CASE STUDY: DOCKSIDE GREEN, VICTORIA, BC.

This case study will discuss the ecological features of Dockside Green, a carbon neutral mixed-use community that is built on a 15-acre former brownfield site in Victoria, BC. This award winning development has received worldwide recognition; the development has the distinction of being the first in North America to apply for and to attain the highest score for LEED ND (Leadership in Energy and Environmental Design) Platinum certification in the world. This important project is often referred to as a model for green Neighbourhood Development for the numerous renewable and innovative energy systems and green technology, which are incorporated into one development. Buildings contribute the greatest percentage of green house gas emissions make Green Building Technology an imperative for all new build and renewed projects and inspire cities to consider the long-term benefits. The inclusion of green technology in a closed-loop system, higher energy standards as well as the low-rise medium to high-density scale of Dockside Green makes it an efficient model for new urbanism, while reducing its carbon footprint.

Dockside Green, Courtesy Windmill Developments

This project's genesis was a result of the City of Victoria's acquisition of the Dockside Lands; formerly used for a paint factory and logging mills, from the province of BC, for $1.00 in 1989. In 2004 after extensive public consultations, the city issued a request for proposals to remediate and develop the highly contaminated site following the community focused design principles of 'new urbanism'. The success of Dockside Green was dependent on the forward thinking commitment of LEED Gold builder Joe Van Bellegham, LEED Platinum architects Busby, Perkins, Wills and the support of the City of Victoria. They adhered to the Triple Bottom Line philosophy to develop with social, economic and environmental responsibility. The developers incorporated a variety of housing types, live/work residences, remediating green space, and proximity to transit, walkability, shops, businesses, car sharing, and innovative green technology thereby creating a 'sense of place' as Patrick Condon writes in 'Seven Rules' for Sustainable Communities. Throughout the consultation process with the Victoria West Community Association, stakeholders and the Songhees and Esquimalt First Nations, the design team used an integrated design approach, a relationship that continues today.

Detailed Harbour view from Bridge, showing the scope of the development the green space and Harbour ferry services, Courtesy Dockside

Selkirk Waterway with view to Dockside, Courtesy City of Victoria

Inspired by successful green projects such as Sweden's Hammarby Sjolstad and BedZED in England and the Selkirk Waterfront Project in Victoria, the developers of Dockside Green hoped to set a new building standard in North America by building a 100 percent carbon neutral Closed-Loop Design using Green Building Techniques, Alternative energy, Onsite Recycled Waste Water and Heating systems.

This Green Technology will be discussed in detail as the focus of this essay and include the following features:

An Onsite District Energy System for heating fuelled by Biomass Waste,
An Onsite Storm and Waste Water Treatment Plant
Solar Power and Rooftop Electric Turbines
Green Roofs/Green Wall/Rain Water Collection
Fresh Air Ventilation systems/Exterior Sun Shades
Onsite Recycling/Construction Waste Recycling
Energy Saving Features/Green Materials Used in Each Suite
The Reuse of Harvested Underwater Trees for Building
A Planned Staffed Sustainability Centre to be Built

Phase Type	Phase Name	LEED® Designation	Level Achieved	Score
Residential	Synergy	LEED NC	Platinum	63/70
Residential	Balance	LEED NC	Platinum	63/70
Commercial	Inspiration	LEED CS	Platinum	53/61
Commercial	Prosperity	LEED CS	Platinum	60/70

LEED Points attained so far, Courtesy Dockside

The Interactive Master Plan:
http://www.docksidegreen.com/Residential/Masterplan.aspx
'Natural Growth: The Story of Dockside' video with the Mayor of Victoria
http://www.youtube.com/watch?v=RDAG8IfLYy4&feature=relatedNews Coverage on Victoria's Draft Official Community Plan, April 2011
http://www.youtube.com/watch?feature=player_embedded&v=HThcP520ZuA
Interview with Peter Busby on Sustainability
http://vimeo.com/14040387

Aerial View of the Dockside Area and Surroundings, Courtesy City of Victoria

DISTRICT HEATING SYSTEM: Biomass Gasification Plant

Interactive Display Board for the Biomass Plant, Courtesy Dockside

Biomass Plant, Courtesy Dockside

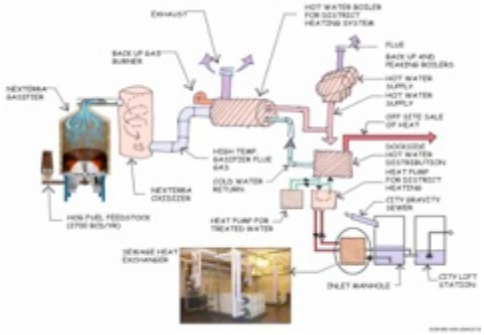


Diagram explaining Biomass Process, Courtesy Nexterra Corp

This modernistic looking building integrates seamlessly into the Dockside Community while providing interpretive signage for passersby. BedZED initially inspired the developers of Dockside Green to use a biomass heat generator system, successfully used in Sweden. The Dockside biomass gasification technology built by Nexterra Energy Corporation offers self-sufficiency for the community by providing low-cost clean heat and hot water according to Dejan Sparica of Nexterra. He explains that gasification requires 20-30 percent less oxygen than conventional combustion and provides better performance.

"The system will take urban wood fuel - including recycled wood construction debris and municipal tree trimmings - and convert it to low emissions synthesis or syngas. The syngas is then directed through an oxidizer and then a boiler which in turn will provide heat and hot water…the system will require delivery of approximately one truckload of wood fuel every two days". The system has onsite central backup boilers in case of failure. Dockside Green Power Ltd, a micro energy utility run by Corix, provides the service to the residents and businesses as well as additional exported energy, which makes the project the first development in North America to be greenhouse gas positive. As of 2010, a pipeline from Dockside Green provides gas service to the Delta Point Hotel, further offsetting costs for the residents. GHG emission reductions in the 2009 Sustainability report are 5215 tonne CO2 e/year.

Biomass technology has been successfully used in eco-friendly projects like Hammarby Sjostad in Stockholm, which also harvests power from domestic waste to make syngas for heating, cooling, transportation and the fuel for the gas stoves in each home.

Just as Hammarby Sjostad has provided a model for the world to follow in district heating and cooling energy systems, Dockside Green district energy has become a model for other North American district energy projects such as: UBC, UNBC, USC, Veteran Affairs Med. Ctr, US Dept. Energy/Oak Ridge National Lab, Tolko Ind. Kamloops, Kruger Products, BC.

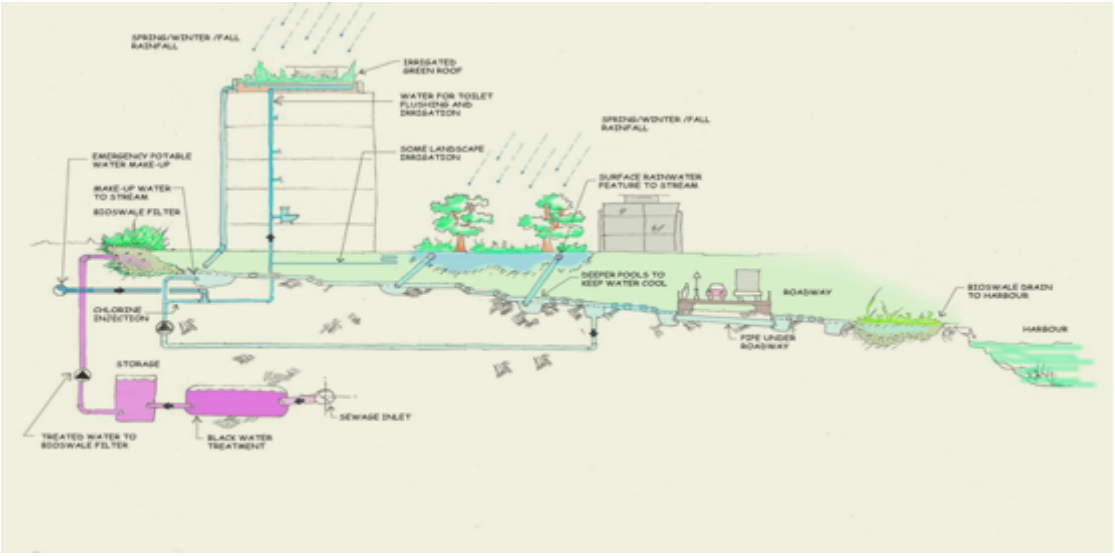
The Nexterra website details these and other future District Energy projects: http://www.nexterra.ca.

This informative Nexterra video details the Biomass System at Dockside Green: http://youtu.be/39blxH9PEi4.

An interactive website for the Green Energy Utility at Dockside: http://docksidegreenenergy.com

STORMWATER AND WASTEWATER TREATMENT:

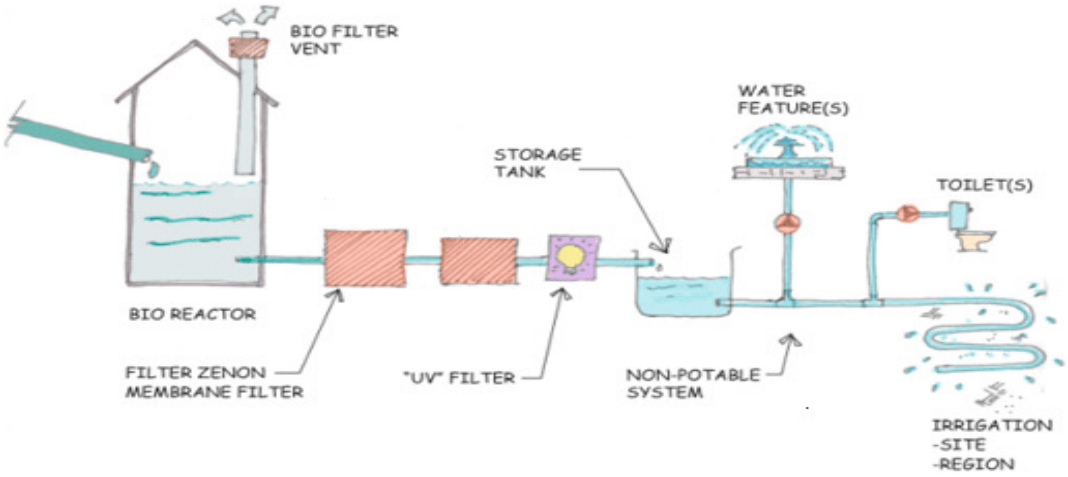
Courtesy Dockside



Water Reduction Feature, Courtesy Dockside Green
http://www.docksidegreen.com/Sustainability/Ecology.aspx

The innovative Waste Water Treatment Plant is fully integrated with the site and as is the practice throughout Dockside, displays a prominent interactive signage board explaining the water treatment process. The case study prepared by GE Water & Treatment Technologies outlines the process which uses ZeeWeed* MBR (membrane bioreactor) technology to explain how sewage is completely treated onsite and stored in tanks to be recycled for use in 'flushing toilets, landscape irrigation and water features' creating a

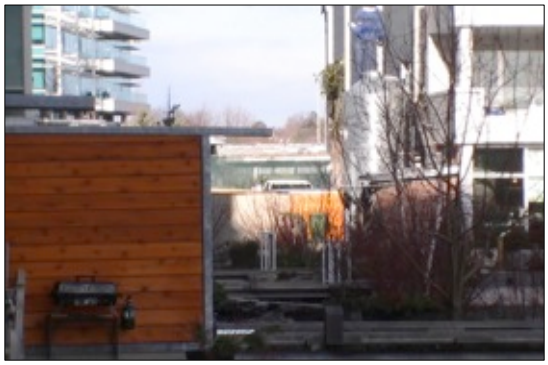
closed-loop system. According to Portland based architect Ken Pirie, the plant is able to recover heat from graywater and sewage treatment and also afford to sell 18,000 gallons to nearby industrial users. Any remaining solids are redirected to the biomass plant.



A diagram of water treatment, Dockside Green

On its list of environmental features, the developers of Dockside estimate that onsite water treatment and reuse will save up to 70 million gallons of potable water per year, 65 percent less than other mixed-use developments. A constructed stormwater creek has been created to run throughout the development with several storm retention ponds connected to the creek, which is home to wildlife such as stickleback, trout, and ducks and also serves to channel water from the roofs through decorative troughs. It is an integrated ecology, which includes a living stream, indigenous vegetation and reeds to provide a natural wetland. The stormwater is used to irrigate the central greenway and landscape plantings. Rainwater is allowed to infiltrate the soil before flowing into the creek. The project addresses many of Condon's suggestions about the importance of addressing watershed function, infiltration and green infrastructure.

Retention Pond, Courtesy Dockside


Decorative Metal Roof Trough, Courtesy Author

Any surplus recycled water flows via underground pipes into Victoria Harbour and not the city storm system, a stark contrast to the city's former treatment of effluent, which was dumped, virtually untreated, into the ocean. Aesthetically pleasing concrete runnels carry storm water alongside residential staircases leading to the man made creek. Paved surfaces at Dockside Green are permeable to facilitate stormwater drainage.


Concrete Runnels flow into creek.


Stormwater creek runs along side Balance townhouses. Courtesy Author


Stormwater Channel, Hammarby Sjostad. Courtesy Stephen Salter

Hammarby Sjolstad, a neighbourhood of Stockholm, uses a similar method of wastewater recycling shown in this photo from a 2007 case study. Victoria based engineer Stephen Salter (Reusing the Resource) explains Sweden's role in developing technology, spurred by the 1973 oil crisis, to convert sewage and wastewater into biogas fuel to power vehicles, provide hot water and heat to homes. "Sweden has established a goal of using no petroleum-derived fuel by the year 2020" (Salter). Salter explains that decomposing organic waste produces methane and carbon dioxide to produce a biogas similar to natural gas. He refers to this biogas as 'current carbon' from plant life rather than ancient carbon from fossil fuels that is recycled back into the atmosphere. The Hendriksdals plant in Stockholm converts both sewage and kitchen waste to produce biogas energy.

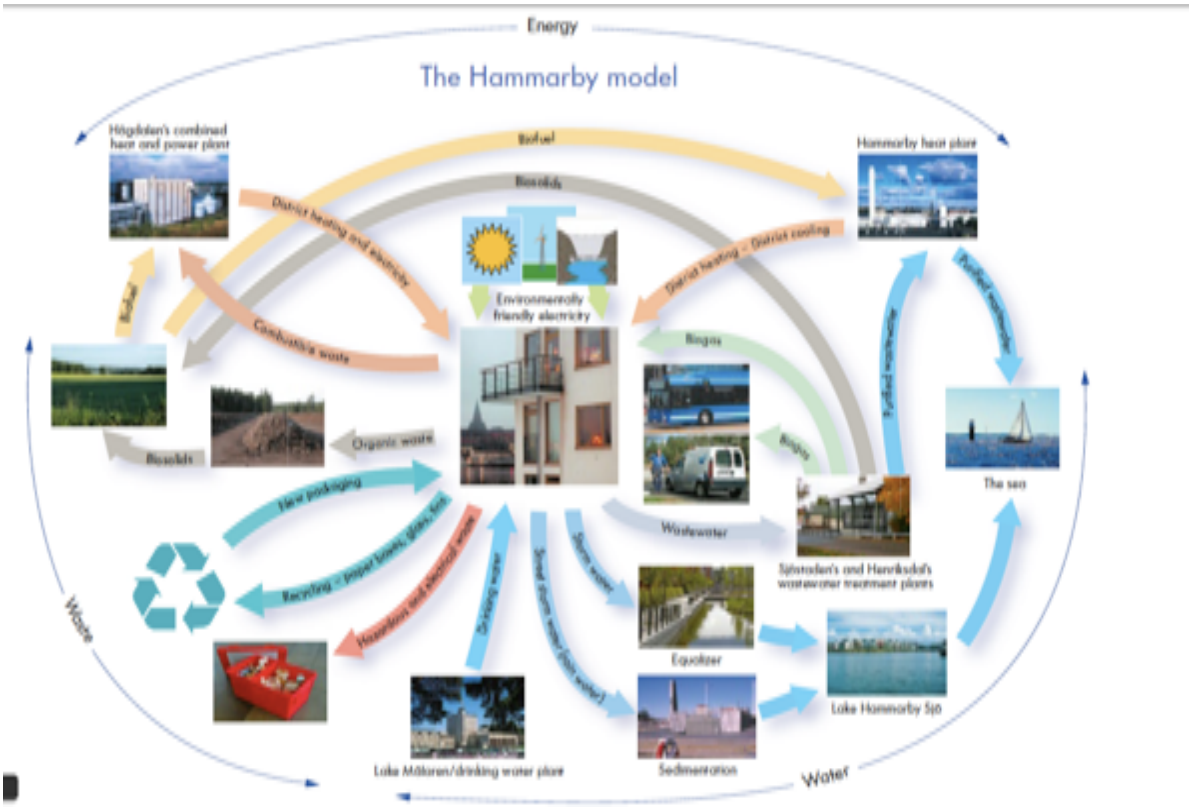


Photo Courtesy of Stellan Fryxell

"We are like tenant farmers chopping down the fence around our house for fuel when we should be using Nature's inexhaustible sources of energy – sun, wind and tide… I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait till coal and oil run out before we tackle that". Thomas Edison

SOLAR POWER AND ROOF TOP ELECTRIC TURBINES:

Photovoltaic solar panel awnings and electric wind turbines draw power from the sun to provide energy to commercial space in Inspiration Cl-1. The developers were inspired by BedZED's use of wind power but the developers decided to choose a more 'conventional' look in anticipation that wind power will become standard for all future developments (J Huffman, BPW Architects).

Courtesy Dockside Green
Wind Turbines and photovoltaic awnings on Inspiration CL-1.

Courtesy inhabitat.com/bedzed-beddington-zero-energy-development-london
In contrast to Dockside, BedZED's colourful Wind Turbines and Solar Panels
http://inhabitat.com/bedzed-beddington-zero-energy-development-london

To capture solar energy, photovoltaic lighting is used for onsite landscape lighting, for light standards in Point Ellice Park, traffic signals, bus shelters, the office building Cl-1, Inspiration and the Harbour ferry shelter. All light fixtures are designed to use full cutoff. An onsite solar compactor is also powered by photovoltaic technology. Solar power also provides energy for hot water. The estimates for energy savings are expected to be 48-52 percent higher than the National energy code. The Beddington Zero Energy Development in

London, a carbon neutral environmentally friendly community completed in 2002, successfully captures wind power with colourful turbines atop its residential/workspace buildings providing energy from a natural resource.


Hammarby Sjolstad Solar panels that exploit the sun's heat and use it to heat the hot water supply have been installed on many roofs. The solar panels shown in the picture are sufficient to meet half of the building's annual hot water requirement. Courtesy Hammarby Sjolstad

GREEN ROOFS/GREEN WALLS/RAIN WATER COLLECTION

The benefits of green roofs described on an onsite Dockside interactive display board are:

Visually pleasing

Effectively reduce the heat island effect in urban settings

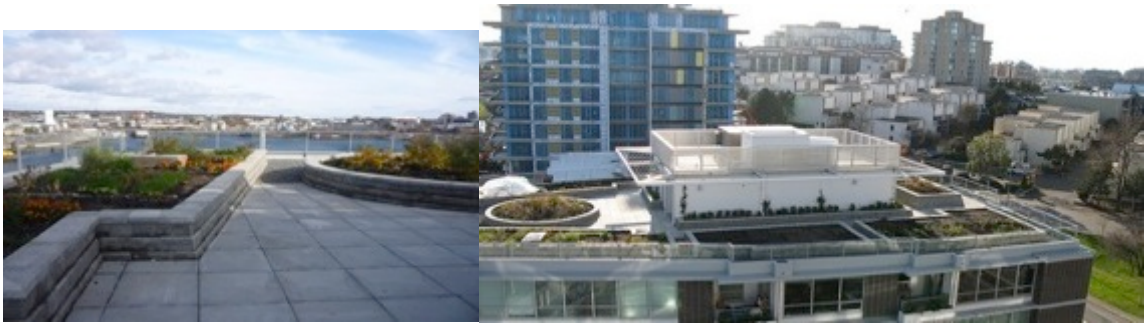
Filter rainwater and protect the roof membrane = decreased maintenance and replacement costs

Sound insulation provided by soil, plants and trapped layer of air

The substrate blocks lower sound frequencies and plants block higher sound frequencies

Dockside Interactive Display, Courtesy Author

Living Wall on Balance, Courtesy Busby, Perkins, Wills

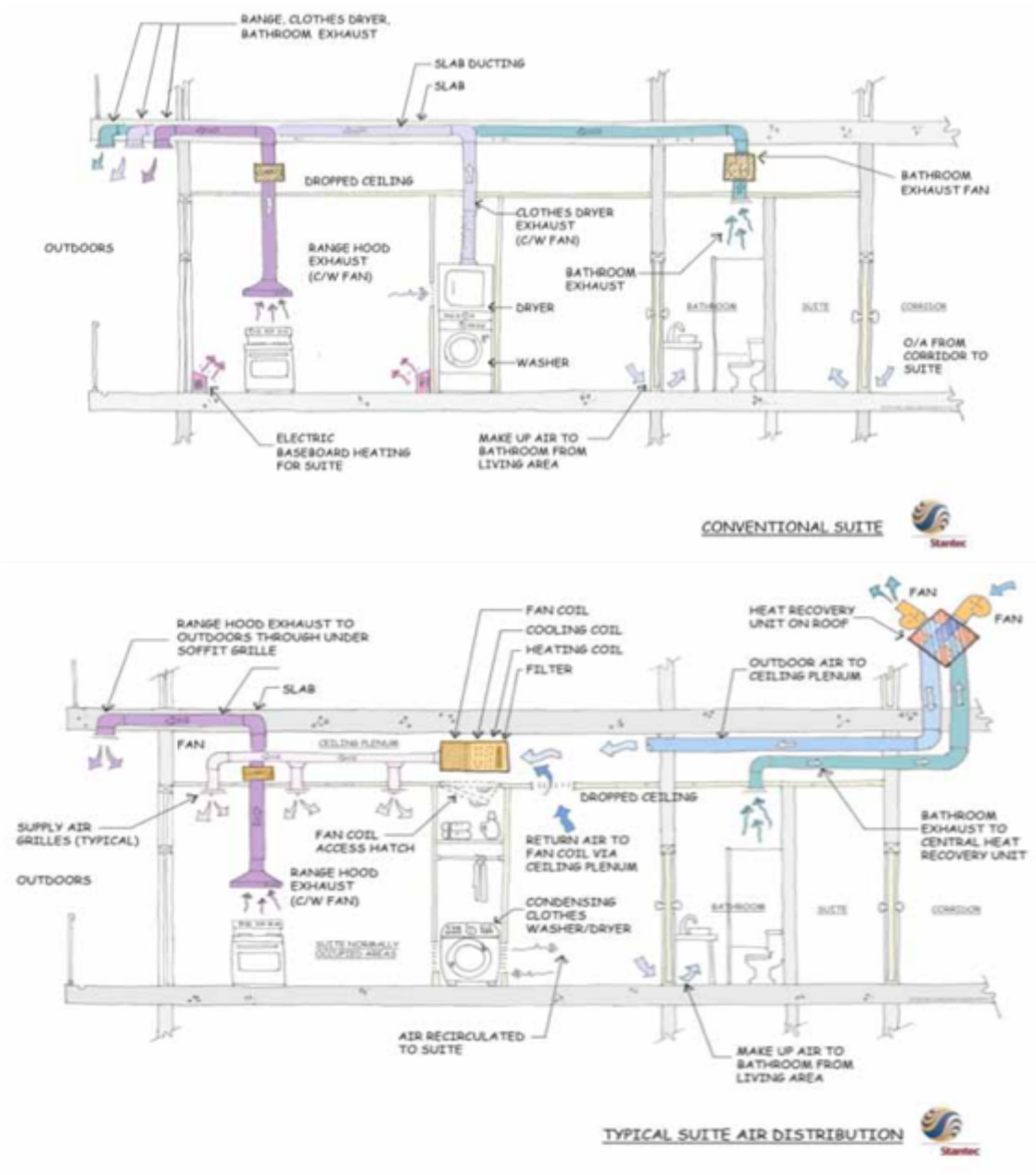


Synergy Roof Top Garden, Courtesy Dockside Green

In addition, the Capital Regional District's website http://www.crd.bc.ca/watersheds/lid/roofs.htm lists other advantages such as greatly reduced volumes in stormwater runoff (65-94 percent in a Portland study), pollutant removal and energy efficiency. Green roofs are valuable when integrated into a stormwater system such as at Dockside. According to the CRD, green roofs are common in Europe and in some cases required by government policy. Research shows that evergreens can reduce wind effects, cool stormwater runoff, which help fish habitat and absorb CO2 emissions. The green roofs on Synergy, Balance and Inspiration which help offset the heat island effect and provide food gardens for the residents are becoming a global trend. The soil layers help to reduce sound, provide insulation in summer and winter and allow rainwater to be absorbed. Waste from the biomass plant and recycled compost provide nutrients for growing.

Balance has two 30' high living (green) wall panels located between a public plaza, which are irrigated by the recycled onsite wastewater, help cool the buildings and reduce energy consumption. Living walls also provide similar benefits to green roofs; the CRD describes living walls as aesthetic vertical gardens designed to enhance livability and provide practical benefits such as stormwater retention, pollutant removal, water conservation and energy savings.

FRESH AIR VENTILATION SYSTEMS/EXTERIOR SUN SHADES:



Courtesy Dockside Green

Highly efficient central or individual heat recovery ventilators are installed in Synergy and Balance to provide 100 percent clean air to each suite. Incoming air is warmed with heat from exhausted air then filtered air is redistributed back to each suite. Heat ventilators are

considerably more efficient and economical than conventional ventilation and provide excellent air quality. The diagrams above show the differences between standard ventilation and a heat recovery system.

South and west facing windows on Synergy and Balance are equipped with exterior motorized sunshades to provide shade in summer months in addition to Low E double glazed windows. The buildings were designed to maximum day lighting and passive solar energy.

Motorized Sun Shades on Synergy
Courtesy Author

ONSITE RECYCLING

Organic waste is processed onsite through a recycling program. Each suite is provided with a carbon filter organics collector and each building has a recycling room thereby eliminating the need for garbage collection. Compost is used for roof gardens and excess collection is provided by a local organization (Dockside Green).

In comparison, Hammarby Sjostad has banned food waste from landfills and devised a system whereby waste is collected via 'chutes', sent through underground vacuum tubes to the methane digester, which is 'co-digested' with sewage to produce biogas (Salter).

CONSTRUCTION WASTE RECYCLING

Dockside's 2009 sustainability Report informs that 95 percent of construction waste from Synergy was reused or recycled and avoided going to a landfill (Dockside Green).

REUSE OF UNDERWATER HARVESTED WOOD FOR BUILDINGS

http://www.tritonlogging.com

The developers of Dockside Green stayed true to their commitment to use as much recycled construction material as possible and did so by using sustainable wood products. Triton Logging uses a 'revolutionary' Sawfish technology to harvest submerged underwater wood left by BC's hydroelectric dams in Lois Lake Reservoir. According to Dockside's Sustainability Report, there are 45,000 dam reservoirs worldwide with underwater forests of more than 300 million trees available to reclaim. Wood from Triton products was used for the cladding on Synergy townhomes and commercial buildings Prosperity/Inspiration.

Prosperity

CI-1 Inspiration 3

Wood Cladding on Synergy Townhouses and Cl-1 Inspiration, Courtesy Docksid

ENERGY SAVING FEATURES /GREEN MATERIALS USED IN EACH BUILDING/SUITE

Use of low emitting VOC paints, sealants and adhesives are standard practice throughout
No urea formaldehyde in wood products used, Low emitting carpets with wool as an upgrade
Chemical and pollutant grates at high volume entry points to prevent contaminates in building
Green cleaning supplies for each resident for six months, Condensing Dryers in suites, R17 insulation
Bamboo flooring and cabinet doors used in suites, Cork flooring and paneling used in lobbies
Recycled carbon neutral Interface 'Cool Carpet' tiles used in corridors and common areas
Dual flush Water Closets, Low Flow Faucets and Showers in suites and commercial units
Terrazzo floor tiles made of post consumer glass, Occupancy sensor lights in closets
40 percent Fly Ash in 7" solid reinforced concrete floors reduces GHG emissions

The use of low VOC materials and energy saving fixtures is an important element to ensuring a healthy energy saving environment by reducing off gassing and carbon emissions. An innovative feature used in the development provides Energy Monitors in each suite, which allow residents immediate access and to remotely control their energy consumption via Internet from anywhere in the world. The two-way monitors display energy, hot water and electricity use and provide info on the carbon emissions for the suite as well as enable the residents to track and compare usage over time. According to Reliable controls VP Tom Zaban, smart meters are the way of the future, allowing homeowners to be accountable for their carbon footprint. He speculates that BC hydro will have similar two-way monitors available by 2013 as future homes include energy monitors as standard practice (Dockside Green Site).

Energy monitors in individual suites

Remotely programmed via the Internet, Courtesy Dockside Green

SUSTAINABILITY CENTRE

Dockside Green will have a permanently staffed sustainability centre onsite at build out, which Ken Pirie states, will be situated near a large circular plaza and amphitheater. Dockside plans to demonstrate renewable energy and environmental systems through educational programs and they have committed to sharing knowledge with developers and other communities to promote sustainable design. At present, Dockside has given site tours to government officials from around the world and shared educational information on sustainable design to other countries. There is an outreach program to teach students about 'sustainability issues and environmental stewardship' (Dockside). BedZED had a similar program for the first year in which "green lifestyle officers" educated and motivated residents in ways in which to adopt a green lifestyle. Hammarby Sjolstad presently has an environmental information centre which offers study classes, demonstrations, conference rooms; in addition to which, the centre exports environmental technology for urban projects to cities and countries, including Toronto, Canada.

CONCLUSION

The importance of Dockside Green is significant for its ability to provide an instructive model on closed-loop district energy systems and to set a new standard and norm in the building industry. The US Green Building Council for LEED ND is using Dockside, as a result of its all-inclusive design approach, as a pilot project to determine certification for other similar large mixed-use self-sufficient community projects. The council estimates that buildings account for 1/3 of GHG in addition to another 1/3 for transporting people, goods

and services to the buildings. Dockside's comprehensive implementation of energy saving features ensures that the building codes are fifty percent higher than the current building code. The reuse of a dormant brownfield site such as that used by Dockside Green for another purpose is an important component of smart growth and new urbanism, especially when the location is such that land is limited. According to architect Peter Busby, there is 'enormous carbon-cutting potential in the kind of waste to energy plant found at Dockside' but there is a need to move beyond the 'not in my back yard' philosophy. He states that Sweden obtains 25 percent of their energy through this type of 'loop system'. There are many similarities between Dockside, Selkirk and Hammarby Sjolstad; all are sited on former industrial harbourfront land. All these projects have learned how to view waste as a valuable asset and to produce energy onsite among the many other sustainable building practices. All these projects are still in various stages of attaining build out so are still able to adopt the newest green technology. Integrated planning has been an important aspect to these projects as well ensuring that environmentally responsible building choices are made at the outset to maximize potential. Dockside Green is immensely successful in providing a working model for sustainable communities as evidenced by it's attaining the highest LEED ND certification in the world. According to Peter Busby, as green building progresses, this designation may eventually become a 'Living Building Certification'.

"It's this shift to the mainstream that makes projects such as Dockside Green so valuable, said Monika Wynne, University of Victoria associate professor of business strategy and sustainability. Projects like Dockside Green have a huge role [in the sustainability movement] because they are on the leading edge. … They are destroying past practice and bringing in new thinking."

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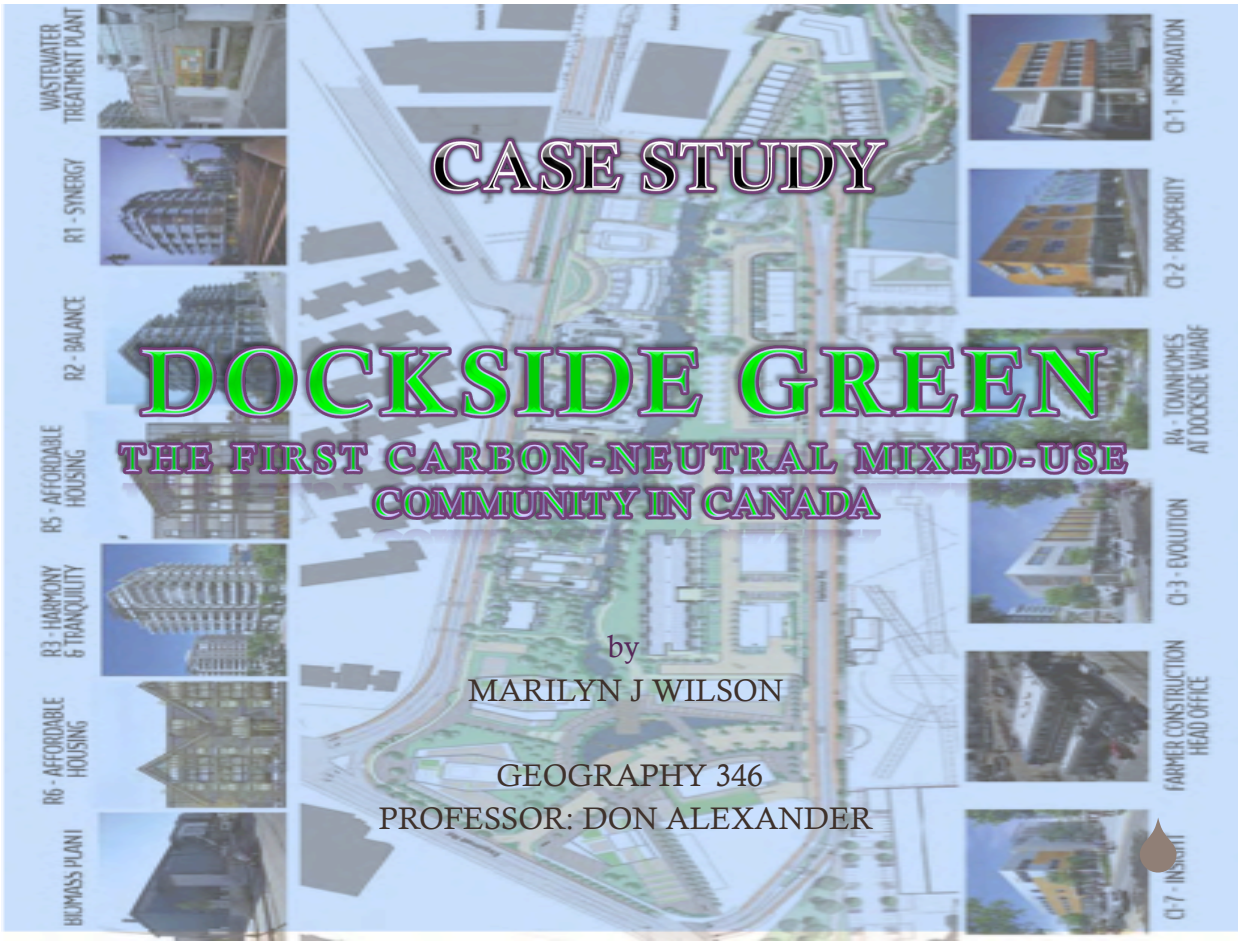

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