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Pricing Works

How pricing of municipal services and infrastructure can lead to healthier and more efficient cities

—

by Stewart Elgie, Michelle Brownlee, Sara Jane O'Neill,
and Mercedes Marcano

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Metcalf Foundation

The mission of The George Cedric Metcalf Charitable Foundation is to enhance the effectiveness of people and organizations working together to help Canadians imagine and build a just, healthy, and creative society.

Stewart Elgie

Stewart Elgie is a professor at the University of Ottawa and director of its Environment Institute. He is also founder and chair of Sustainable Prosperity, Canada's major green economy think tank and research network. With a doctorate (Yale) in law and economics, his research focuses on economic approaches to solving environmental problems. Elgie received Canada's Clean 50 Award (2015) for sustainability leadership, and the Law Society of Upper Canada Medal (2001) for exceptional lifetime contributions to law.

Michelle Brownlee

Michelle Brownlee is Director of Policy at Sustainable Prosperity. Before joining Sustainable Prosperity, Michelle taught Economics at Mount Royal University in Calgary and spent over 10 years in the federal government advising senior decision makers on energy, resource, and climate change policy and programs. She holds undergraduate and graduate degrees in Economics (Mount Allison University and Queens University, respectively).

Sara Jane O'Neill

Sara Jane O'Neill is a Senior Research Associate with Sustainable Prosperity. She holds a Master's in Environmental Sustainability (University of Ottawa) as well as a Master's in Environmental Planning (University of Calgary), and is an accredited LEED Associate Professional in Neighbourhood Development. She has worked as a communities planner in B.C., an environmental planner with Conservation Authorities in Ontario, and as a project manager for infrastructure projects on Department of National Defence sites across Canada. Her Masters' research in planning focused on how municipalities implement changes in stormwater management practices, while her environmental sustainability Masters' research focused on environmental justice in sustainability planning.

Mercedes Marcano

Mercedes Marcano is a Research Associate with Sustainable Prosperity. Mercedes has a Master's in Public and International Affairs from the University of Ottawa and a BA in Liberal Studies from Universidad Metropolitana in Venezuela. She has worked in both the private sector and in the public sector. Mercedes has contributed to Sustainable Prosperity projects on environmental markets, water quality pricing tools, and climate policy linkages among others. She's also a member of the City of Ottawa's Environmental Stewardship Advisory Committee.

About Sustainable Prosperity and the University of Ottawa

Made up of business, environment, policy and academic leaders, Sustainable Prosperity (SP) is a national green economy think tank/do tank housed at the University of Ottawa's Institute of the Environment. We harness leading-edge thinking to advance innovation in policy and markets, in the pursuit of a greener, more competitive Canadian economy. At the same time, SP actively helps broker real-world solutions by bringing public and private sector decision-makers to the table with expert researchers to both design and apply innovative policies and programs. We believe that achieving the necessary innovation in policy and markets for a stronger, greener Canadian economy requires a new knowledge base and new conversations. SP's approach is to promote both by generating policy-relevant, expert knowledge to inform smart policy solutions and foster innovative conversations and connections.

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CONTENTS

5 Foreword

7 Summary

9 Introduction
12 What is full cost pricing?

14 Exploring Pricing for Urban Form
14 Why Urban Form Matters
15 Pricing Mechanisms for Sustainable Urban Form
16 Development Cost Charges
17 Property Taxes
18 Revitalization Tax Exemption
19 Pricing Mechanisms Beyond Municipal Authority
20 Discussion — Pricing Mechanisms

21 Exploring Pricing for Commercial Wastewater
21 Why Commercial Wastewater Matters
24 Pricing Mechanisms for Wastewater
26 Over Strength Discharge Fees
30 The European Experience
31 Discussion — Towards Full Cost Pricing

34 If Pricing Works, Use it
34 Political Conditioning
34 Fairness Impacts
35 Complementary Policies
35 Policy Impact
35 Legal Impediments

FOREWORD

The goal of the Metcalf Foundation's Environment Program is to help build a low-carbon, resource efficient, and resilient Canada. Given the scale and complexity of the task of envisioning and realizing such a transformation, the Foundation sought to elicit a multiplicity of views and opinions, with a particular focus on southern Ontario.

In 2014, Metcalf commissioned a series titled *Green Prosperity Papers*. The aim was to contribute to the emerging policy conversation by connecting Ontario's robust university-based research capacity to timely public policy challenges. We invited proposals from a select number of researchers at Ontario-based universities who have a track record of producing research for public dissemination.

The six resulting *Metcalf Green Prosperity Papers* all address intersections of the environment and economy while taking up a range of topics from social justice, to fiscal reform, to democratic governance.

Since we commissioned the papers, Canada's commitments to climate action and growing a green economy have advanced substantially. The Foundation hopes the ideas explored in this series will assist in the crucial work, that is now underway, toward building a low-carbon, resource efficient, and resilient Canada.

Sandy Houston,
President and CEO
Metcalf Foundation

SUMMARY

Ontarians benefit enormously from our natural environment. Healthy ecosystems provide us with many environmental goods (clean air, clean water, and timber) and environmental services (floodwater absorption, climate moderation, and pleasant scenery). However, growing cities, industries, farms, and other economic activities are eroding our natural environment's ability to provide these critical environmental goods and services. These economic activities impose environmental costs on our society that are not factored into the prices we see in markets.

Municipal policy-makers have tools at their disposal to change prices in ways that help to reflect these environmental costs. These market-based policies — like environmental fees, taxes, or market-based instruments — use prices to provide an incentive to minimize environmental harm and to conserve environmental goods and services. At the same time, these policies have the benefit of creating revenue streams for municipalities and encouraging innovation on the part of those paying the fees.

Unfortunately, Canada makes less use of these environmental pricing tools than almost any other OECD country. In this paper, we look at the opportunities to make greater use of these price-based policy tools, particularly at the local level, to help address environmental problems *and* provide revenue that municipalities need to support their budgetary and environmental objectives.

For price to be most effective, the policy that influences the price must be well designed. In the municipal context, one basis of good design is that the prices for municipal services reflect their full costs — meaning the municipality generates sufficient revenue to recover the costs of providing services. This is particularly important in Canadian municipalities, where infrastructure is aging, key parts of the natural environment are under stress, and citizens and businesses are demanding access to quality services and infrastructure without significant general tax increases. The 2012 Canadian Infrastructure Report Card revealed that about 30% of municipal infrastructure ranks between "fair" and "very poor." The replacement value of these assets totals $171.8 billion nationally.[1]

In this paper, we look at two examples where pricing can be used as an important tool to address environmental problems and raise revenues: urban form and commercial wastewater discharge. This paper shows that pricing is an important tool, and to use that tool well it is critical to get the prices right. This means reflecting, as much as possible, a broad definition of full cost that includes environmental harm. Getting prices right in

1 *The Canadian Infrastructure Report Card*. (2012). Retrieved from http://www.canadainfrastructure.ca/en/

these two cases — through one or more pricing mechanisms — could lead directly to three transformational outcomes in Canadian municipalities.

1. An improved environment, through the promotion of more sustainable use of natural resources like land and water:

- For urban form, this means more compact cities.
- For commercial wastewater, this translates directly into healthier waterfronts and ecosystems.

2. Increased financial sustainability of municipal services. This can be through improved wastewater treatment, or the full range of municipal infrastructure and services provided to neighbourhoods and districts — through a user pay approach that, at minimum, incorporates full cost recovery, and more ambitiously, also reflects full environmental cost pricing. This will help avoid revenue shortfalls in the provision of services, now and in the future.
3. Greater innovation. As citizens and businesses incorporate the full cost of these municipal services (land use, wastewater, and others) in their decision-making, they will be encouraged to make efficient use of resources, and to adopt cleaner production processes and technologies.

From the case studies explored in this paper, and a number of real world examples of how pricing has led to these positive changes, it is becoming clear that **pricing works**.

INTRODUCTION

Ontarians benefit enormously from our natural environment. Clean water is essential to our health, and it supports recreation (swimming and canoeing) and commerce (agriculture, fishing, and manufacturing). Forests, wetlands, and green space provide valuable environmental services including flood control, air purification, and carbon storage, and they also support recreation. Clean air and a stable climate are essential foundations for our cities, businesses, and families. Our wellbeing depends on these environmental goods and services.

However, growing cities, industries, farms, and other economic activities are eroding our natural environment's ability to provide these critical environmental goods and services. Our activities impose environmental costs on society that are not factored into the prices of the things we buy, sell, and do. As a result, there is little or no incentive to minimize environmental harm and conserve the health of our ecosystems.

Policy-makers have tools at their disposal to change prices in ways that help to reflect these environmental costs. These are referred to as market-based instruments[2] because they influence the prices seen in markets. In essence, market-based tools — like environmental fees, taxes, or trading systems — can raise prices for activities that create negative environmental impacts and decrease prices for activities that have positive environmental impacts.

The main advantage of market-based tools is that they generally achieve environmental goals at a *lower cost* than conventional regulations. They achieve this by allowing firms and people options to reduce their environmental impact and give an economic incentive for doing so. This lower cost of meeting goals helps with the core problem that holds governments back from setting ambitious environmental standards — concern that it will cost too much to comply, thus hurting the economy.

Market-based instruments are also much better at encouraging innovation. Typical environmental regulations require firms to achieve a certain minimum standard, but provide no incentive to do better. This is a speed limit approach. Market-based tools, by contrast, provide an economic reward to firms for every unit of pollution they reduce. Firms are encouraged to reduce as much as possible because they will make more money.[3] This drives innovation, which is critical to economic success in a greening global marketplace.

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2 Market-based instruments are also referred to as market-based tools or economic instruments.

3 In some cases, a pricing instrument is not appropriate, such as in the case of particularly harmful chemicals for which a regulatory ban on the use of the substance could be warranted. In other cases, a mix of complementary policies may work best.

Unfortunately, Canada makes less use of these market-based pricing tools than almost any other OECD country.[4] This is particularly true at the municipal level, where failure to charge for environmental costs is a major driver of problems like sprawl, congestion, water pollution, and loss of green space. It also deprives cities of a large potential revenue source to fund water infrastructure, transit, or green space.

In this paper, we look at the opportunities to make better use of these policy tools, particularly at the local level, to help address environmental problems *and* provide revenue that municipalities need to support their environmental objectives.

This means correcting for environmental costs by using a policy mechanism that influences pricing not only in theory, but also in practice. There is an increasingly large body of evidence that shows that pricing does in fact influence behaviour.

- The City of Toronto changed the rate structure for residential and commercial water users from a complicated seven-step block rate structure to a simplified, differentiated, and higher rate structure for commercial and residential users. Over the last 10 years, as prices for water use increased in Toronto by 6% to 10.8%, residential water use declined by 24%.[5]
- A study in Japan considered how pricing and appealing to people's sense of what is right impacts electricity conservation. Researchers discovered that increasing prices during peak electricity demand times led to an 18% decrease in electricity use compared to an 8% decrease as a result of appealing to people's sense of what is right.[6]
- Analysis of the 407 toll road around Toronto shows that consumers are willing to pay charges for routes that allow time savings and increased reliability.[7]
- The introduction of a charge for all vehicles[8] to enter London's (United Kingdom) central zone resulted in a 21% decrease in overall traffic, 30% congestion reduction, and 43% increase in cycling.[9]

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4 See *Smart, Practical, Possible: Canadian Options for Greater Economic and Environmental Prosperity*, Canada's Ecofiscal Commission (2014), p.20, retrieved from http://ecofiscal.ca/wp-content/uploads/2014/11/Ecofiscal-Report-November-2014.pdf

5 Arros, P. (2013). *Toronto's Water Policy and Water Consumption Decline*. Sustainable Prosperity Issue Summary. Retrieved from http://sustainableprosperity.ca/sites/default/files/publications/files/Toronto%27s%20Water%20Policy%20and%20Water%20Consumption%20Decline.pdf

6 Brownlee, M. (2015). *Hearts, Pocketbooks and kilowatt-hours: How Different Policy Approaches Work to Decrease Energy Use*. Sustainable Prosperity blog. Retrieved from http://www.sustainableprosperity.ca/blog/hearts-pocketbooks-kilowatt-hours-how-different-policy-approaches-work-decrease-energy-use

7 Vijay, G. & Knowles, J. (2013). *The Value of Travel Time and Reliability: Commuting on 407 ETR*. The Conference Board of Canada. Retrieved from http://www.conferenceboard.ca/topics/energy-enviro/traveltime.aspx

8 Except emergency vehicles, public transport, taxis and high efficiency vehicles.

9 Cairns, S. & Arros, P. (2014). *Policy Bundles for Reducing Transportation Emissions in Large Cities*. Sustainable Prosperity Policy Brief. Retrieved from http://www.sustainableprosperity.ca/sites/default/files/publications/files/TransportationBundles%20Oct%202014.pdf

- A similar congestion pricing scheme in Stockholm demonstrated that charging vehicles to enter the city centre resulted in a 10% to 14% decrease in air-borne pollutants in the inner city and a 22% drop in congestion.[10]
- Data from Portland, Oregon show that increases to waste collection rates corresponded with increased recycling by households.[11]
- The introduction of British Columbia's carbon price coincided with a 16% decrease in overall fuel use in its first five years. This occurred while the province's economy was growing slightly more quickly than the rest of Canada's.[12]
- The Province of Ontario's introduction of time-of-use electricity pricing led to a shift in when energy is used, which was the goal of the policy.[13]
- The United States SO2 market has led to a greater than expected emissions reduction, at less than half the predicted compliance costs.[14]
- Sweden's tax on NOx emissions led to 55% of firms adopting new emission abatement technology in its first year alone.[15]

What these examples show is that **pricing works** to **reduce environmental harm** in a way that minimizes costs and motivates innovation. For pricing to be most effective, the policy that influences the price must be well designed. At the municipal level, one basis of good design is that the pricing of services reflects the full costs of those services. In theory, full cost pricing allows municipalities to generate sufficient revenue to recover the costs — infrastructure costs, operating costs and environmental costs — of providing the services. This is particularly important in Canadian municipalities where infrastructure is aging, key ecosystems are under stress, and citizens and businesses are demanding access to quality services and infrastructure without significant general tax increases. The Association of Municipalities of Ontario estimated in 2012 that their infrastructure deficit alone, just to meet existing backlogs, totals $60 billion.[16]

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10 Eliasson, J. (2014). *The Stockholm Congestion Charges: An Overview* (working paper). Centre for Transport Studies. Retrieved from http://www.transportportal.se/swopec/CTS2014-7.pdf

11 Hong, S. & Adams, R. M. (1999). Household Response to Price Incentives for Recycling: Some Further Evidence. *Land Economics*, 75 (4), 505-514. The authors also note the importance of non-price mechanisms to manage residential waste.

12 Elgie, S. (2014). *British Columbia's Carbon Tax Shift: An Environmental and Economic Success*. World Bank blog. Retrieved from http://sustainableprosperity.ca/news/british-columbia%E2%80%99s-carbon-tax-shift-environmental-and-economic-success

13 Navigant Consulting Limited. (2013). *Time of Use Rates in Ontario - Part 1: Impact Analysis*. Retrieved from http://www.ontarioenergyboard.ca/oeb/_Documents/EB-2004-0205/Navigant_report_TOU_Rates_in_Ontario_Part_1_201312.pdf

14 Environmental Protection Agency. *Cap and Trade: Acid Rain Program Results* https://grist.files.wordpress.com/2009/06/ctresults.pdf

15 Organization for Economic Cooperation and Development. 2010. *Taxation, Innovation and the Environment*. Retrieved from http://www.oecd.org/env/tools-evaluation/46177075.pdf

16 Association of Municipalities of Ontario. (2012). *Towards a New Federal Long-Term Infrastructure Plan, AMO's Submission to Infrastructure Canada*. Retrieved from https://www.amo.on.ca/AMO-PDFs/Reports/2012/AMO_Submission_to_Infrastructure_Canada_2012Aug29F.aspx

Full cost recovery and **full cost pricing** are important terms that are not always used consistently. **Full cost recovery** means that prices reflect short-term and long-term costs of goods, services, and infrastructure. Sometimes it is meant to also include environmental costs; at other times, it is defined as also requiring that pricing revenues be used solely to fund the operations and infrastructure of the system. On the other hand, **full cost pricing** generally includes environmental costs. It is less often meant to imply that funds, raised by the price, be allocated uniquely to the provision of that good or service.

The two cases we present in this paper — urban form and commercial wastewater — show that pricing is an important tool, and to use the tool well it is critical to get the prices right. In the municipal context, getting prices right means reflecting, as much as possible, a broad definition of full cost.

WHAT IS FULL COST PRICING?

What does full cost pricing entail? Working through the example of residential water use pricing can show how a comprehensive definition of full cost pricing might be considered.

At a minimum, the price residential users pay for water should include all the costs of getting the water to the residence — the operating and maintenance funds for the water delivery system. If we stopped here, this would be a fairly narrow definition of full cost pricing.

To push the definition further, the infrastructure that delivers the water either needs to be built, for new developments, or requires replacement from time to time. For much of Ontario, replacement has not been done in decades or even over a century, meaning there is a large cost on the horizon. These costs should be factored in. This principle is embodied in the emerging practice of infrastructure asset management, which considers how to finance a facility's costs over the entire life cycle of maintenance, rehabilitation, and replacement.

Going even further, drawing water from its source, whether an aquifer, a lake, or a river system, also has an environmental impact in that a resource that benefits everyone is degraded or "drawn-down."[17] Ideally, this cost would also be reflected in the price.[18] In this sense, the *full* cost of water is the cost of operating the delivery systems + the cost of reinvesting in infrastructure + the environmental costs. In a case where goods or services have a cost in and of themselves, such as the value of land when a municipality sells land to a developer, or the cost of a garbage bag when a municipality mandates specific bags for waste collection, this cost would also be included. This formula with water can be generalized to other municipal goods and services as:

FULL COST = **price of good or service + price of delivery + price of building and keeping up infrastructure + environmental cost (both the cost of pollution and the cost of maintaining ecological systems)**

17 Canada's Ecofiscal Commission points out in a recent blog how drawing down water sources below their regenerative level increases infrastructure costs and pumping/delivery costs as well. See Thivierge, Vincent. *Know Thy Water: The First Commandment of Water Pricing*. Canada's Ecofiscal Commission blog. July 22, 2015. http://ecofiscal.ca/?s=Know+thy+water

18 In the case of water use, this externality could include the depletion of an aquifer, the loss of habitat as water levels decline in a river, the environmental impact of the water delivery and treatment infrastructure (including energy use and impacts on land), among others.

This is a provocative idea. It includes both the visible costs (the costs to the municipality of providing the good or service) and the "invisible" ones (the cost of environmental degradation). It includes short-term aspects like getting water to residents today, and long-term impacts like reinvesting in major infrastructure and mitigating environmental impacts. The calculation of these various aspects of cost can be complicated and some aspects are very hard to qualify, quantify, and value, particularly ones not priced in the market, such as environmental quality.[19]

However, if a narrow definition of cost is used when setting prices, users are not paying for the full impact of the goods and services they consume. The result is that all other residents end up paying for select users' services — either through an increased tax bill, increases in other rates, decreased quality of service, deferred maintenance and replacement costs, or decreased environmental quality. In the absence of accurate pricing, all residents are in essence subsidizing the heaviest users. This has the potential to have important distributional impacts.[20]

In this paper, we look at two examples where pricing can be used as an important tool to influence behaviour. The first examines the various **policy options** municipalities have available **to influence urban form and encourage sustainable urban growth**. The second considers how municipalities can apply **pricing tools** to **commercial wastewater discharge** to reduce local water pollution in cost effective ways. These two examples show that pricing is an important tool, and to use that tool well it is critical to get the prices right — reflecting, as much as possible, a broad definition of full cost that includes the costs of environmental harm. Getting pricing right in these two cases — through one or more market-based instruments — could lead directly to three transformational outcomes in Canadian municipalities:

1. An improved environment, through the promotion of more sustainable use of natural resources like land and water:
   - For urban form, this means more compact cities.
   - For commercial wastewater, this translates directly into healthier waterfronts and ecosystems.

2. Increased financial sustainability of municipal services. This can be improved wastewater treatment or the full range of municipal infrastructure and services provided to neighbourhoods and districts, through a true user pay approach that reflects a broad definition of full cost pricing. This will help avoid revenue shortfalls in the provision of services, both now and in the future.

19 As a further complication, for resources like water use and electricity, time-of-use, and season-of-use may also matter in a calculation of full cost.

20 At the same time, it is important to note that increasing prices to reflect a broader definition of full cost can have disproportionately negative impacts on some demographic groups; however, policy-makers can find ways to remedy this through the policy design, or through the use of complementary policies.

3. Greater innovation. As citizens and businesses are made to incorporate the full cost of these municipal services (land use, wastewater, and others) in their decision-making, they will be encouraged to make efficient use of resources while adopting cleaner production processes and technologies.

EXPLORING PRICING FOR URBAN FORM

WHY URBAN FORM MATTERS

Canada has become a suburban nation. In 2006, over 80% of Canada's population in metropolitan areas lived in suburban regions.[21] Since that time this number has likely only increased. The range of negative effects from this trend is well documented. People living in spread-out, car-dependent neighbourhoods are more likely to walk less, weigh more, and suffer more from cardio-vascular diseases compared to people living in higher density communities.[22] Oldridge estimated that 1.5–3.0 percent of total direct healthcare costs in developed countries are related to inactivity.[23] Sprawling developments that increase our dependency on cars also create other negative externalities by increasing traffic congestion, smog, and air pollution, which have been linked to increased respiratory disease and asthma.[24] In addition they take away greenspace and agricultural lands that are essential for human health and food production.[25]

One reason why urban sprawl has persisted despite these known ill effects is because of the revenue it is thought to provide to cash-strapped municipalities. In Ontario, for example, municipalities have experienced chronic fiscal deficits over the past three decades.[26] Ontario municipalities rely mainly on property taxes for municipal revenue, with over 95% of their tax revenue coming from property taxes alone. In 2013, the City of Toronto had an operating budget of $9.4 billion, of which 39.4%, the highest percentage of all sources, came from property taxes.[27] Because most municipalities do not have the power or authority to implement other tax measures to

21 Gordon, D., & Janzen, M. (2013). Suburban Nation? Estimating the size of Canada's Suburban Population. *Journal of Architectural and Planning Research, 30* (3), 197-220.

22 Ewing, R., Scmid, T., Killingsworth, R., Zlot, A., & Raudenbush, S. (2003). Relationship Between Urban Sprawl and Physical Activity, Obesity, and Morbidity. *American Journal of Health Promotion, 18* (1), 47-57.

23 Oldridge, N. (2008). Economic Burden of Physical Inactivity: Healthcare costs associated with cardiovascular disease. *European Journal of Cardiovascular Prevention and Rehabilitation, 15* (2), 130-139.

24 Bray, R., Vakil, C., Elliott, D., & Abelsohn, A. (2005). *Report on Public Health and Urban Sprawl in Ontario.* Ontario College of Family Physicians. Toronto: Ontario College of Family Physicians.

25 ibid

26 Fanelli, C. (2014). *Under Pressure: How Public Policy is Constraining Ontario Municipalities*. Canadian Centre for Policy Alternatives. Toronto: Canadian Centre for Policy Alternatives.

27 ibid

increase revenue, they are limited in how they can manage their financial situation.[28] This has resulted in increasingly constrained municipalities, particularly in Ontario, having to work within this financial deficit while still remaining accountable for additional responsibilities downloaded from the province over the past decades.[29] Since property taxes are a municipality's main source of revenue, there is a strong history of encouraging development in order to increase revenue.

Today, many cities are coming to realize that when the overall costs of development are considered, additional suburban development does not bring in additional net revenue. This is particularly significant over longer term horizons. Calgary and Edmonton, for example, have analyzed the true costs of urban sprawl and found that their suburban developments are financially unsustainable. In a 2011 report for the Finance and Treasury Department for the City of Edmonton, an analysis was provided on the expected expenses and revenues for 17 new or developing neighbourhoods within the City. The analysis demonstrated that, on average, the expenses for these neighbourhoods would be 1.36 times greater than their revenues over a 30-year period.[30] In Calgary, a 2009 report by Plan It Calgary compared the potential infrastructure capital costs of two development patterns: a dispersed, business-as-usual pattern and a more compact development pattern.[31] They found that over a 60-year time frame the dispersed pattern would likely cost 32% more compared to the compact pattern.

Suburban development or urban sprawl, therefore, not only has a negative impact on human health and well-being and the environment, but it is also financially unsustainable for cities. A new sustainable form of development is required but, due to the fiscal constraints facing most municipalities and their limited ability to create new revenue streams, how can this be achieved?

PRICING MECHANISMS FOR SUSTAINABLE URBAN FORM

There exist many different mechanisms by which municipalities can encourage a more sustainable growth pattern. These mechanisms include regulations, zoning, and urban growth boundaries. These tools are essential, but do not address one of the major causes of sprawl — prices. Pricing can send a very clear signal to the market to encourage sustainable growth simply by making it the more economically feasible option. A 2012 survey of Toronto-area residents confirmed that housing prices influenced their choice of where to live for 79% of respondents.[32]

28 ibid

29 ibid

30 Leeman, B., Ohm, P., & Rose, J. (2011). *Costs and Revenues for New Areas: Finance and Treasury Department Report.* Edmonton: City of Edmonton.

31 The IBI Group. The Implications of Alternative Growth Patterns on Infrastructure Costs. April 2009. http://www.reconnectingamerica.org/assets/Uploads/planitcalgarycoststudyanalysisaprilthird.pdf

32 RBC — Pembina Home Location Study, Understanding where Greater Toronto Area residents prefer to live. July 16, 2012. http://www.pembina.org/pub/2358

The following is an overview of the pricing mechanisms available to local governments wishing to take a comprehensive approach to transitioning to a sustainable urban form.

Development Cost Charges

Development cost charges (DCCs) are charges levied by municipalities from developers for costs related to infrastructure requirements for new growth. The calculation of the development charge is determined by the municipality but is constrained to what is permitted through provincial legislation. Development charges are often viewed as a revenue-generating tool for municipalities to cover the costs of growth-related infrastructure. But they can also be used as a growth management tool.[33] According to the 2014 City of Ottawa Consolidated Financial Statement, development cost charges accounted for 3.3% of total revenue in 2014 and 4.3% in 2013.[34] In the City of Toronto, development charges accounted for only 1.5% of total revenue in 2013.[35]

In Ontario, *The Development Charges Act, 1997* sets out which services municipalities are allowed to charge for, how the charges are calculated, and how the revenue collected can be used. The *Act* does not allow municipalities to fully recover the total costs of new growth from development charges. The cost of ongoing operations and maintenance of the infrastructure cannot be included, nor can development charges cover services such as transit, acquisition of land for parks and recreation, cultural spaces, and waste management that are required to service new developments. Developments that are built within existing urban areas can rely on existing infrastructure and services, but developments built outside of the urban areas require all new servicing. Because the developers are only responsible for covering the upfront costs of installing the new infrastructure, and not the ongoing maintenance or other services, the remaining costs are downloaded to the city. To cover these remaining costs the city must either increase property taxes for all residents or find another source of funding. As a result of the current structure of DCCs, development occurring in suburban regions offload costs onto all taxpayers of the municipality while the benefits from that development are incurred by only a few.

Development cost charges can be used as a growth management tool by levelling the playing field between different types of development, and by incentivizing development in existing built-up areas. For example, the City of Kitchener has adjusted their DCCs to be 74% lower in central neighbourhoods compared to suburban areas.[36] They have also set different charges

33 Sustainable Prosperity. (2012). *Managing Urban Sprawl: Reconsidering Development Cost Charges in Canada*. Ottawa: Sustainable Prosperity.

34 City of Ottawa. 2014. City of Ottawa 2014 Consolidated Financial Statements. http://documents.ottawa.ca/sites/documents.ottawa.ca/files/documents/COO_2014_financial_statements_en.pdf

35 City of Toronto. 2013. City of Toronto 2013 Consolidated Financial Statements. http://www1.toronto.ca/City%20Of%20Toronto/Accounting%20Services/Financial%20Reports/Files/pdf/2013/2013far_cfs.pdf

36 Thompson, D. (2013). *Suburban Sprawl: Exposing hidden costs, Identifying innovations*. Ottawa: Sustainable Prosperity.

for suburban lots with or without existing services such that unserviced suburban lots are charged 157% more than serviced central lots.[37] By adjusting development cost charges to ensure that growth pays for growth, the market is more likely to also adjust in favour of compact development or redevelopment in existing areas.

When growth pays for growth, an efficient use of existing resources occurs because it becomes more economically beneficial to build compact developments. As well, adjusting DCCs to reflect the true cost of a development, including all related services, ensures that those who benefit from those services are also responsible for paying for them. Brunnen[38] highlights the fact that there are certain municipal services that would not be provided by the market (i.e. government services) and these need to be collectively financed because they benefit everyone. Other municipal goods and services, such as roads, water, and sewer lines, have very distinct beneficiaries and costs that can be identified. For these services it is more efficient for those who directly benefit from the service to also pay for the service.

The management and application of development charges to encourage a more sustainable urban form is directly linked to a municipality's reliance on property taxes for revenue. If developers are able to cover all costs associated with a new development, including increased development charges, and still make a profit, a municipality may allow suburban development because it would no longer incur additional municipal costs and might bring in additional revenue from property taxes. From this standpoint, the adjustment of development charges alone is likely not enough to guarantee a transition to a more sustainable urban form.

Property Taxes

Municipalities rely on property taxes for the majority of their annual revenue stream. Property taxes are calculated using a general formula of the value of the property multiplied by a tax rate. The tax rate determined by the municipality depends on what the annually assessed municipal revenue needs to be.[39] As previously discussed, adjusting development cost charges to ensure that growth pays for growth would alleviate the need to continually increase property taxes to cover the extra costs of new developments. But property taxes themselves can also be adjusted to provide a greater incentive for a more sustainable urban form.

Property tax rates are often varied within a municipality depending on the class of property. This can be an incentive or a disincentive for certain

37 ibid

38 Brunnen, B. (2013). *A Framework for Municipal Expenditures.* Calgary: Manning Foundation.

39 Thompson, D. (2013). *Suburban Sprawl: Exposing hidden costs, Identifying innovations.* Ottawa: Sustainable Prosperity.

buildings types. For example, in Edmonton the tax rate for higher density apartment buildings is higher than for single-family dwellings.[40] The same is true for some areas of Toronto and Montreal. To encourage denser developments, property tax rates can be varied to provide incentives for higher density dwellings as opposed to single-family dwellings. Higher property tax rates for lower density developments, combined with appropriate development charges for the full cost of sprawling new developments, will effectively make compact, high density developments within existing built-up areas the more cost effective option by more accurately reflecting the true costs of low density sprawl. A recent study by the Halifax Regional Municipality demonstrated that the cost of the high-density urban settlement form was 2.4 times lower than a low-density suburban form.[41]

Revitalization Tax Exemption

Another tool that could be used by municipalities to encourage a denser urban form is a type of Revitalization Tax Exemption (RTE). In B.C., the Community Charter provides municipalities with the opportunity to implement RTE programs that exempt property from municipal property value taxes.[42] The City of Chilliwack, for example, has a Downtown Revitalization Tax Exemption to encourage downtown development.[43] In Ontario, the Ministry of Municipal Affairs and Housing (MMAH) released a guide in 2008 on Planning and Revitalization Tools, which recommended using Community Improvement Plans (CIPs) to designate areas where financial incentives such as grants, loans, or tax assistance can be provided to developments.[44] Providing property tax exemptions or reductions to development in infill or downtown areas would provide additional financial incentive for denser urban development. This tool, however, similar to the density bonusing (see next section), serves to encourage development in downtown areas but does not specifically act to stop sprawl from continuing.

Density Bonusing

Density bonusing is a type of agreement between a municipality and a developer that lets the municipality receive a benefit for allowing a developer to exceed existing height or density restrictions.[45] It is a commonly

40 ibid

41 Halifax Regional Municipality. (2005). *Settlement Pattern and Form with Service Cost Analysis*. Halifax: Halifax Regional Municipality.

42 For more information see BC Climate Action Toolkit http://www.toolkit.bc.ca/tool/revitalization-tax-exemptions-rtes

43 See City of Chilliwack Downtown Revitalization Tax Exemption Program https://www.chilliwack.com/main/page.cfm?id=1037

44 Ontario Ministry of Municipal Affairs and Housing document available at http://www.mah.gov.on.ca/AssetFactory.aspx?did=5866

45 Moore, A. (2013). *Trading Density for Benefits: Toronto and Vancouver Compared*. Institute of Municipal Finance and Governance. Toronto: Munk School of Global Affairs.

used practice in many U.S. cities but less used in Canada.[46] Toronto and Vancouver, however, have been employing this practice in different ways. Toronto uses Section 37(1) of the Ontario Planning Act, 1990, which authorises increases in the height and density of development otherwise permitted by a by-law.[47] The City of Vancouver uses Community Amenity Contributions (CACs), which are governed by Section 565.1 of the *Vancouver Charter*.

To date, both cities have adopted a case-by-case approach to density bonusing and both tend to ensure that any amenities that come from the agreements are in close proximity to the development itself.[48] They have so far sought to secure different amenities through the process. Toronto tends to secure visually desirable amenities such as parkland, while Vancouver tends to secure affordable housing and community services.[49]

While density bonusing, if more widely practiced in cities across Canada, could help improve downtown areas and attract more people to live in central urban areas, it will not necessarily address the cost issues of developing in urban versus suburban regions. Density bonusing could potentially increase the costs of living in central areas if they become more desirable and if demand for housing in that area increases, thereby increasing the cost of urban housing.

Pricing Mechanisms Beyond Municipal Authority

Additional pricing mechanisms, outside of the control of a municipality, can have significant impacts on the ability of municipalities to encourage a more sustainable urban form. Federal and provincial governments provide much needed funding to municipalities to improve transit and infrastructure. If municipalities correct for the subsidies provided for new suburban developments, more provincial funding could then go towards other programs that support a more sustainable urban form. These could be transit, energy efficiency upgrades, active transportation infrastructure, and parks and greenspaces.

An additional way to make downtown living more affordable would be mortgage assessment reform at the provincial level. Currently mortgages are assessed based on the cost of the home and do not take into account the other costs, including transportation, of living in certain locations.[50] In many suburban regions, the extra costs of commuting, gas, parking, and

46 ibid

47 See Planning Act, 1990. s. 37(1)

48 Moore, A. (2013). *Trading Density for Benefits: Toronto and Vancouver Compared*. Institute of Municipal Finance and Governance. Toronto: Munk School of Global Affairs.

49 ibid

50 Burda, C., Allan, T., Dunn, B., Lintner, A., McClenaghan, T., & Zizzo, L. (2012). *Live Where You Go: Encouraging location-efficient development in Ontario*. Drayton Valley: The Pembina Institute.

vehicle maintenance override the apparent cost savings of buying a cheaper home in a suburban neighbourhood.[51] If mortgage affordability assessments were required to account for the total costs of living in different areas, more people would be able to afford to live in location-efficient urban neighbourhoods.

DISCUSSION — PRICING MECHANISMS

The costs associated with suburban sprawl, financially and in terms of community health and wellbeing, are known. Yet suburban sprawl continues. There are many factors that affect why people choose to live in certain areas, why developers choose to develop in certain areas, and why municipalities continue to approve certain developments. A single policy change or pricing mechanism cannot address all of the factors that drive suburban sprawl. A greater understanding is needed not only of the various tools available to encourage sustainable community development, but also of how they interact overall to impact community form.

With respect to pricing mechanisms, amending development cost charges to accurately represent the true costs of new developments will provide a significant pricing disincentive for developing outside of urban boundaries. However, if municipalities remain reliant on property taxes and new development for increased revenue, the demand and approval of suburban housing may continue. Municipalities still need to diversify their revenue sources to reduce their dependence on property taxes and new developments. Other forms of municipal eco-fiscal reform can support this.

Downtown tax exemptions and density bonusing both work to improve urban areas and attract people to live in the downtown. However, if downtown housing prices and property taxes remain high, the cost of living in urban areas may remain out of reach for many, effectively pushing people to continue to demand suburban living. True cost DCCs and varying property taxes, or reforming mortgage assessments to account for density and location would contribute to reducing the generally higher costs of living in downtown areas and, when combined with density bonusing or tax exemptions, would improve the attractiveness and affordability of downtown living.

Overall, each pricing mechanism has its strengths and weaknesses in terms of the level of impact it can have on urban form and whether it stops suburban sprawl or encourages urban densification. Table 1 highlights the various pricing mechanisms that could be used to support specific urban form objectives. A combination of pricing mechanisms, along with non-pricing mechanisms including zoning, urban containment boundaries, and Community Improvement Plans, can all work together to create a robust municipal toolbox for encouraging a more sustainable urban form.

51 ibid

Table 1: Pricing Mechanisms for a Sustainable Urban Form

TO ENCOURAGE SUSTAINABLE URBAN FORM MUNICIPALITIES NEED TO:	PRICING MECHANISM:
Contain urban sprawl	• DCCs that reflect all costs of development • DCCs that are higher for suburban areas
Encourage infill development	• Lower property tax rates for higher density buildings • Increase property tax rates for underutilized land • Waive DCCs for infill developments • Density bonusing for amenities • Mortgage assessment reform
Encourage downtown revitalization	• Community improvement plans & revitalization tax exemptions • Density bonusing • Federal and provincial funding for transit, active transportation, etc.
Improve Public Awareness of Costs	• Information regarding housing pricing and housing affordability (full cost of living in certain locations to include transportation, mileage, gas, parking, services, etc.) • Transparent municipal budgets

EXPLORING PRICING FOR COMMERCIAL WASTEWATER

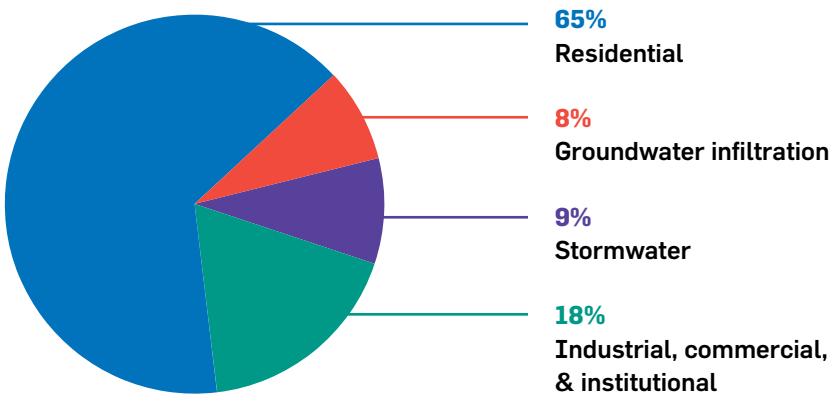
WHY COMMERCIAL WASTEWATER MATTERS

Municipal wastewater discharges are a leading source of water pollution in Canada. Municipal wastewater can contain grit, debris, suspended solids, disease-causing pathogens, decaying organic waste, nutrients, and approximately 200 different identified chemicals.[52] When not treated appropriately, it can severely impact the quality of the water in which it is released. Because the smallest streams are connected to rivers, lakes, and oceans, a contaminated water body — regardless of its size — can negatively impact a

52 Statistics Canada. (2012). *Human Activity and the Environment — Section 4: Wastewater discharges*. Retrieved from http://www.statcan.gc.ca/pub/16-201-x/2012000/part-partie4-eng.htm

much larger area with resulting effects on human health, marine and freshwater organisms, and the economy.

Figure 1: Municipal Wastewater Sewer Flows, Percentage by Source



As Figure 1 shows, 18% of municipal wastewater flows come from industrial, commercial, and institutional users, compared to 65% from residential users and less than 10% from each of stormwater and groundwater infiltration.[53,54] At first glance, commercial wastewater might not seem like a priority area for the use of pricing policies due to its small contribution to the total volume of municipal wastewater. However, commercial wastewater warrants particular focus because of its uniqueness.

Simply put, commercial wastewater is not like industrial or residential wastewater in composition or in treatment options. Industrial wastewater can vary significantly across industrial processes, and is thus generally treated privately. On the other hand, residential wastewater is generally quite homogeneous and is treated by municipal wastewater treatment plants that are designed in large part with the most common components of residential wastewater in mind: primarily human waste, organic matter, nitrogen, and phosphorous.

Commercial wastewater can be unlike either of these. Like industrial wastewater, it can vary significantly in composition from one facility to another. However, commercial operations are often too small to make private treatment feasible. Like residential wastewater, most commercial wastewater dischargers access municipal services. However, municipal treatment plants are less efficient in treating contaminants discharged

53 Statistics Canada. (2012). *Human Activity and the Environment — Waste Management in Canada*. Retrieved from http://www.statcan.gc.ca/pub/16-201-x/16-201-x2012000-eng.pdf (The 2012 report includes 2006 data).

54 This percentage of wastewater from industrial, commercial and institutional users tends to increase in larger municipalities. For example, in municipalities under 2000 people, residential users account for 70% of water use, but in cities with a population over 500 000 people, residential users only account for 56% of water use. Environment Canada. (2011). Municipal Water Use Report. Retrieved from https://ec.gc.ca/Publications/default.asp?lang=En&xml=B77CE4D0-80D4-4FEB-AFFA-0201BE6FB37B (2009 Municipal water use statistics).

Understanding the Urban Water Use Cycle in Ontario

Close to 90% of Ontarians are served by municipalities' intricate water and wastewater systems. Water is sourced from rivers, streams, lakes, and underground aquifers. It is treated to remove contaminants and pathogens in order to make it safe for drinking and other uses. A pressurized system of pipes, pumps, and valves distributes this treated water to customers who use it for different purposes. After use, the wastewater collection system (sewers) collects most of the used water and conveys it to a wastewater treatment plant. These plants use physical, chemical, and biological processes to restore water quality before the effluent is safely released into the environment. Wastewater treatment plants in Ontario generally treat used water from commercial, residential, and — in some cases — industrial customers. Stormwater runoff is either collected by a stormwater sewer and transported to a surface water collection area, like a stormwater pond, or mixed with wastewater in a combined sewer.

by non-residential users, like the commercial dischargers who contribute a variety of substances to wastewater, depending largely on their type of operations. Many commercial operations discharge wastewater with higher concentrations of fats, oil and greases, metals, and organic compounds.[55] Municipal wastewater treatment costs rise whenever a significant percentage of wastewater originates from commercial sources because additional resources are needed to treat the wider range of toxic substances usually found in commercial wastewater. This means pricing that improves the quality of commercial wastewater has the potential to be very impactful.

The potential returns from taking action to address commercial wastewater are even more evident when the costs of the infrastructure are considered. In Ontario, most water-related infrastructure is owned by municipalities and is generally operated by municipal staff. There are 680 drinking water systems and 466 wastewater systems in the province serving a wide range of population sizes.[56] However, many of these systems are at — or close to — the end of their life expectancy. Many municipalities, particularly smaller ones, are struggling to maintain their current systems. The 2012 Commission on the Reform of Ontario's Public Services noted that half of the $72 billion in municipally owned water and wastewater assets require upgrading over the period 2005–2019. On top of that, many of these water systems face the challenge of meeting the demands of a growing population. Alterations in weather patterns due to climate change will also place an additional burden on local stormwater systems and drinking water sources.

While municipal wastewater is inherently local, in Canada wastewater is regulated by federal, provincial, and municipal regulations.[57] Recent changes to the federal and provincial legislative and regulatory frameworks governing water and wastewater services, including the introduction of the federal Wastewater System Effluent Regulations (2012) and Ontario regulations established under Ontario's Safe Drinking Water Act (2002), Clean Water Act (2006), and the Water Opportunities and Water Conservation Act (2010),[58] have added a renewed focus on investments, operations, and performance of these systems. Although the legislative changes have generally helped improve water quality and management in Ontario, municipalities incur considerable costs in complying with these mandatory changes. Using pricing to address commercial wastewater offers the chance to increase revenue and improve environmental outcomes.

55 Many municipalities require commercial users such as restaurants and car garages to install interceptors on all fixtures to prevent the release of grease, oil, and sand to the sewer.

56 Water Tap website. *Water and wastewater utilities in Ontario*. Retrieved from http://www.watertapontario.com/asset-map/utilities/water-and-wastewater-utilities

57 Many municipalities are able to set bylaws for wastewater discharge. Related to this, overstrength charges based on contaminant concentrations are discussed later in this paper.

58 The Water Opportunities Act of 2010 helps municipalities prepare sustainability plans for municipal water services, municipal wastewater services, and municipal stormwater services. The sustainability plans require the preparation of an Asset Management Plan along with a Financial Plan, which will provide for full cost recovery of the systems.

PRICING MECHANISMS FOR WASTEWATER

Despite some recent water and wastewater pricing increases in Ontario, the prices that Ontarians pay for water use and disposal still have far to go to fully correspond with the operating and maintenance costs incurred by municipal water and wastewater system operators, let alone reflect the negative impact that water use and wastewater discharge can have on the environment. Currently Ontarians — together with the rest of Canadians — pay very little for the water they use and dispose of. An OECD study revealed that Canadians pay one of the lowest water supply and sanitation rates as a share of disposable income — 1.2% of disposable income compared to the 2.3% average among 22 OECD countries.[59]

In general, by adequately charging for wastewater treatment, Ontario municipalities could encourage greater water conservation, improve water quality, and recover the costs of maintaining their complex water and wastewater treatment infrastructure. Specifically, by tying the fees for discharge into municipal sewage systems, to the quality and volume of wastewater produced by commercial users, municipalities can lower local water pollution, help finance much needed wastewater treatment infrastructure, and encourage business to innovate.

Current wastewater pricing in Ontario is largely based on volumes of water **used** (rather than the volume discharged). Over 85% of Ontario municipalities that ifmpose water use pricing have water meters and volume-based billing for residential and commercial users. This provides an incentive for consumers to reduce consumption of water or the production of wastewater, as opposed to flat fee systems.[60,61] Although meters are commonly used to measure water consumption, calculating the cost of treating wastewater is more complicated because both the quality and quantity of wastewater influence the costs of treatment. Residential users typically pay a wastewater charge linked directly to their water usage.[62] In pricing regimes based solely on water use, neither the quantity nor quality of the wastewater influences the user's cost.[63] For commercial users, despite the variation in wastewater quality among different commercial operations,

59 OECD. (2010). *Pricing Water Resources and Water and Sanitation Services*. (page 74)

60 Environment Canada. (2011). *Municipal Water Use Report*. 2009 Municipal water use statistics. Retrieved from https://ec.gc.ca/Publications/default.asp?lang=En&xml=B77CE4D0-80D4-4FEB-AF-FA-0201BE6FB37B

61 Although volume-based metering is intended to better reflect the costs associated to the level of water consumption. There are some costs that are fixed regardless of water use rates. As a result, many municipalities have begun to charge a base fixed charge, along with a volume-based charge, to secure a constant revenue stream that would help cover fixed costs.

62 For instance, in Ottawa, small users pay a wastewater charge of 117% of their water usage. Ottawa's water rate is $1.699. If a resident uses 182 m^3 a year, that resident will pay $309.22 for water usage and $361.79 ($309.22 * $1.17) for wastewater. In Toronto, consumers under a threshold size pay a combined water and wastewater rate of $3.20/$m^3$ used. City of Ottawa website. *Water and Sewer Bill — Changes to your Water and Sewer Bill*. Retrieved from http://ottawa.ca/en/residents/water-and-environment/water-and-sewer-bills/changes-your-water-and-sewer-bill and City of Toronto. (2015). *Water and Wastewater Rates and Service Fees*. Retrieved from http://www.toronto.ca/legdocs/mmis/2015/ex/bgrd/backgroundfile-77554.pdf

63 As noted earlier, due to their heterogeneity, industrial users within municipalities often have their own wastewater treatment operations or have individual agreements with the municipality regarding wastewater levels and limits.

most municipalities' wastewater charges generally parallel residential ones; they are usually based on the amount of water supplied, scaled by a recovery ratio.

Table 2: Municipal Commercial Wastewater Pricing Tools

	WASTEWATER
FLAT FEE	• Users pay a flat fee for unlimited wastewater discharge
QUANTITY	• Volumetric Pricing • Users pay a fee related to the volume of wastewater created • As is often the case, users pay a fee related to the quantity of water used
QUALITY	Tools that introduce a price that reflects water quality include: • Regulatory measures (implicit pricing) • Water quality trading regimes (explicit pricing) • Over strength discharge fees (explicit pricing)

The quality of the wastewater can have a significant impact on water treatment costs. Fortunately, there are other tools available for municipalities to link commercial users' wastewater charges to the quality of their wastewater. These include:

Regulatory measures, such as limiting concentrations of pollutant releases via bylaws or banning the release of particular pollutants, are an important tool available to municipalities.[64] While they do not place an explicit price on pollution or environmental degradation, they can be seen as placing an implicit price on the banned/limited substances.

Water quality trading systems[65] offer a means of capping total pollution releases to a system, and have been shown to work well in the few examples where they have been used in Canada including the South Nation river watershed and the Nottawasaga watershed. They are likely less practical in commercial wastewater applications than in industrial or agricultural systems though, due to the large number of small commercial entities.

64 Provincial (Ontario Environmental Protection Act and Regulations, Ontario Water Resources Act and Regulations) and federal (Canadian Environmental Protection Act and Notices) legislation establish effluent quality criteria for wastewater and sludge generated from wastewater treatment plants, however, it is the municipalities that set discharge concentration limits for certain pollutants via the use of municipal bylaws. Stantec. (2012). *Over Strength Surcharge Review for Toronto Water, City of Toronto*. Retrieved from http://www.toronto.ca/legdocs/mmis/2012/pw/bgrd/backgroundfile-50669.pdf

65 For more on water quality trading in Ontario, refer to these blog posts by Mercedes Marcano, *Sustainable Prosperity: Pricing Water Pollution: Water quality trading in Ontario* http://www.sustainableprosperity.ca/blog/pricing-water-pollution-water-quality-trading-ontario and *Top 10 Lessons from Ontario's Water Quality Trading Experience:* http://www.sustainableprosperity.ca/blog/pricing-water-pollution-top-10-lessons-ontario%E2%80%99s-water-quality-trading-experience

Pricing tied to wastewater quantity, as distinct from water use quantity, could be an important wastewater pricing tool. However, it would require metering of wastewater and would still not take into account the quality of the wastewater, and thus, the cost of treating it.[66]

Pricing tied to water quality entails users paying a fee that is based on the concentrations of certain pollutants in excess of a regulated limit. Pricing tied to wastewater quality — and in particular over strength discharge fees — is an interesting tool already in use in Canada and elsewhere that could be used more extensively. It is examined in the next section.

Over Strength Discharge Fees

Municipalities often create sewer use bylaws that limit the concentration of contaminants allowed in wastewater entering the municipal sewer system.[67] These bylaws may also establish over strength discharge fees, also referred to as over strength fees or over strength charges, which are intended to recover the additional costs associated with treating substances discharged at higher concentrations than the limits set in the sewer bylaw. Over strength fees are calculated based on the difference between the bylaw concentration limit and the actual discharge concentration.[68] Concentrations within the limit are not charged, as it is deemed that the treatment costs for these acceptable concentrations are captured by the basic wastewater charges.

These fees allow commercial (and sometimes industrial) wastewater dischargers to avoid building expensive in-house systems to treat their wastewater while, in theory, ensuring the financial sustainability of municipal wastewater treatment plants. Over strength fees allow these non-residential users to locate their operations within the city, increase income generated through municipal taxes, and create employment opportunities for residents.

Typically, covered substances include: a measure of oxygen demand such as biological oxygen demand (BOD); solids present in the wastewater such as total suspended solids (TSS); fats, oils and greases, often referred to as FOG, and phosphorous. If a commercial operation exceeds the limits set by the municipality, its operators arrange with the municipality to put wastewater quality monitoring in place and to pay for concentrations in excess of

66 Some cities do include wastewater metering upon request. For Instance See "City of Calgary, Effluent Metering Program" website here: http://www.calgary.ca/UEP/Water/Pages/Water-and-wastewater-systems/Wastewater-system/Sewer-service-surcharge-program/Effluent-Metering.aspx

67 Any commercial user that exceeds the bylaw concentration limit has the option to build in-house capacity to treat their wastewater before it is released or enter into an over strength agreement with the municipality. Failure to comply with the bylaw concentration limits can result in fines. In Toronto — for example — these fines can amount to $100,000 per day. Stantec. (2012). *Over Strength Surcharge Review for Toronto Water, City of Toronto.* Retrieved from http://www.toronto.ca/legdocs/mmis/2012/pw/bgrd/backgroundfile-50669.pdf

68 Ibid

the regulation.[69] In 2013 in Toronto, there were 211 such agreements in place with commercial operations.[70] Typical commercial dischargers entering into these arrangements include, among others, food and beverage operations, laundries, and waste collection. A commercial discharger entering into such an agreement typically has business revenues ranging from $300,000 to $9 million annually.

There are different pricing structures and formulas that municipalities use to calculate over strength discharge fees. Some municipalities charge for every type of pollutant that exceeds the concentration limit. Other cities, like Toronto, only charge a fee based on the pollutant that exceeds the bylaw concentration limit by the greatest amount. Three Canadian cities — Toronto, Ottawa, and Calgary — and their current over strength discharge fee regimes are profiled below.

OTTAWA'S SPECIAL DISCHARGE AGREEMENTS AND FEES

When wastewater discharges from commercial and industrial users exceed limits for substances that can be treated at Ottawa's wastewater treatment plant, a facility can enter into an agreement with the City in order to comply with the by-law. The agreement outlines monitoring and reporting requirements. It also sets special surcharges (over strength fees) intended to recover the costs of additional treatment. Currently the City allows facilities to enter into agreements to discharge five treatable substances.

Over strength surcharge fees for the city of Ottawa*

PARAMETERS	FEES
Suspended solids	$0.81 per Kg
Biochemical oxygen demand	$1.53 per Kg
Phenolic compounds	$1.53 per Kg
Phosphorus	$2.45 per Kg
Kjeldahl nitrogen	$6.10 per kg
Initial fee for establishment of Agreement Facilities must also pay a $1003.00 one-time flat fee when they enter into the Special Discharge Agreement.	**$1003.00**

*City of Ottawa website. *Sewer Use Regulations for Business and Industry*. Retrieved from http://ottawa.ca/en/residents/water-and-environment/sewers-and-sewage-treatment/sewer-use-regulations

69 Some agreements limit the total volume and flow as well. The City of Toronto provides a good overview of how an over strength charge agreement can be structured. Refer to *Over Strength Surcharge Review for Toronto Water, City of Toronto*. Retrieved from http://www.toronto.ca/legdocs/mmis/2012/pw/bgrd/backgroundfile-50669.pdf

70 ibid

TOWARDS FULL COST RECOVERY IN TORONTO'S WASTEWATER SURCHARGE PROGRAM

In Toronto, industrial and commercial dischargers whose effluents surpass the allowable limits for certain contaminants may enter into an agreement with the City to pay a fee to cover the additional costs associated with treatment. As of December 2013, 211 organizations had signed surcharge agreements with the city including restaurants, meat and other food packaging businesses, dry cleaners, garment factories, and chemical manufacturing.*

Although the City adjusted over strength fees in 2013 to better reflect the costs associated with treating higher concentration effluents, the formula currently used to calculate surcharge fees does not achieve full cost recovery. Currently, the surcharge fee is based only on the contaminant that exceeds the bylaw limit by the greatest amount. A motion to extend the fee to all substances exceeding the threshold was defeated in March 2015 by a vote of 18 for and 24 against at Toronto City Council. Economic considerations were noted for why some councillors, including the Mayor, voted against.

Over strength surcharge fees for the City of Toronto (Fees before and after 2013 amendments)

PARAMETERS	FEES USE FROM 1996–2012	FEES EFFECTIVE JANUARY 2013
Suspended solids	$0.57 per Kg	$0.60 per Kg
Biochemical oxygen demand	$0.57 per Kg	$0.62 per Kg
Phenolic compounds	$0.57 per Kg	$0.62 per Kg
Phosphorus	$0.57 per Kg	$1.69 per Kg
Kjeldahl nitrogen	Not added as a treatable parameter until 2013	$1.18 per kg
Initial fee for establishment of Agreement	No initial fee	**$800.00**

A 2013 Toronto Water briefing note estimated that the current formula only achieves 76 percent of full cost recovery (defined to included infrastructure, operating and maintenance fees, but not environmental costs) of the Toronto's Wastewater Surcharge Program. This equals $9.2 million annually. However, if the City applied over strength surcharge fees based on all contaminants (parameters) exceeding bylaw limits — as recommended in the 2012 Over Strength Surcharge Review and by Toronto Water — the City could achieve full recovery estimated at $12.1 million annually. Again, environmental costs are not included in the definition of full cost recovery.

While fee adjustments made in 2013 are seen as a step in the right direction, not implementing the recommendations to surcharge each parameter prevents Toronto from accurately capturing the costs of treating the contaminants released by commercial and industrial users.

*City of Toronto website — *Industrial Waste Control. Retrieved from* http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=333807ceb6f8e310VgnVCM10000071d60f89RCRD&vgnextchannel=fe4cfe4eda8ae310VgnVCM10000071d60f89RCRD

CALGARY INCREASES ITS OVER STRENGTH CHARGES

Calgary has an over strength fee referred to as "a sewer service surcharge." It is applied to regular sewer users when the City's lab tests show high levels of pollutants. Businesses on the program have their wastewater sampled and tested on two separate days and the average concentration is then used to generate a price per cubic meter of wastewater. These prices are in place for three months, and then samples are redone and fees recalculated.

PARAMETERS	FEES 2015	FEES 2016	FEES 2017	FEES 2018
Total suspended solids (TSS)	$1.357 per Kg	$1.360 per Kg	$1.362 per Kg	$1.365 per Kg
Biochemical oxygen demand (BOD)	$1.707 per Kg	$1.710 per Kg	$1.713 per Kg	$1.717 per Kg
Fats, oils and greases (FOG)	$2.304 per Kg	$2.308 per Kg	$2.313 per Kg	$2.317 per Kg

Calgary revised these charges in November 2014 and has established annual rates for each year, from 2015 to 2018. Rates increase steadily for all three effluents over this time period. These changes, along with changes to other elements of water and wastewater pricing in Calgary, were determined with three principles in mind:

Fairness and Equity to customers. Rates reflect each customer's fair share of the costs to provide them with water and wastewater, meaning customers pay for what they use.

Financial Sustainability. Water services are not funded through property taxes, so rates fund all necessary investments and growth, including treatment plants, pipes, and storage reservoirs.

Water Resource Management. Water is a precious resource and the supply is limited. Water rates are structured to encourage all customers to conserve water, to protect the river and the watershed, and to meet all environmental regulatory water requirements.

* City of Calgary website. *Water and Wastewater Rates*. Retrieved from http://www.calgary.ca/UEP/Water/Pages/Customer-service/Water-and-wastewater-rates/Water-and-Wastewater-Rates.aspx#SR

THE EUROPEAN EXPERIENCE

While little empirical analysis that explores how commercial wastewater quality improves after the introduction of a change in a price exists, there is some evidence from Europe. A country often noted as a leader in wastewater management is the Netherlands. In the Netherlands local water boards, rather than municipalities, have authority to operate wastewater systems and water quality management.

In the 1970s, a Dutch wastewater levy was set up with the local water boards authorized to collect the levy in order to support sewage systems. The levies apply to discharges of organic material, nitrogen, mercury, cadmium, copper, zinc, lead, nickel, chromium, and arsenic. The charge is based on "habitant equivalents," where one habitant equivalent is standardized to the average amount of the pollutant that one individual produces in one day from a household.[71] Unlike the Canadian over strength discharge programs described earlier, in the Dutch program there is a charge associated with the presence of a contaminant in wastewater at *all* concentrations (i.e., not just for concentrations above a threshold level.) This creates an incentive for wastewater dischargers to reduce emissions, regardless of their level of pollution.

Significant changes in the levies for organic pollution between 1975 and 1995 provide a good example of how the charge can have a significant impact on water quality. An increase in the average charge for organic pollution by Dutch water boards, by 130% from 1980 to 1995, contributed to a more than 80% reduction in emissions of organic material from 1975 to 1995. Most of the reduction happened after the charge was significantly raised.

The Netherlands' pricing approach is in contrast to what other countries have done. For instance, Denmark relied largely on a local approach to wastewater standards until 1987. While the Netherlands introduced wastewater levies in the 1970s, it was only in 1988 that Denmark introduced a bill mandating full cost pricing, including environmental impact. Then in 1995, a wastewater tax was added in Denmark for industrial and waste treatment plants. A retrospective look at the timeline of Danish policy changes shows wastewater discharges improving only after 1987, when prices were adjusted. Little additional change occurred after the introduction of the tax. However, the rate of compliance of sewage treatment plants, which had been approximately 70%, reached near full compliance when the tax was added.[72]

71 Park, L. (2012). *Municipal Use of Economic Instruments to Incentivize Water Quality: Policy Choice in Canada and the Netherlands*. University of Ottawa (unpublished)

72 European Environment Agency (2005). Effectiveness of Urban Wastewater Treatment Policies in Selected Countries: An EEA Pilot Study. Retrieved from: http://www.eea.europa.eu/publications/eea_report_2005_2

The EU's Water Framework Directive

The EU's Water Framework Directive was adopted in 2000, in recognition of the need to conserve adequate water supplies. It introduced pricing as an important element of efforts to ensure adequate water supplies, calling the focus on price "one of the Directive's most important innovations." According to the Directive, member states are required to ensure the price charged to consumers "reflects the true costs." The Directive states, "the principle of recovery of the costs of water services, including environmental and resource costs associated with damage or negative impact on the aquatic environment should be taken into account in accordance with, in particular, the polluter-pays principle. An economic analysis of water services based on long-term forecasts of supply and demand for water in the river basin district will be necessary for this purpose." Exceptions are possible in disadvantaged areas or to provide basic services at an affordable price. The effectiveness of the Directive will be of great interest in the coming years as 2015 marks the end of the Directive's first management cycle.

Despite these different policy approaches, as well as differing institutions and varying preferences for centralized wastewater treatment infrastructure, both the Netherlands and Denmark have achieved similar wastewater improvement objectives. However, according to the European Environment Agency (EEA), the Dutch approach has been more cost effective.[73] The Dutch spend a lower share of GDP on wastewater treatment than do other EU member states. Their early use of economic instruments encouraged in-house reductions in wastewater, which has helped avoid costly centralized wastewater treatment infrastructure investments. As the EEA points out in a comparison of several member states, "the Dutch-Danish comparison suggests that Member States with low or inadequate water pollution levies (Spain, France and Estonia) or no full-cost pricing of sewerage (Spain, Estonia and Poland), may overinvest in excessive capacity if they do not take account of the potential for reducing discharges from industrial sources."[74]

DISCUSSION — TOWARDS FULL COST PRICING

Full cost pricing for wastewater is not a new idea. It has had significant discussion, and some implementation, in Ontario. The Canadian Water and Wastewater Association (CWWA) defines full cost recovery: "as requiring that water and wastewater funds are managed separately from other municipal funds, the operation is break-even, any deviation is compensated in subsequent years, and all capital and operating costs are recovered." The CWWA definition moves even further towards full cost pricing by noting that: "The CWWA supports including environmental costs (such as source water protection) in the costs to be recovered." Environment Canada's 2011 Municipal Water Pricing Report[75] notes that full cost pricing would include consideration of environmental quality. The 2005 Watertight Panel report[76] includes environmental costs in its definition of full cost.[77] The US EPA definition of full cost includes the promotion of efficient water use.[78] A broad definition of "true cost," including source protection and water quality losses, is included in the European Union's Water Framework Directive,[79] which requires members of the EU to reflect this full cost in their operations. (See sidebar box for more on the European Directive.)

73 ibid.

74 ibid, page 47

75 Environment Canada. (2011). *2011 Municipal Water Pricing Report*. Retrieved from http://ec.gc.ca/Publications/default.asp?lang=En&xl=992156D4-2599-4026-9B4C-47855D26CCB8

76 Canadian Environmental Law Association. (2005). *Watertight: The case for change in Ontario's water and wastewater sector*. Publication No. 522 ISBN No. 1-897043-41-4. Retrieved from http://s.cela.ca/files/uploads/522_watertight.pdf

77 Also, note that it could also be argued that costs associated with monitoring, regulation and facilitating community involvement in water use management should also be included in the full cost.

78 United States Environmental Protection Agency. (2006). *Expert workshop on full cost pricing of water and wastewater service*. Final summary report. Retrieved from http://water.epa.gov/infrastructure/sustain/upload/2009_05_26_waterinfrastructures_workshop_si_fullcostpricing.pdf

79 European Commission. (2010). *Water Framework Directive*. Retrieved from http://ec.europa.eu/environment/pubs/pdf/factsheets/water-framework-directive.pdf

In Ontario, the Sustainable Water and Sewage Systems Act (2002), which was passed but not proclaimed (it was later repealed — see sidebar box), would have required municipalities to include water source protection in their definition of full cost recovery. Despite never coming into force, the creation of the Act encouraged many municipalities to move towards more full cost recovery pricing for water and wastewater. A study funded by the Association of Municipalities of Ontario finds that more than half of Ontario municipalities have begun to develop or implement plans that move towards more full cost recovery.[80] However, we could find no evidence that these plans incorporate environmental costs into pricing.

If municipalities move to full cost pricing that incorporates a broad definition of cost, including both short-term and long-term infrastructure and environmental costs, there are a number of implications to consider. Knowing that generally pricing does in fact work to change behaviour, policy-makers would be wise to consider three key points:

1. If we understand wastewater to be part of a larger municipal system, then changing pricing or administration of one aspect of the system will impact other parts of the system. For instance, charging for wastewater quality or quantity can influence water use, which has impacts on infrastructure needs and revenues. These linkages within the system need careful consideration so that the system as a whole is environmentally and fiscally sustainable.[81]
2. Pricing changes can have different impacts on different groups of users or taxpayers. This can disproportionately impact small business, lower-income families, or users who do not have many options to change their practices or technologies. Well-designed pricing instruments can buffer this effect. For example, this can be by providing basic use amounts at a lower cost and/or include complementary measures such as transitional pricing, short-term subsidies, or educational support to mitigate any impacts deemed to be unfair. This is true of pricing policies in general, but particularly true for municipal services like wastewater where the number of residences and businesses that could be impacted could amount to thousands or millions.
3. Basing policies on science and engaging stakeholders will help ensure environmental success and public acceptability. This requires engaging early with stakeholders and natural scientists to determine

80 Watson and Associates. (2012). *Towards Full Cost Recovery for Municipal Water and Wastewater Services: A Guide for Municipal Councils*. Prepared for the Association of Municipalities of Ontario. Retrieved from https://www.amo.on.ca/AMO-PDFs/Reports/2012/Guide-for-Municipal-Councils.aspx

81 For instance, there may be concern that increasing prices will change behavior so much that, even with the increased price, overall revenues do not grow much due to a large decline in the demand for the good or service. This is sometimes expressed with water use. For instance, see this paper for a discussion of the US context *Declining Water Sales and Utility Revenues: A Framework for Understanding and Adapting* by Beecher and Chestnut (2012), retrieved from http://ipu.msu.edu/research/pdfs/Summit-Summary-and-Declining-Water-Sales-and-Utility-Revenues-2012-12-16.pdf

the impact of the resource use on watersheds, and working with economists to put a cost on those impacts in order to reflect the impacts, and the costs of mitigating them, in the calculation of full cost pricing.

Municipal policy-makers face a number of challenges in ensuring water and wastewater systems, and their infrastructure, are environmentally and fiscally sustainable. The recent move to a broader discussion of what full cost pricing/full cost recovery really means in practice is a useful step forward. Continuing this discussion, and further exploring the use of the pricing tools that support its implementation, such as over strength discharge fees for commercial wastewater dischargers, is particularly important given the growing pressures on Southern Ontario's water infrastructure and natural environment.

The Sustainable Water and Sewage Systems Act — A lost opportunity in Ontario?

In Ontario in 2002, the Sustainable Water and Sewage Systems Act (SWSSA) was passed. However, as it was never proclaimed, it was repealed in 2002. The Act, and the regulations that were to be under it, would have required municipalities to develop asset management plans, paired with full-cost recovery plans, and set water and wastewater rates accordingly. This was a direct response to one of the key recommendations of the Walkerton Inquiry regarding the need for full-cost pricing. The SWSSA defined full costs for water service as "source protection costs, operating costs, financing costs, renewal and replacement costs, and improvement costs associated with extracting, treating, or distributing water to the public and such other costs which may be specified by regulation." Similar provisions were made for wastewater services respecting the "collecting, treating or discharging [of] wastewater."[82] The inclusion of source protection is notable.

Part of the reason the Act was not proclaimed was that Northern and smaller municipalities indicated that economic issues within their communities would limit their ability to implement the rate increases needed to address full cost recovery.[83]

82 Government of Ontario. (2002). *Sustainable Water and Sewage Systems Act*, 2002 (repealed). Retrieved from http://www.ontario.ca/laws/statute/02s29

83 Watson and Associates. (2012). *Towards Full Cost Recovery for Municipal Water and Wastewater Services: A Guide for Municipal Councils*. Prepared for the Association of Municipalities of Ontario. Retrieved from https://www.amo.on.ca/AMO-PDFs/Reports/2012/Guide-for-Municipal-Councils.aspx

IF PRICING WORKS, USE IT

Moving to pricing that more fully reflects the costs of building, operating, and maintaining infrastructure, of providing services, of using natural resources, and of ensuring ecosystems are healthy and protected has the capacity to shift behaviour. The two case studies of how pricing can lead to more sustainable urban form and municipal wastewater systems differ from each other significantly, with distinct considerations, actors, and implications, but they are united in offering the opportunity to think boldly about local financial and environmental sustainability.

To move the concept of full cost pricing from a provocative idea to a functioning reality will require contributions from a number of different experts, working both independently and collaboratively. While not exhaustive, we propose here a list of the top five areas for policy-focused research to be undertaken in Canada. We indicate who, in addition to municipal managers, planners, and decision-makers, could contribute to the knowledge base and help move full cost pricing from concept to reality.

POLITICAL CONDITIONING

In order to broaden the definition of price to include all short-term and long-term financial and environmental costs, education of municipal decision-makers will be required, alongside efforts on the part of researchers to gain a deepened understanding of the challenges municipal decision-makers face in delivering municipal goods and services. This is inherently a local question, though there are no doubt some universal experiences and knowledge barriers to be found. Beyond that, it is helpful to consider what political conditions could best allow municipal decision-makers to gain support for pricing changes. This might best be informed by political scientists and other social scientists looking at the experiences of other governments — municipal, regional and national — who have had success in implementing broader definitions of full cost.

FAIRNESS IMPACTS

An important question to ask prior to policy change relates to the potential distributional impacts, and potentially unjust impacts, of the policy. For pricing policies, the impact can hit businesses and consumers immediately through their bills for goods and services. In the cases where impacts are deemed unjust, approaches exist to mitigate the impacts in the short-term or longer-term, through pricing thresholds, cut-offs, exemptions, tiered prices, or through the use of complementary policies. (See more on complementary policies in the next point.) Well-designed pricing policies should not lead to unexpected impacts if sufficient data are available and analysis is carried out prior to implementation. For this task, economists, statisticians, and behavioural experts can provide guidance, and impacted citizens, businesses, and other stakeholders will have much to contribute.

COMPLEMENTARY POLICIES

Sometimes one policy is enough, but often more than one is needed. In the case of policies that use pricing to influence behavioural change, there is frequently a role for complementary policies. In particular, educational tools, such as information campaigns and clear communication of the price change are often helpful. As noted above, transitional policies, such as temporary exemptions or subsidies for groups unfairly impacted, may be warranted. When ecosystems are at critical points and environmental harm beyond a certain point is simply untenable, regulatory backstops are necessary to ensure a minimum performance is achieved. Policies such as these, and many more, can be used in conjunction with the price change in order to ensure that both fiscal and environmental outcomes are achieved. Natural scientists and social scientists, as well as accountants and asset managers all have contributions to make to discussions of the need for and design of complementary policies.

POLICY IMPACT

While each municipality is local by definition, and the policies implemented in one municipality will not have the same impacts as in another, it is nonetheless possible to undertake good analysis in advance in order to understand the likely impacts as well as the policy's environmental and financial effectiveness. Data, modeling, and case study analysis can help inform policy design. Immediate impacts, long-term impacts, and secondary impacts all warrant consideration. There are a number of questions that support designing effective policy, such as: how can we ensure pricing reflects valuation of ecosystem goods and services and the negative impacts of pollution? and what public and private costs should be incorporated into price calculations in order to ensure pricing is truly full-cost pricing? Both natural and social scientists have obvious roles to play in considering policy design for maximum effectiveness and efficiency.

LEGAL IMPEDIMENTS

Finally, legal considerations are important. As evident in the commercial wastewater pricing case explored in this paper, failure to implement legislation can prevent uptake of full cost pricing. In some cases, provinces and municipalities might be lacking powers. In other cases, such as with development cost charges, the powers might exist but municipalities are sometimes constrained to the extent that they can use them. Given the mix of municipal services, varied municipal authorities across provinces (and even within provinces), an interesting priority area for further exploration would be in gaining an in-depth understanding of what municipalities in different jurisdictions could do within their existing powers, and what legal barriers in other areas would need to be addressed to enable full cost pricing. Lawyers could make an important contribution in this area.

In some ways, these are considerations any good policy-maker would think about for any new potential policy change; however, the ways in which they

are considered and explored differ in the municipal context. And the environmental aspect of full-cost pricing requires a natural science understanding and expertise in addition to the social sciences, urban planning, and financial services expertise. The challenge to design full cost pricing may seem daunting, but the various experts noted above, working on the five priority areas, could move forward the idea, whose time — fiscally and environmentally — has come.

Pricing Works: How pricing of municipal services and infrastructure can lead to healthier and more efficient cities

By Stewart Elgie, Michelle Brownlee, Sara Jane O'Neill, and Mercedes Marcano

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