

Roadmap to Carbon Neutrality

Sustainable Building Symposium

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What does carbon neutral mean?

Buildings

- Buildings that do not generate any net carbon in operations
- Renewable energy generation
- Renewable energy use
- Offsetting energy use in other operations

- Or buy carbon credits and green power compliance but not sustainable



Use less Energy



What does carbon neutral mean?

Beyond Buildings

- Building Materials and Construction
- Transportation to/from Building
- Energy for travel



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Achieving Carbon Neutrality



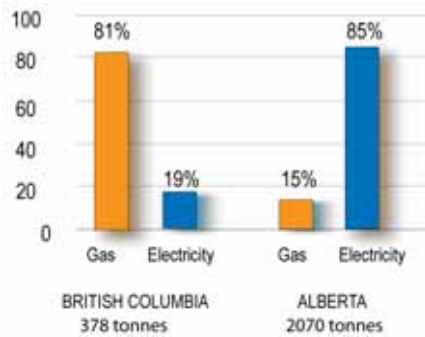
- Determine your building's carbon footprint
- Review the opportunities on site, neighborhood, regionally
- Evaluate the options for practicality, cost functionality, availability
- Review capital, operating, maintenance costs
- Review funding options for capital and operating costs

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GHG Emissions from Buildings



- **In BC (and similar provinces) with relatively clean electrical power**

- 81% GHG emissions from heating
- 19% GHG emissions from electricity

- **In Alberta (and similar coal based provinces)**

- 15% GHG emissions from heating
- 85% GHG emissions from electricity

GHG reduction solutions are different!

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4 Steps to Reducing GHG Emissions

Step 1 – Define it

- Benchmark against similar buildings
- Analyze utility data for existing buildings
- Calculate GHG/Carbon footprint
- Calculate Carbon tax



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4 Steps to Reducing GHG Emissions

Step 2 – Reduce it

- Audit process
 - Identify areas for saving energy
 - Research applicable incentive programs
- Upgrade systems and design
 - Low temperature heating systems
 - Integrated systems
 - Higher efficiency equipment and systems
 - Envelope improvement measures
 - Natural ventilation systems

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4 Steps to Reducing GHG Emissions

Step 3 – Plan for it

- Look for synergies within regions & neighborhoods
 - Central heating
 - Waste heat from neighboring buildings



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4 Steps to Reducing GHG Emissions

Step 4 – Practice it

- GHG free fuel
- Biomass incineration/Co-generation
- Solar heat collectors
- Solar photovoltaic generation
- Wind Power
- Micro hydro
- Biogas
- Heat Pumps
- Offsetting strategies



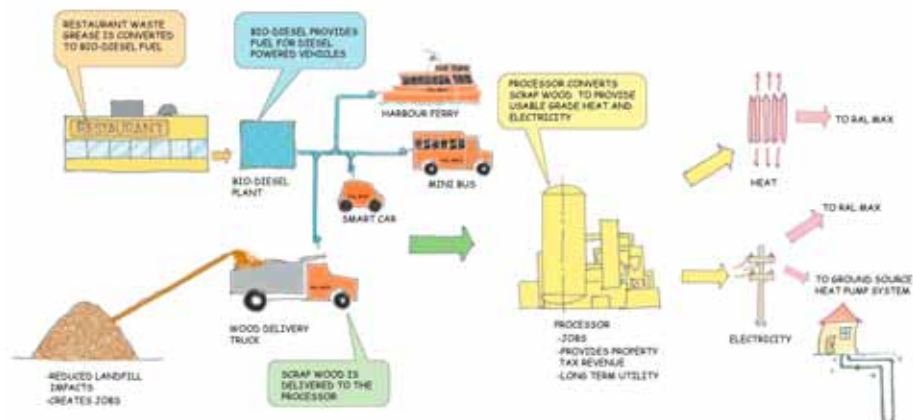
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Waste as fuel

BIO-MASS AND BIO-DIESEL SYNERGY

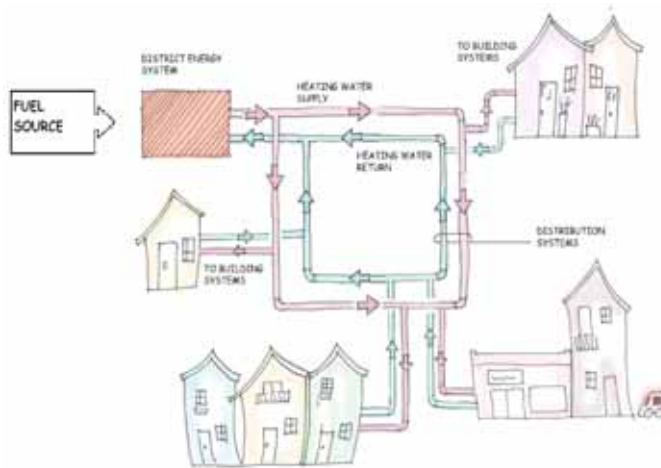


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District Energy

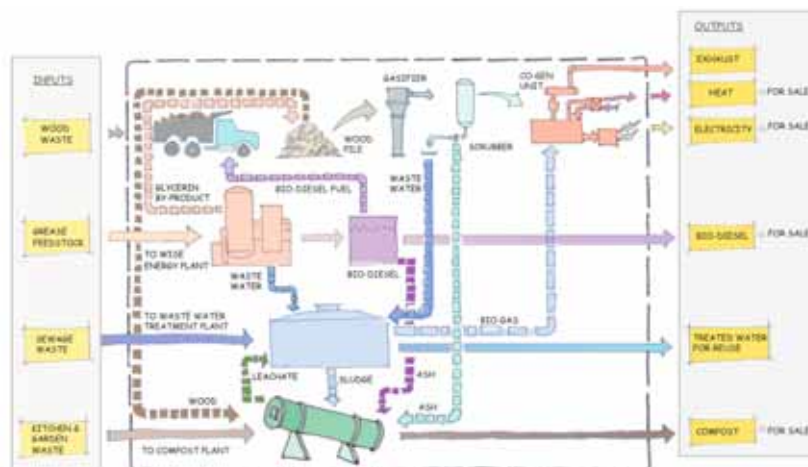


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System Synergies - Communities



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Biomass Incineration



- Incineration of appropriate waste wood/products
- Flue gas filtration for air quality
- For building heating
- Electricity only in very large plant
- Small (house) and large scale options

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Biomass Gasification



- Gasification and oxidation of appropriate waste wood
- Flue gas filtration
- For building heating
- Developing small scale electrical cogen

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Biomass Gasification

Nexterra's Gasifier System - How It Works

1. Fuel In-Feed

Locally sourced wood waste (including recycled street wood construction and municipal tree trimming) is loaded into the fuel bin and conveyed to a rotating bin near the gasifier.

2. Gasifier

Fuel enters the gasifier and goes through several stages including drying, pyrolysis (chemical change brought about by heat), and gasification. The wood is converted into synthetic "syngas" that can be used like natural gas.

3. Oxidizer

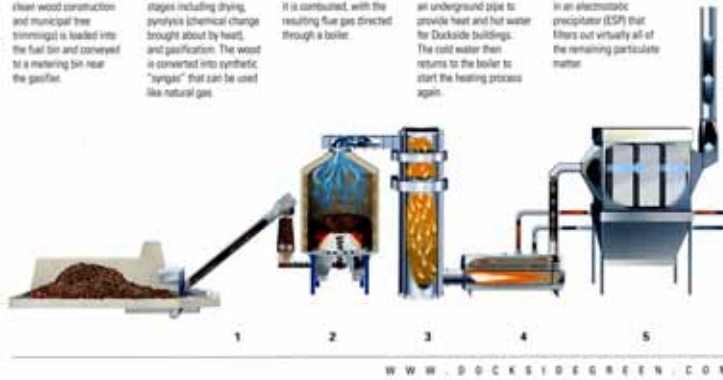
The syngas is conveyed into the oxidizer where it is combusted, with the resulting flue gas directed through a boiler.

4. Boiler

Hot water from the boiler is transported by an underground pipe to provide heat and hot water for Dockside buildings. The cold water then returns to the boiler to start the heating process again.

5. ESP

After exiting the boiler, the flue gas is cleaned in an electrostatic precipitator (ESP) that filters out virtually all of the remaining particulate matter.

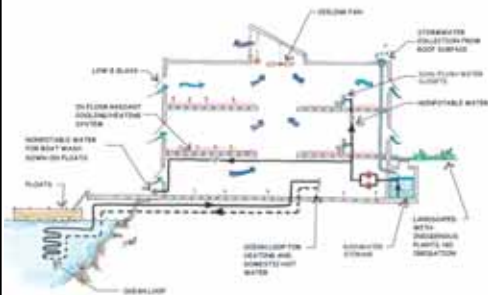


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Heat Pumps



- Shift heating to electrical energy but use less
- COP of heat pump gives efficiency and lower operating cost
- Ground Source, air to air, heat from groundwater or sewage, building waste heat

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Solar Collectors



- Can be used for specialized heating such as DHW, pools, etc.
- Requires a use for the heat in the summer

Drake Landing, Okotoks, AB

- Solar provides 90% of building heating
- Ground field thermal storage
- Subsidies for solar/ground field

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Solar Photovoltaic Generation



White Rock Operations Center – Busby Perkins + Will

- Still very costly energy
- Requires incentives/subsidies
- Ontario – 50% capital cost, \$0.45/kwh

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Wind Power



- Great opportunity where wind is available
- Options for building mounted equipment also



Micro hydro



- Opportunities in the Rain Forest
- Many projects underway on West Coast



Biogas



- Scrub/filter gas for 98% methane – vehicle fuel
- Potential sources
 - *Animal waste – manure*
 - *Slaughterhouse waste*
 - *Agricultural waste*
 - *Food waste*
 - *Landscaping material*

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Biogas



Manure Production
(26,000 head of Cattle)



Manure Utilization Plant



Exhaust Heat Recovery System

Integrated Manure Utilization System
Highmark Renewables - Vegreville, AB

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Co-generation / Tri-generation



- Edmonton Airport: Considering Tri-Generation system that will get EIA in the range of Kyoto in spite of 400% growth in campus
- University of Calgary: Co-Generation – if done now, would get U of C to about Kyoto levels in spite of growth of campus

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Projects

Center for Interactive Research on Sustainability

Vancouver, BC



- Very low energy use building
- Some PV and Solar Collectors
- Remote micro hydro could be developed by project partners and power CIRS

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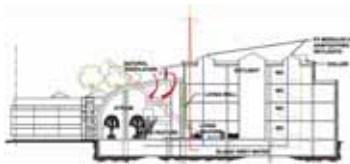




Projects

Innovation Place

University of Regina, Regina, SK



9 Research Drive, Regina, Saskatchewan
Stantec Architecture

- 14,000 m² office building, LEED Platinum+
- Wind power on adjacent site to power building
- Deep geothermal for heat
- Net Zero Energy
- GHG Neutral

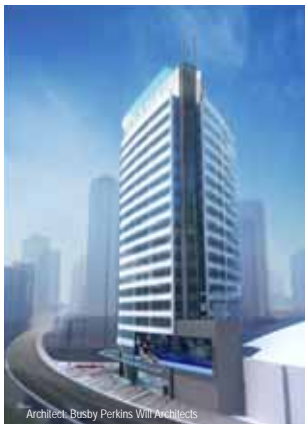
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Projects

Canuck Tower – GM Place (Carbon Neutral)

Vancouver, BC



Architect: Busby Perkins Will Architects

Developer office building:

- 40% Energy Reduction ASHRAE 90.1, 2004
 - Exceeding probable 2010 Energy Code
 - >60% GHG Emission Reduction
 - Exceed 2030 Challenge target/opening day
- Net Zero GHG Emissions – Building Operation
 - Ground source heat pump
 - Heat from ice rink
 - Heat from tenant cooling
 - Heat from interior cooling
- All electric building
- Sell heat to arena to offset electrical GHG signature

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Projects

Edmonton International Airport

Edmonton, AB



Architect: Stantec Architecture

- 43,000m² addition requiring more heat/cool plant and electricity
- Use gas turbine tri-gen system
 - Electricity, heating, cooling
- **Will about achieve Kyoto in spite of 400% increase in area**
- Looking at sour gas flaring as alternative fuel
- 5 yr simple payback – smaller turbine unit
- 4 yr simple payback – larger turbine unit

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Carbon Trading

ECO SECURITIES



- Voluntary market – North America
- Regulated Market – Europe
- Validate & Commercialize Credits
- Support in bringing emission reduction projects to market
- Provides services to companies facing carbon regulations or contemplating a voluntary carbon management program

- Buildings are not the low hanging fruit

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Conclusion



- The times are changing & holistic thinking is key
- Consider choices at the community scale to make building decisions easier
- Reduce, Reuse, Recycle, Rethink!