

Waste collection recycling tubes
in Hammarby Sjöstad

Snapshot
of the future
TAKE 2

Modern Alchemy

Turning Waste into Gold in the Future Cityscape

In this Watershed Sentinel series we jump past the problems and the chaos to get ahead of the game and see where the future is under development, here and now.

by Stephen Salter

Economists and ecologists across Canada are locked in debate: How much pollution can the planet absorb? How much will Kyoto cost? I think we're asking the wrong questions.

City life has isolated us from nature's laws, so that we tend to see the environment as "out there" and separate from ourselves. We have the illusion of clean homes because we've become adept at making the by-products of city life — sewage, garbage, carbon dioxide from our cars — go away, out of sight and out of mind. In nature however, there is no "away." Nature's cycles are closed, complete, and perfect.

In my community of Victoria BC, local government had long argued our ocean dilutes the 40 billion litres of raw sewage the community annually pumps out to sea. Industry is rightly prohibited from using the dilution argument, which is like saying, "Don't worry about climate change today, as the breeze will blow the emissions away from your tailpipe." In the end, it turned out dilution was an administrative notion rather than an environmental reality. When contaminant levels in the water and sea beds around our sewage outfalls were compared

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with Canadian environmental regulations in November 2005, it became evident our spotless community had created two contaminated marine sites. In July 2006, the provincial government ordered sewage treatment.

The question is, what kind of treatment? Will we follow traditional thinking and treat waste as a liability, or can the materials that contaminate our ocean become assets?

How Waste Works

We're actually sitting on a huge source of renewable energy: ourselves. While we ponder a nuclear future, heat pumps could recover enough energy from sewage to heat a third of our buildings. We subsidize oil companies to drill for fossil fuel, while dumping enough vegetable oil through our outfalls to run all 200 of Victoria's buses. While we dig for coal, we spend more public money to bury millions of tonnes of organic energy in landfills every year. If, on the other hand, we made use of waste energy and materials as Sweden does, our cities could easily meet their Kyoto targets.

Waste pollutes twice; first when it hits the environ-

ment, and again when we extract more resources to replace those we've discarded. Most people understand how recycling pop cans reduces new mining. We're beginning to understand it works the same way with water, but we're far from competent when it comes to municipal waste and sewage. Landfills and sewage outfalls are dead ends, massive failures of imagination, because the value in waste is greater than the cost of throwing it away: waste is worth more alive than dead.

For example, at current growth rates, Greater Victoria will outstrip its water supply in a few decades, and perhaps sooner with climate change. When we exploit the next source, we'll do permanent damage to the Leech River system. When we create waste, we waste creation. If instead we use rainwater more intelligently and reclaim pure water from sewage for irrigation or to rejuvenate dry creeks, we can prevent that damage. This lesson has been learned in drier regions like Israel, Australia, and California, where reclaimed water is sold for irrigation and to industry.

Sustainable Stockholm

I began to wonder what life would be like in a city built on nature's rules. In October 2006, I visited Sweden to learn how their cities convert waste to energy as a means of fighting air pollution and climate change. I hoped to bring back strategies we could use here: I was the caveman borrowing fire from the next tribe. Officials from government, municipal energy companies, and waste facilities opened their doors and patiently answered my questions. I went

searching for leading-edge technologies but discovered something more valuable: cutting-edge common sense.

In Stockholm, officials from the Swedish Environmental Protection Agency and the Swedish Energy Agency explained their environmental objectives for air quality, greenhouse gases, and livable communities. The oil shock of 1973 started Sweden on the path toward energy independence, and recent drivers for biofuels include climate change and a desire for cleaner air in cities. I was given

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a graph showing Canada's carbon dioxide emissions have risen 24% since 1990, while Sweden's have fallen by 4%.

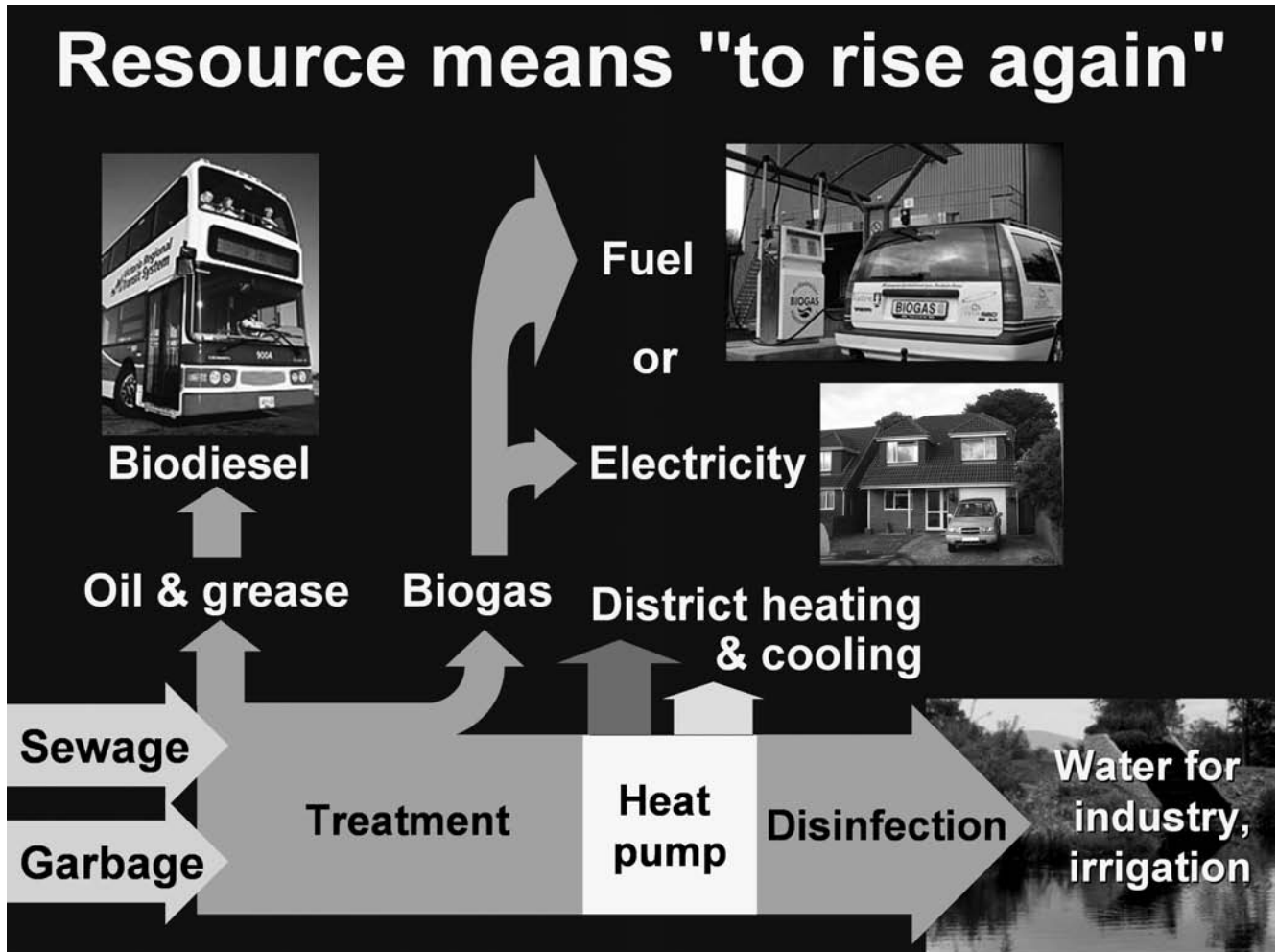
Sweden's steering policies include a carbon tax on fossil fuels to reflect their real cost to the environment, and to encourage development of renewable fuels like biodiesel, ethanol, and biogas.

When organic waste decomposes in anaerobic digesters, it produces a mixture of methane and carbon dioxide called raw biogas. After the carbon dioxide is removed in an upgrading plant, the biogas is indistinguishable from natural gas except for its origin. Unlike the carbon in fossil fuels, the carbon in biogas is pulled from the atmosphere by plant life each summer. When biogas is burned, the carbon returns to the atmosphere, completing a closed cycle.

Continued on Page 18 ➔



Biogas bus in Stockholm



⇐ *Modern Alchemy continued*

Unlike the one-way trip of carbon from fossil fuels, biogas from waste does not contribute to climate change. Another benefit of biogas is that it produces fewer traditional pollutants, like smog and particulate emissions, than fossil fuels.

Picture this: a child in Stockholm carefully puts her orange peel into a separate container. Her parents pay less to dispose of this separated organic waste, which is delivered not to a landfill but to Stockholm's Hendriksdals sewage treatment plant. There it is co-treated with sewage sludge to produce enough biogas (methane from organic material) to run 50 local buses, a number that will rise to 200 by 2010. Landfill pollution is prevented, air pollution is reduced, and because the carbon in organic waste comes from the atmosphere, the biogas does not contribute to climate change.

The plant's Business Development Manager explained that biogas from her plant also provides cooking fuel for the sustainable development of Hammarby Sjöstad. When dinner is over, food waste in the development is sent through underground vacuum tubes to a central collection point, and diverted to the sewage plant to produce more biogas.

Meanwhile, the heat energy in Stockholm's sewage is sold to the local energy company, Fortum, where heat pumps extract enough energy to provide heat and hot water for 80,000 homes. The energy and material loops between the sewage treatment plant and the community mimic nature's cycles, and spotting these closed loops became a game for me in Sweden.

When I asked about cost, my hosts explained that the sewage plant is paid for its resources. Stockholm treats sewage to tertiary standards, but revenues from sales of biogas and heat reduce the overall cost. While the monthly cost of secondary treatment in Canada is \$10 per home, residents of Stockholm pay \$6 for advanced tertiary treatment because revenues from sales of heat and biogas help offset the treatment plant's costs.

Eco-Employment in Gothenburg

In Gothenburg, the Manager of Sustainable Water and Waste Management explained that the financial and environmental benefits of energy from waste are compelling. In

the 1970s, fossil fuels caused heavy smog in Gothenburg, and the city responded by developing a district heating network.

District heating costs less than oil or electricity, but gives companies like Gothenburg Energy an incentive to insulate their clients' buildings, in order to leave more energy in the heating pipes for future subscribers. In this simple arrangement, the economic interests of the energy company and the environmental interests of the community are aligned. After heat is extracted from sewage, the water is cold enough to run separate district cooling networks that provide air conditioning in offices — reducing energy use further still. In North America, energy firms' profit comes from selling us greater pollution, the result of selling energy as a commodity rather than as a service.

In Gothenburg, a thousand people are employed providing renewable energy from local sources, including waste. Greenhouse gases are reduced and sustainable jobs are created, proving Canada's question about Kyoto-killing jobs is misguided. Sweden is quietly proving that ecocycles are not only better for the environment, but also better for the economy.

Fossil-Free Kristianstad

Kristianstad is a community of 35,000 in the heart of Sweden's Skåne region, one of the most fertile agricultural areas in Europe. The city's tourism theme is "The Spirit of Food," and I felt very much at home in this setting of im-

maculate, ancient fields sprouting wind turbines beside the crops. At two metres below sea level, Kristianstad is the lowest point in Sweden, and climate change is very much on the community's mind. Closing the local ecocycles is part of the community's "fossil-free Kristianstad" initiative.

Kristianstad's Coordinator of Climate Change Strategy explained how biogas solves several problems: sustainable disposal of organic waste, and the need for clean-burning, carbon-neutral fuel. Agriculture and related food industries produce organic waste, which, in 1995, the city decided to turn from a liability into an asset. The solution was to build

On the score of fighting pollution with intelligence, Sweden leads six-one. Their genius is integrated planning.

the Karpalund biogas plant, which accepts organic waste from kitchens, food factories, and farms. In a wonderful example of closed loops, farmers deliver manure to the Karpalund plant, then reload with the liquid residue from the biogas plant. This residue is rich in nutrients and, being free of contaminants, is returned to farmland. Residue from Swedish sewage plant digesters is composted separately for industrial landscaping.

In Kristianstad, biogas runs all of the community's transit and school buses, several city trucks, a dozen taxis, several hundred cars, and the surplus goes to a cogeneration

Continued on Page 20 ➔



Sewage plant in Stockholm

plant that provides electricity and district heating. Biogas in Sweden is about 25 percent cheaper than gasoline, partly because of the Swedish carbon tax and partly because it comes from waste. Kristianstad encourages its citizens to separate their organic waste by charging more for mixed waste, and encourages car owners to switch to biogas by subsidizing the cost of conversion and providing owners of biogas cars with free parking. Kristianstad stands out as a leading example of the power of integrated resource and community planning.

Before saying goodbye, I refueled my rental car with biogas from the sewage plant. Later, as I drove down the highway, I realized this was my first greenhouse gas-neutral trip, powered by the people of Kristianstad.

I was moved by the generosity of my Swedish hosts and thanked them profusely for their time and help. Environment is a global issue, they replied with a gentle smile.

Can Sweden's Ideas Work in Canada?

Some may wonder if the practices in Sweden can work elsewhere, where (visible) costs of energy, environmental regulations, and tax structures differ. Whenever the opportunity arose, I asked Swedes about their views on taxes and the environment to help me make comparisons. One couple said "We are rich because we live in a rich country." They explained that to them, knowing that people and the environment are looked after brings peace of mind, and so justifies their taxes. Several people explained the Swedish law granting access to private land, *Allemansrätt*, translated as "everyman's right" of common access. Swedes are free to traverse and even camp on private land within simple

guidelines concerning respect for an owner's privacy and livelihood. The result is a stronger bond between Swedes and their environment.

Beyond the social and environmental value of resource recovery, Sweden proves it is good for the economy: Sweden is living the ideas in *Natural Capitalism* (Hawken and Lovins). The premise of this book is that placing a higher value on the planet's resources will lead us to close our material and energy loops, reduce pollution in the form of waste, and increase employment. Biogas and district heating in Sweden are good examples of this "radical resource productivity," and the country is going further still by reducing taxes on employment and increasing taxes on raw materials, including fossil energy.

Three main principles emerged from my time in Sweden.

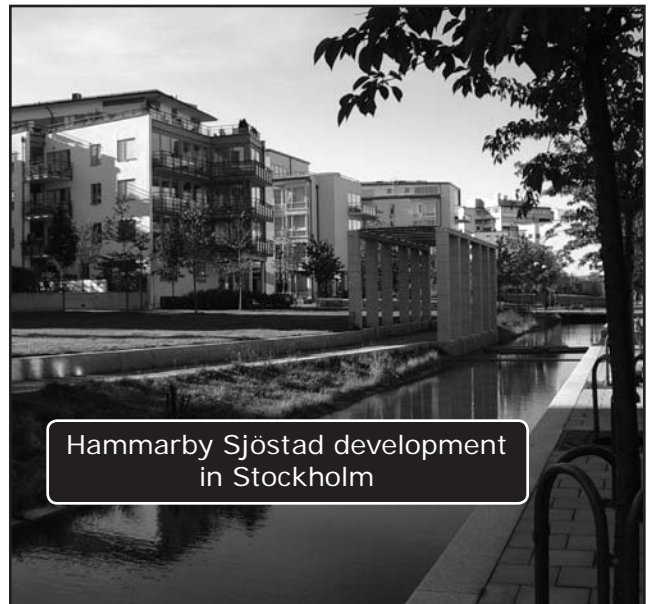
The first is that everything in nature and in cities is connected. When our planning for liquid waste, solid waste, energy, and transportation is integrated, the results for the community are optimized. Planning for each of these areas in isolation, on the other hand, sub-optimizes or "pessimizes" the results for the community.

Second, we can make waste pay its own way by recognizing every output as an input, every waste as a resource. Recovering more value from waste costs less overall, for example when sewage plants are paid to accept kitchen waste, as well as for their heat energy and biogas.

Finally, waste is just a resource in the wrong place, and we need to use each resource for its highest purpose. It makes sense to save drinking water for drinking, and to



District heating pipes in Gothenburg



Hammarby Sjöstad development in Stockholm

use reclaimed water for irrigation, for example. Similarly, until last year, the sewage treatment plant in Stockholm burned some of its biogas to heat its treatment processes. The plant now buys heat from the energy company, an exchange that makes more biogas available for city buses. The result is less pollution overall, higher economic returns for the treatment plant, and lower costs for the bus company.

Instead of just recycling or, worse still, downcycling (in which waste loses value), Swedish cities are upcycling their resources. Biogas and compost are worth more than the apple cores they come from.

It's All Connected

More than a century ago, John Muir said “When we try to pick out anything by itself, we find it attached to everything else in the universe.” A visit to the web site of Sweden’s EPA (www.internat.naturvardsverket.se) shows how clearly the country’s environmental objectives and solutions are interlaced, the mirror image of the environmental problems humans have created. In North America, organic waste rots in our landfills and produces methane, a greenhouse gas with 21 times the global warming effect of carbon dioxide. In addition, the leachate from landfills pollutes our water. On the other hand, when Swedes divert kitchen waste from landfills and into biogas digesters, they reduce water pollution and greenhouse gases from landfills, greenhouse gases from fossil fuels, dependency on oil, and create local employment.

We’ve failed to see our place in the ecosystem, preferring instead to put ourselves at the top of the food chain and above nature’s laws. Our words for waste reflect our mindset and interfere with creative thinking. Calling sewage an “effluent plume” or boasting that the local dump is an “award-winning landfill” belies the appalling damage these failures create. It’s time to change our minds, beginning with our use of language. The word resource means “to rise again”, and if we talk about resource recovery rather than disposal, we begin on the path toward sustainable cycles.

Canada and Sweden share cold climates, warm hearts, and a love of hockey. But on the score of fighting pollution with intelligence, Sweden leads six-one. Their genius is integrated planning, while we’ve fragmented our city governments into departmental silos and committees, obscuring the big picture. Departmental specialists in solid and liquid waste, transportation, and energy toil in isolation because we don’t hold our cities to account for an ecological bottom line. Our administrations are designed to optimize administrative convenience, not environmental and social benefits. We’ve fragmented our governance, our thinking, our resources, and our efforts. As a result, our politicians struggle with issues of fresh water, sewage, energy, climate

change, transportation, and waste separately, and the costs add up. It’s unclear who profits from this arrangement, but taxpayers and the environment pay the price.

Senior government may set policy, but in the end we’re the architects of our communities, and planet-saving changes will begin here. Vancouver is dithering over upgrades to secondary treatment for the Iona and Lions Gate plants. Victoria is drafting plans for sewage treatment, but not with a truly integrated approach. Today, our cities have a unique opportunity, and we must urge our leaders to learn from Sweden’s ecological ingenuity. If we’re to live more sustainably, we must change our mindset because, in the end, there’s no such thing as waste, only wastefulness.



Stephen Salter, PEng is a professional engineer who specializes in energy and the environment. As a consultant, Stephen helps clients reduce pollution, often by reclaiming resources from waste. Stephen also works as a volunteer with the Georgia Strait Alliance and the TBuck Suzuki Environmental Foundation to encourage politicians to think like Swedes. Stephen lives in Victoria.



The author fills up with biogas at the pump in Kristianstad

Recommended authors: Karl-Henrik Robèrt, Paul Hawken, William Rees, Sarah James & Torbjorn Lahti
 Recommended web sites: Georgia Strait Alliance, Swedish EPA, Kristianstad