REGIONAL DISTRICT OF NANAIMO

SUMMARY REPORT

Benefits of Green Building and Compact Community Development

BACKGROUND

High performance green homes and buildings mitigate the environmental impacts of the built environment while reducing the lifecycle costs of buildings and infrastructure.

Compact development patterns and a balanced mix of housing types further reduce environmental impacts of the built environment. Urban containment limits the area of land converted to use for housing and encourages transportation alternatives to the automobile. A balanced mix of housing types increases the proportion of multi-family dwellings and apartments, leading to greater energy and water efficiency when compared to single-family detached dwellings.

While these general statements are widely accepted as true, the extent to which green building and compact development patterns actually translate into reductions in the impacts of built form on the environment are rarely quantified.

As part of the implementation of the Regional District of Nanaimo's *Green Building Action Plan*, the RDN contracted the services of the Sheltair Group to undertake research to determine the type and extent of environmental benefits of promoting green buildings and more compact land use patterns in the RDN.

The research included the following tasks:

- Identify the range of impacts associated with new construction in the RDN over the 20 period between 2011-2031.
- Quantify the annual and cumulative impacts of new construction if it were built to a conventional standard.
- Compare these results to the impacts of the same construction if it were built to an identified standard for green building.
- Explore the added environmental benefits of green buildings in compact communities.

RANGE OF IMPACTS

For the purpose of this analysis, the environmental impacts associated with new construction are:

- Building Energy Use;
- Transportation Energy Use;
- Water Consumption;
- Volume of Wastewater;
- Solid Waste;
- GHG Emissions; and
- Area of Land Converted to use for Housing.

SCENARIOS

To provide a comparison, three scenarios were developed:

1. **Business-as-Usual Scenario (BAU)**

   The BAU scenario is based on the minimum required building standards as determined by the BC Building Code, and assumes development pattern that is equivalent to what is on the ground today. That is, the mix of housing types and the distribution of housing across the region (percent inside versus outside the UCB) is the same in 2031 as today.

2. **Green Building Scenario (GB)**

   The GB scenario calculates the impacts of construction assuming that 100% of new construction takes the form of green buildings. New residential construction is envisioned as EnerGuide 85 for energy performance and Built Green–Gold for non-energy related issues (e.g. water use). Calculations for non-residential construction are based on requirements for achieving LEED–Gold. The overall development pattern is the same as the BAU scenario.

3. **Green Buildings—Compact Communities Scenario (GB-CC)**

   The GB-CC scenario uses the building types envisioned for the GB scenario and calculates the additional impacts of dramatically increasing residential density within the UCB. Specifically, the scenario contemplates environmental impacts if all new development after 2011 occurs within the UCB, and all new residential development takes the form of multi-family dwelling types. This includes redevelopment of 30% of the existing single family detached dwelling stock into higher density forms. The result is 83% of the population residing inside existing UCBs by 2031, compared to 67% today. This scenario highlights the efficiencies gained from building a diversity of dwelling types, as well as the reductions in transportation related GHG emissions due to a moderate shift away from private automobiles to buses, bicycles and walking as more people would be living in compact, pedestrian-oriented communities.

SUMMARY OF RESULTS

After calculating the impacts of new construction for each of the three scenarios, the **Green Building** scenario will result in a **40% reduction in water use**, and a **16% reduction in GHGs** when compared to the BAU scenario.

The **Green Building—Compact Communities** scenario will result in a **48% reduction in water use** and a **36% reduction in GHGs** when compared to BAU. In addition, by 2031, 13% less land will have been converted to use for housing.

DETAILED RESULTS

This section provides the results and an analysis for each of the impacts listed above. All graphs show data for the following milestone years: 2011, 2016, 2021, 2026, and 2031, and the values shown are only for year 2031 (the end of the study period).

In each graph, the BAU scenario appears as a black line, the GB scenario is represented by a light green line, and the GB-CC scenario is represented by a dark green line. For each impact, two graphs are shown. The first illustrates impacts as absolute quantities and shows trends for each scenario over time. The second graph shows the percentage reduction in impacts over time for the two green scenarios relative to the business-as usual scenario. For these graphs, the BAU scenario equals 100% for each milestone year.

Building Energy Use

Significant reductions in building energy use arise from building to a green standard. By 2031, green building alone can reduce energy use from a predicted 5,200,000 GJ/ year for new development in the BAU scenario to 3,700,000GJ/ year in the GB scenario. This constitutes a 30% reduction in building energy use in 2031. By building a greater diversity of dwelling types, including more apartments and row style homes as envisioned in the GB-CC scenario, building energy use for new development could be expected to drop to 2,700,000 GJ/year, or 48% less than the BAU scenario. This is largely due to the fact that more compact units use less energy for space heating than single family detached homes.

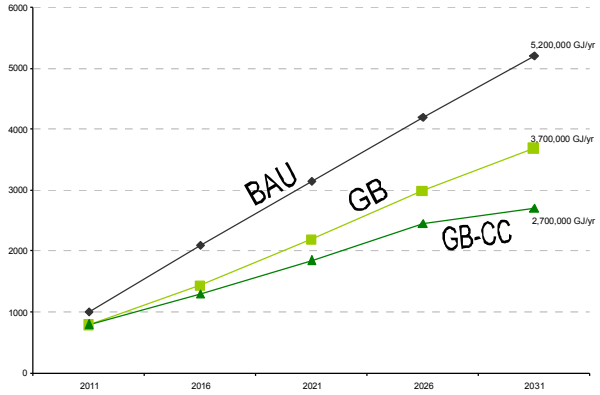

Figure 1: Building Energy Consumption by Scenario (GJ/year)

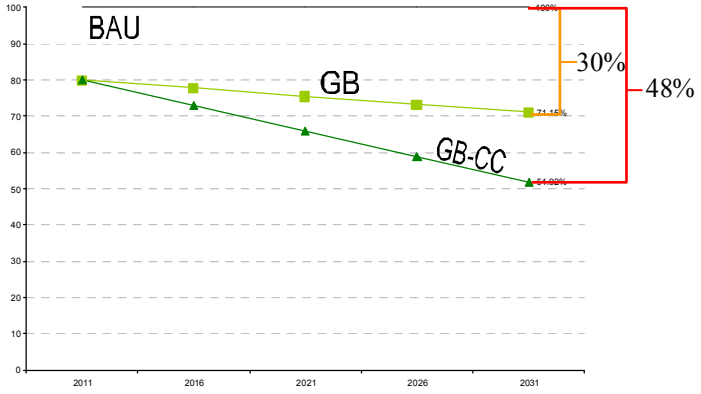

Figure 2: Percent Reduction in Building Energy Consumption for Green Scenarios (BAU = 100%).

Transportation Energy Use

Transportation energy is measured in litres of fuel consumed and is based on an estimate of vehicle kilometres travelled by residents of new development for each scenario. Land use in the GB scenario mirrors the BAU scenario, so transportation energy is the same in both, rising to 77 million litres of fuel consumed to serve new development in the RDN by 2031. By contrast, reduced transportation demand associated with compact community design results in significant fuel saving in the GB-CC scenario, with 54 million litres of fuel consumed in 2031. This equals about a 30% reduction in fuel consumed to meet transportation needs when compared to the BAU and GB scenarios.

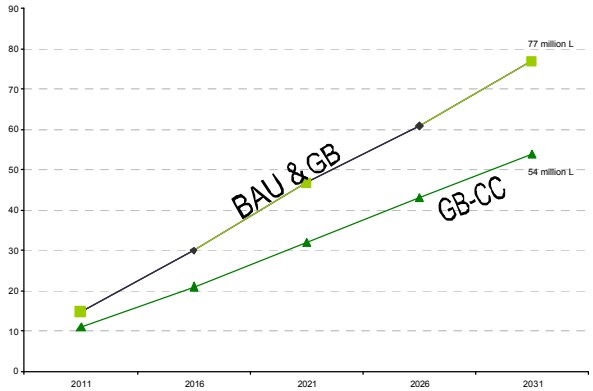

Figure 3: Transportation Energy Use by Scenario (Millions of Litres/ year)

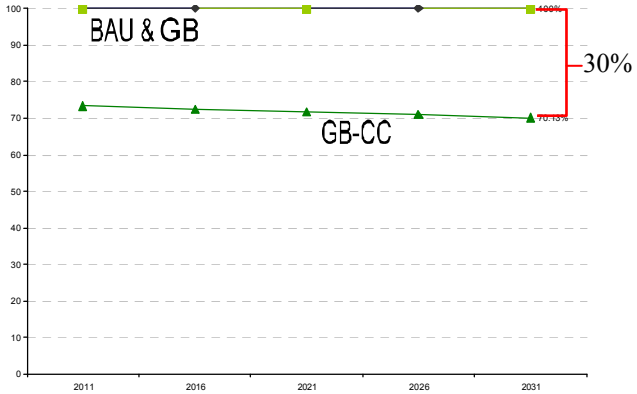

Figure 4: Percent Reduction in Transportation Energy Use for Green Scenarios (BAU = 100%).

Water Consumption

Figures 5 and 6 highlight the fact that the greatest reductions in water use come from building to a green standard, while marginal reductions are associated with overall development pattern. This is illustrated by the GB and GB-CC scenarios achieving almost the same reductions relative to the BAU scenario. Specifically, in 2031 business-as-usual development will result in 15,000,000 m^3 of water consumed, while green building will consume 8,500,000 m^3 of water (a 43% reduction from BAU), and green buildings in compact communities will consume 8,100,000 m^3 of water (a 48% reduction from BAU). Volume of wastewater is measured as a percent of total water consumed (84%), consequently the proportions are the same as below, and the graphs are not shown.

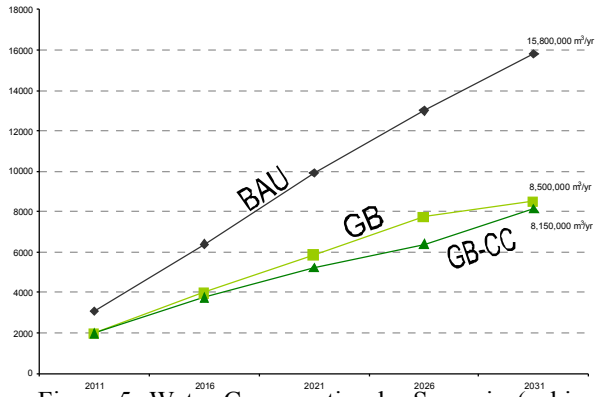

Figure 5: Water Consumption by Scenario (cubic metres/ year)

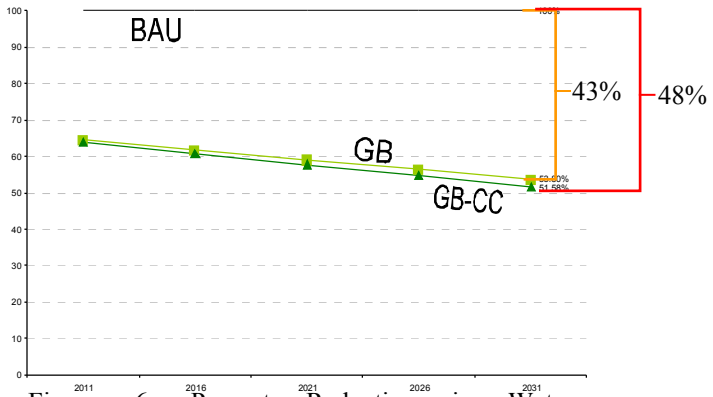

Figure 6: Percent Reduction in Water Consumption for Green Scenarios (BAU = 100%)

Solid Waste

Solid waste reduction in both green scenarios are achieved through lower levels of outdoor yard waste as well as increased diversion potential from implementation of solid waste credits in relevant green building guidelines. Figures 7 and 8 show that the majority of reductions are achieved through green building, but significant additional reductions will result from more compact development. In 2031, new development in the RDN is predicted to produce 27,000 tonnes of solid waste under BAU conditions, while the GB scenario shows a reduction of 40% to 16,500 tonnes, and the GB-CC scenario shows a reduction of 55% to 12,500 tonnes of solid waste.

Figure 7: Solid Waste Generated by Scenario (tonnes/ year)

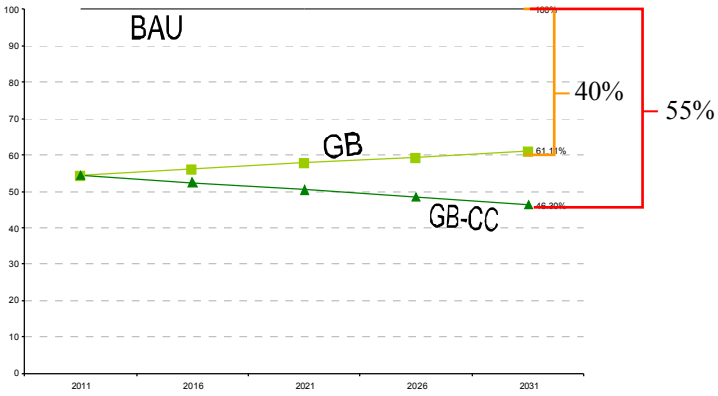

Figure 8: Percent Reduction in Solid Waste Generated in Green Scenarios (BAU = 100%)

GHG Emissions

Estimates for GHG emissions, measured in tonnes per year, include combined emissions from buildings, solid waste and transportation. In 2031, under business-as-usual conditions, it is estimated that new development in the RDN will emit 339,000 tonnes of GHGs. By building green buildings, that amount can be reduced by 16% to 286,000 tonnes, and by building green buildings in compact communities, GHG emissions can be reduced by 36% of the BAU levels to 218,000 tonnes. Examining these scenarios shows that GHG emissions (and reductions) are more responsive to development pattern than building construction standards.

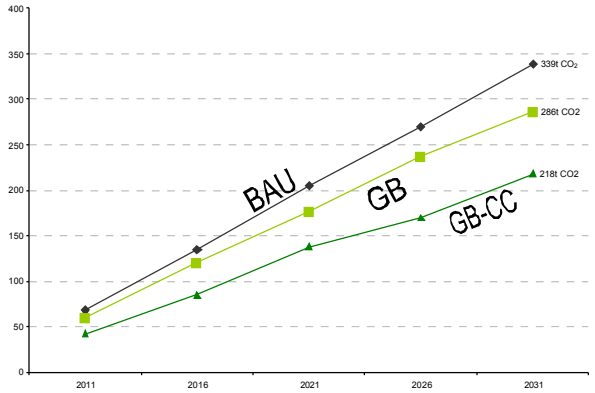

Figure 9: GHG Emissions by Scenario (tonnes/ year)

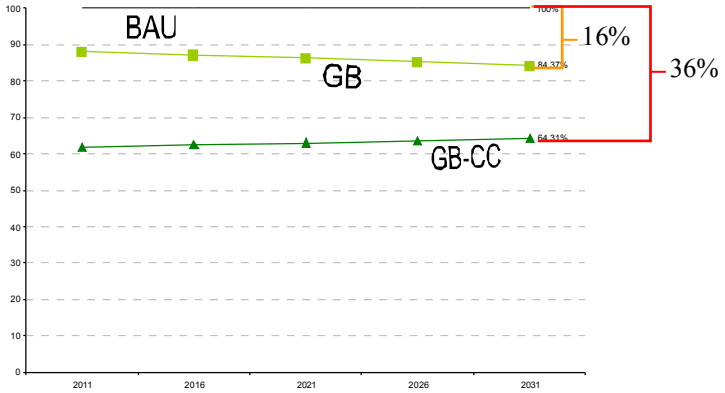

Figure 10: Percent Reduction in GHG Emissions for Green Scenarios (BAU = 100%)

Land Area

To accommodate new housing development, land must be cleared. Since land use in the BAU and GB scenarios are the same, in both scenarios 2,600 hectares of land is cleared by 2031to accommodate new housing. In the GB-CC scenario, which envisions that all new residential development take the form of multi-family dwellings inside Urban Containment Boundaries, less land is required to accommodate residential development. In 2031, 2,300 hectares, or 13% less land is converted to use for housing.

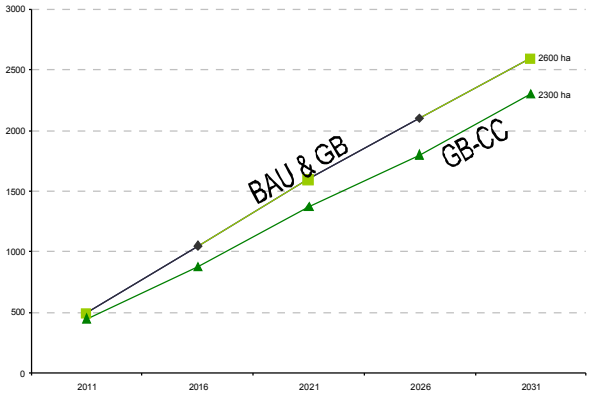

Figure 11: Land Are Converted by Scenario (hectares)

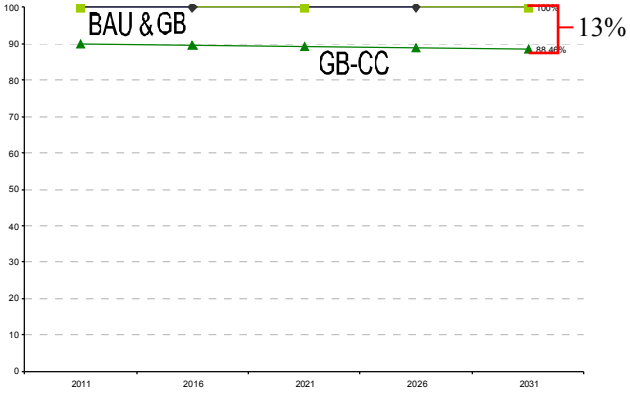

Figure 12: Percent Reduction Land Are Converted for GB-CC Scenario (BAU and GB = 100%)

Conclusion

This research project has provided essential information to the Regional District of Nanaimo. While assumptions must necessarily be made to proceed with this type of quantitative analysis, a clear picture emerges showing that significant reductions in the environmental impacts of new development can be achieved by following two courses of action:

1. Building new development to a green standard; and
2. Ensuring that new development includes a diversity of housing types and occurs in a compact pattern within Urban Containment Boundaries.

What is interesting about the findings presented here is that development pattern appears to have a greater impact than green building standards on many of the impacts considered, particularly building energy use, transportation energy use, and GHG emissions. Since the Regional District of Nanaimo influences development pattern with zoning and land-use regulations, this is valuable information that provides well-founded, well researched support for the goals of the Regional Growth Strategy.