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Moving toward greater adoption of integrated resource recovery in BC

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Issue

In the coming decades, cities will require substantial investments in both maintaining existing and building new water and waste management infrastructure. A new national report card by the Federation of Canadian Municipalities (FCM) found that one in four wastewater treatment plants needs to be upgraded or replaced to meet new federal standards (introduced in 2012) at a cost of at least $20 billion.[1] This investment provides a significant opportunity to design this infrastructure following the application of Integrated Resource Recovery (IRR). IRR is a concept that maximizes the recovery of value from waste (liquid and solid) resources. The British Columbia (BC) government has set ambitious targets to reduce its greenhouse gas (GHG) emissions by as much as 80 percent below 2007 levels by 2050.[2] Achieving this reduction will be contingent on how well local governments work toward reducing their carbon emissions. This brief outlines how IRR can be a significant infrastructure strategy to assist the province in meeting its GHG reduction targets and its long term plan to reduce water use, as well as provide more financial resilience to municipalities who might otherwise face even greater challenges paying for infrastructure in the future.

Background

IRR can provide opportunities for generating new revenue for local governments, regional districts and private companies.[3] The purpose of IRR is to avoid consuming new resources by reusing, recycling, and recovering *existing* resources. By reusing water and energy from waste resources, IRR can have the following benefits:[4,5]

- reduce greenhouse gas emissions;
- reduce requirements for new energy sources;
- reuse treated water and thus reduce the need to find new water supplies;
- delay construction of new water and waste infrastructure

- generate additional revenue for a local government and thereby reduce taxpayer costs;[a]
- provide local employment opportunities in new industries based on recovering resources from biofuels and from waste.

With respect to the first three IRR benefits above, the Province of British Columbia has two pieces of legislation that aim to reduce GHG emissions: the BC *Clean Energy Act* has a goal that new electrical energy sources (except electricity produced from burning natural gas for the purpose of producing LNG)[6] will be from clean and renewable resources by 2016; and the BC *Greenhouse Gas Reduction Targets Act*[7] sets the province's target of reducing GHG emissions by at least 33 percent below 2007 levels by 2020 and includes the long-term target of an 80 percent reduction below 2007 levels by 2050. Sections 850 and 877 of the Local Government Act (LGA) require local governments to include in their Official Community Plans GHG reduction targets and a series of policy actions with respect to achieving those targets.[8] BC's Living Water Smart plan is another relevant initiative, this one aimed at reducing water use.[9]

Risks surrounding IRR

While greater adoption of IRR could help achieve these goals, a comprehensive risk analysis is required as some of the techniques employed in an IRR approach are new to BC. Some risks of IRR include[10]:

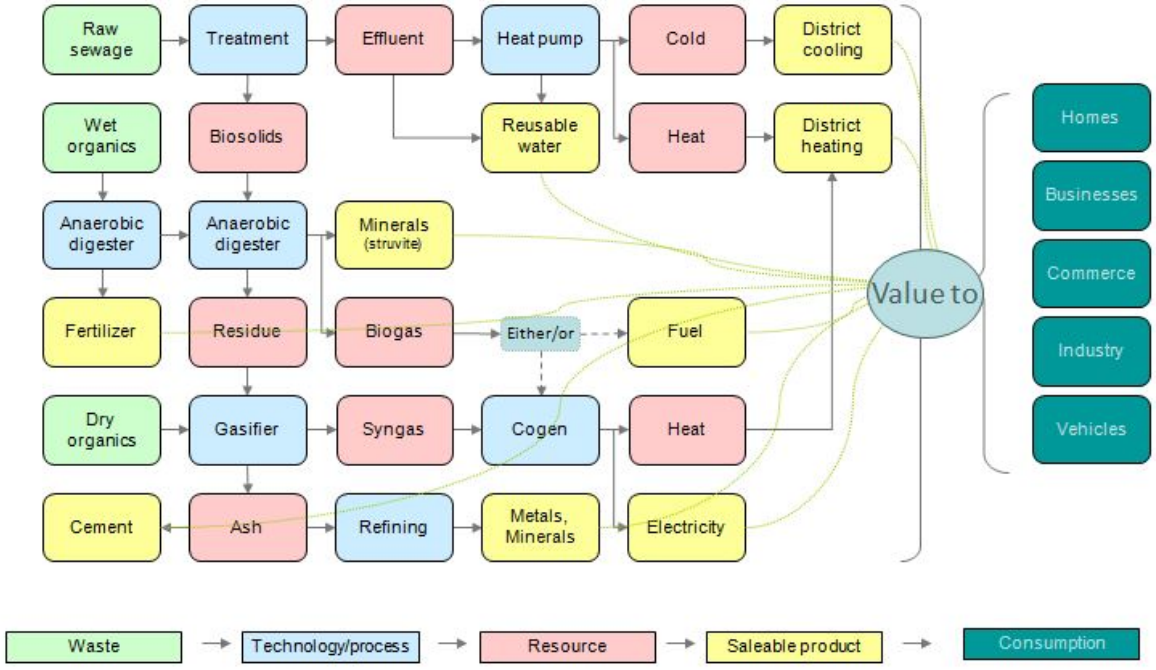
- risk associated with converting existing energy to recovered energy technology, absorbed by owners of existing buildings[b];
- uncertainty around the ownership of waste resources – depending on location within the infrastructure, sewage and biological solid waste can be owned by municipalities, regional districts or the private sector;
- problems with waste streams contaminated with plastics. Small amounts of plastics (such as plastic bags) included in source separated organic wastes such as food can disrupt an anaerobic digester for a short time, thus reducing the effectiveness of recovering resources;
- issues with some energy recovery technologies such as fuel cells which have not been fully commercially tested;
- general risk aversion of public officials and professionals with local governments towards new and innovative approaches.

[a] To the authors' knowledge, there have been very few technical studies completed on the costs and benefits of Integrated Resource Recovery (IRR). Fidelis (2011) examined the costs and benefits of IRR on the North Shore of Vancouver. The study explored several scenarios and found that the optimal IRR model for there is a 90 percent diversion rate of all solid organic waste. The dividend after finance over a 50-year projection is estimated at $44 million (2010 constant dollars, after finance). As revenues from IRR take time to be realized, there is an estimated cost to the taxpayer of $177 per residence per year with costs projected to decrease overtime. This is a considerable reduction from the projected taxpayer costs for replacing the Lions Gate treatment plant. A 90 percent diversion rate of solid organic waste is estimated to reduce landfill gas GHGs by 23-27 percent below 2007 levels for the North Shore.

[b] In the past year, the price of natural gas decreased significantly. This has undercut the viability of some sources of renewable methane from waste. Likewise, electricity from gasifiers using waste that contains fossil based material is not at present considered to be a clean fuel under the Clean Energy Act. BC Hydro is not able to offer the standing offer price for community based energy. However, to the authors' knowledge, the Province is examining this situation and is considering including gasified waste as a clean energy source based on the fact that it comes from a renewable source.

The scope of IRR is outlined in the figure below and includes resource recovery from several sources such as untreated and treated wastewater; wet organics (food and garden waste), and dry organics (wood waste) via district energy heating systems, among others. The 18 projects listed on the BC Ministry of Community, Sport and Cultural Development's Integrated Resource Recovery Inventory (last updated in March 2013) represent only portions of the IRR system outlined below such as North Saanich's thermal energy recovery project, or the City of Vancouver's South False Creek district heating system.[c,d]

Figure 1. IRR through a Systems Approach



Moving from resource recovery to *integrated* resource recovery

A core principle of IRR is to seek the highest and best use of resources.[11] For instance, when a municipality produces wet organic waste, it faces a few options; it can send it to the landfill, compost the waste, or produce biogas and sell it as a biofuel for vehicle use.[12] Producing biofuel from wet organic waste can potentially generate the highest revenues of the three options. As shown in a business case of IRR for the Capital Regional District (CRD), 62 percent of potential revenues were acquired from the production of biofuels utilizing both biosolids from the liquid waste stream and wet organic waste from the solid waste stream.[13] The use and sale of biofuels can also reduce a greater amount of GHGs as compared to composting by reducing fossil fuel consumption.

Under *BC's Greenhouse Gas Reduction Act*, GHG neutral fuels such as biofuels produced from IRR are exempt from the province's carbon tax[14], thus providing a further economic incentive.[e] The City of Surrey has plans to construct a biofuels facility using diverted food

[c] See: http://www.infrastructure.gc.ca/media/news-nouvelles/2011/20110624victoria-eng.html
[d] See: http://vancouver.ca/home-property-development/neighbourhood-energy-utility.aspx
[e] Similar to British Columbia, biofuels in Sweden are exempt from the country's carbon tax. This might help explain how Sweden has quadrupled its use of district heating from 1970 to 2010 (Hammar & Akerfeldt, 2011).

scraps and will use the fuel to power its waste-collection trucks.[f] Biofuel has its highest and best value when applied to vehicle use, but the *integrated* nature of biogas makes it also suitable for heating or electricity production through standard co-generation technology as shown in Figure 1.[15]

An IRR feasibility study was applied on the North Shore of Metro Vancouver and proposed a district energy system to transfer heat from wastewater and organic solid wastes to residential and institutional buildings. Reused water would be applied to industrial users thereby conserving water in the reservoirs and enhancing the productivity of the wetlands. The study found that the potential gross life cycle benefits for IRR were $2.8 billion in new revenues over 50 years. These revenues are approximately equivalent to the lifetime costs (capital, operating and replacement) of the IRR infrastructure. Thus the cost of the new treatment plant could potentially be covered by resource revenues. The project would *also* contribute to Metro Vancouver's sustainability goals by reducing GHG emissions, increasing generation of renewable energy, and ensuring the sustainable use of water resources.[16]

There are opportunities to combine public and private sector capacities to advance IRR. In the City of Colwood, BC, a new private sector development with 2,400 condo units and mixed commercial use (the Capital City Centre) has proposed to extract heat from wastewater; reuse treated water for non-potable uses; apply treated wastewater for wetland enhancement, and combine energy recovery from biosolids and organic waste with power generated by solar photovoltaic modules.[17,18] This project is called a District Energy Sharing System and is estimated to reduce the Capital City Centre's energy supply requirements by 60 percent and its potable water demand by 40 percent. This is consistent with IRR and provides a good public-private model for governments and private companies across the province.

Recommendations

1. **Create an IRR pilot project with carbon tax revenue**
Given the risks and uncertainties surrounding IRR projects, pilot projects can be established to determine how well they operate. It would be prudent to set up a government fund - using new revenues from the carbon tax - to offer initial loan guarantees to procure innovation and encourage transition from resource recovery projects to more integrated models. Recent analysis shows how broadening the carbon tax coverage from 75 to 82 percent of the province's GHG emissions can increase revenue by $125 million annually.[19] Such additional funds that can help support IRR adoption and help the province meets its legislated GHG targets. The carbon tax revenue need not be earmarked toward IRR in perpetuity, but only used initially to provide loan guarantees for pilot projects. This kind of public policy can also demonstrate the viability of IRR to risk-averse private developers.

2. Focus on highest and best use IRR
Local governments should explicitly include revenue generation in their integrated liquid and solid waste management plans to encourage a focus on revenues and not simply on reducing costs. Revenue sharing agreements will have to be negotiated with the private sector where public/private partnerships are the appropriate vehicle for implementing IRR projects. As mentioned, there can be significant environmental and financial benefits around using wet organic waste to produce biofuels (e.g., City of Surrey).

[f] See: http://www.vancouversun.com/technology/Surrey+build+organics+biofuel+facility+that+sets+national+benchmark/7273983/story.html

3. More public announcements of Provincial and federal grants toward IRR can help foster transparency

To encourage greater transparency in IRR projects, it is recommended that when the federal and provincial governments provide grants in support of wastewater treatment plants, they make explicit reference to the degree that IRR is required to contribute to provincial and local government goals for reducing carbon emissions, encouraging renewable energy, and reusing treated wastewater. Such announcements will encourage application of IRR for future treatment plants and demonstrate to the public more sustainable solutions for liquid and solid waste infrastructure.

Conclusion

Water and waste infrastructure has a life span of at least 60 years. Over that time, there will be a profound transition to a low carbon economy and a greater need for projects that reduce GHGs and water consumption. It is therefore vital that new infrastructure in British Columbia be designed with IRR. IRR is a strategy based on substantial long-term endeavors that require sustained investment. The application of status quo designs will only lock the system in for decades and will make it more difficult and expensive to make changes to infrastructure in the future. IRR has the potential to make new water and waste infrastructure a more efficient, resilient, cost effective, and low carbon solution. Sewage is not a waste - it is a resource.

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