents at 100% of median income (Eligibility Requirement)	0			
	Rents at 90% of median income	1			
	Rents at 80% of median income	2		2	2
	Rents at 70% of median income or below	3			
Affordability – number of units	20% of total units (Eligibility Requirement)	0			
	Up to 5 more units over the eligibility requirement	1			
	From 6 more units to 10 more unit over the eligibility requirement	2		3	3
	More than 10 units over the eligibility requirement	3			
Accessibility	Project contains adaptable units, in addition to minimum 10% of unit accessible requirement.	2	0= No 1= Yes	1	2
	Project contains units with universal design, in addition to minimum 10% of unit accessible requirement.	2	0= No 1= Yes	1	2
Energy Efficiency	15% more efficient than 2015 model building codes (Eligibility Requirement)	0			
	More than 15% and up to 25% more efficient than 2015 model building codes	1			
	More than 25% and up to 50% more efficient than 2015 model building codes	2		5	5
	More than 50% more efficient than 2015 model building codes	3			
	Net zero energy ready or equivalent standards of performance	5			
Fostered Collaboration					
Partnerships	Are other Non-profit or For-profit Developers, Urban Aboriginal Groups, or Municipalities, involved in this project	0 = none 1 = 1 partner or more		0	0
Other Government Supports: (Federal/Provincial/Territorial/Municipal)	• Grants • Concessions on property taxes • Concessions on levies • Waiver of development cost charges or other provincial/municipal fees • Expedited Approvals • Waiver of community amenity contributions • Other	0 = no support 1 = 1 or 2 supports 2 = 3 or more supports		2	2
Land donation		2	0= No 1= Yes	0	0
Transit Oriented	Within 1 km of public transit such as bus stop, train station, rapid transit or subway station	1	0= No 1= Yes	1	2
	Project offers access to alternative forms of public transit (parking spots for car sharing service, shuttle bus service, direct connection to underground path system, etc.)	1	0= No 1= Yes	1	
Your Score					**21**
Potential Loan To Cost Percentage					Up to 100% LTC