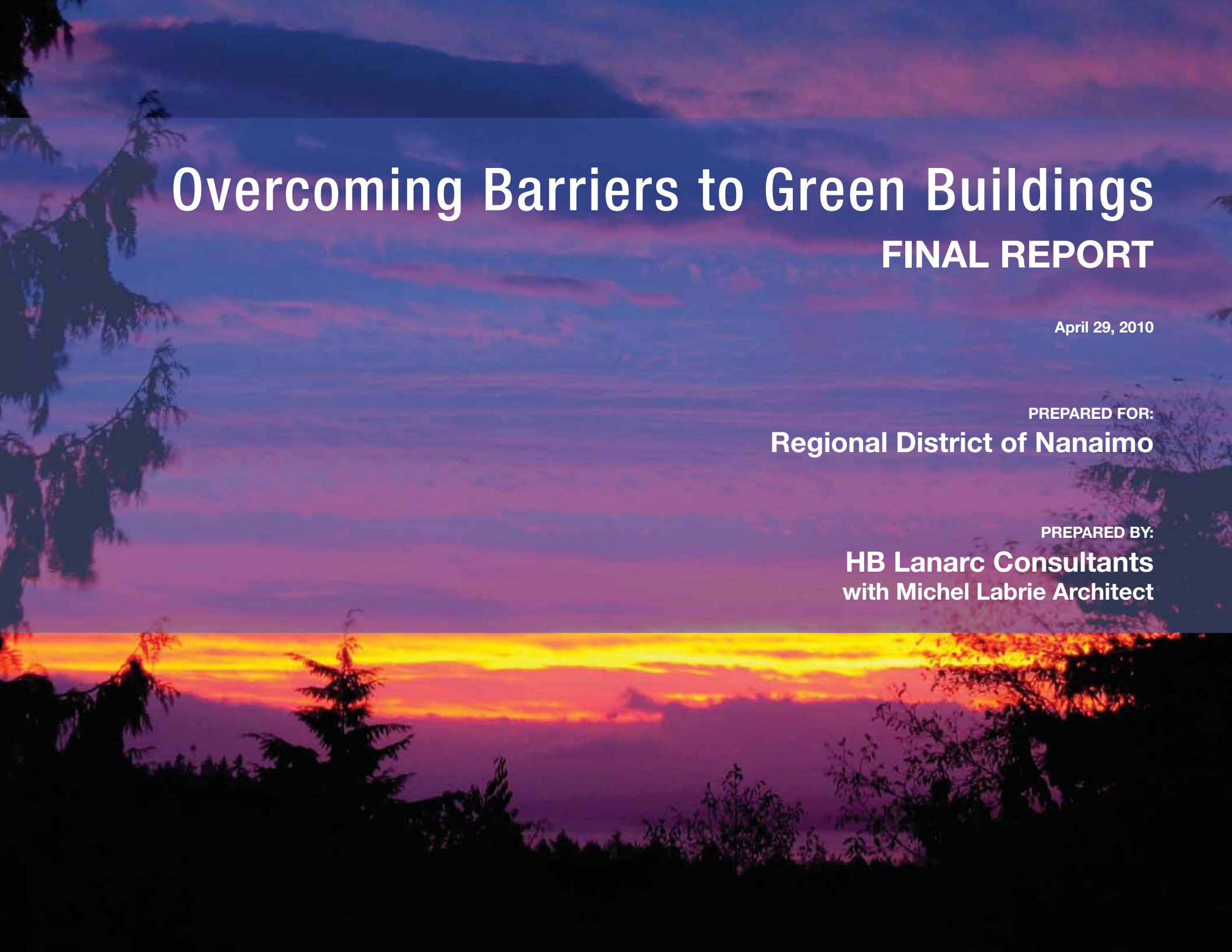

Overcoming Barriers to Green Buildings

FINAL REPORT

April 29, 2010

PREPARED FOR:

Regional District of Nanaimo

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with Michel Labrie Architect

Executive Summary

The Regional District of Nanaimo (RDN) adopted its Green Building Action Plan in 2007. Amongst other actions, the Plan calls for study into the barriers facing green buildings in the RDN, and opportunities to overcome such barriers through incentives, education, capacity building and finance. This Overcoming Barriers to Green Building report addresses these issues, by identifying:

- 'Net Zero' building archetypes – strategies to that can allow buildings to supply their energy and water requirements onsite, on a net-annual basis
- Barriers to the construction of Net Zero buildings
- Recommendations to reduce these barriers

Encouraging green building will benefit the RDN. Green building can:

- Reduce community greenhouse gas emissions, helping the RDN meet Provincial targets, and Climate Action Charter commitments
- Reduce energy use, increasing energy security and buffering residents from price volatility
- Reduce water use, increasing water security and potentially reducing the RDN's future spending on water and wastewater infrastructure
- Stimulate local economic development, and assist local developers and builders by keeping them ahead of the regulatory curve
- Provide healthier homes and neighbourhoods

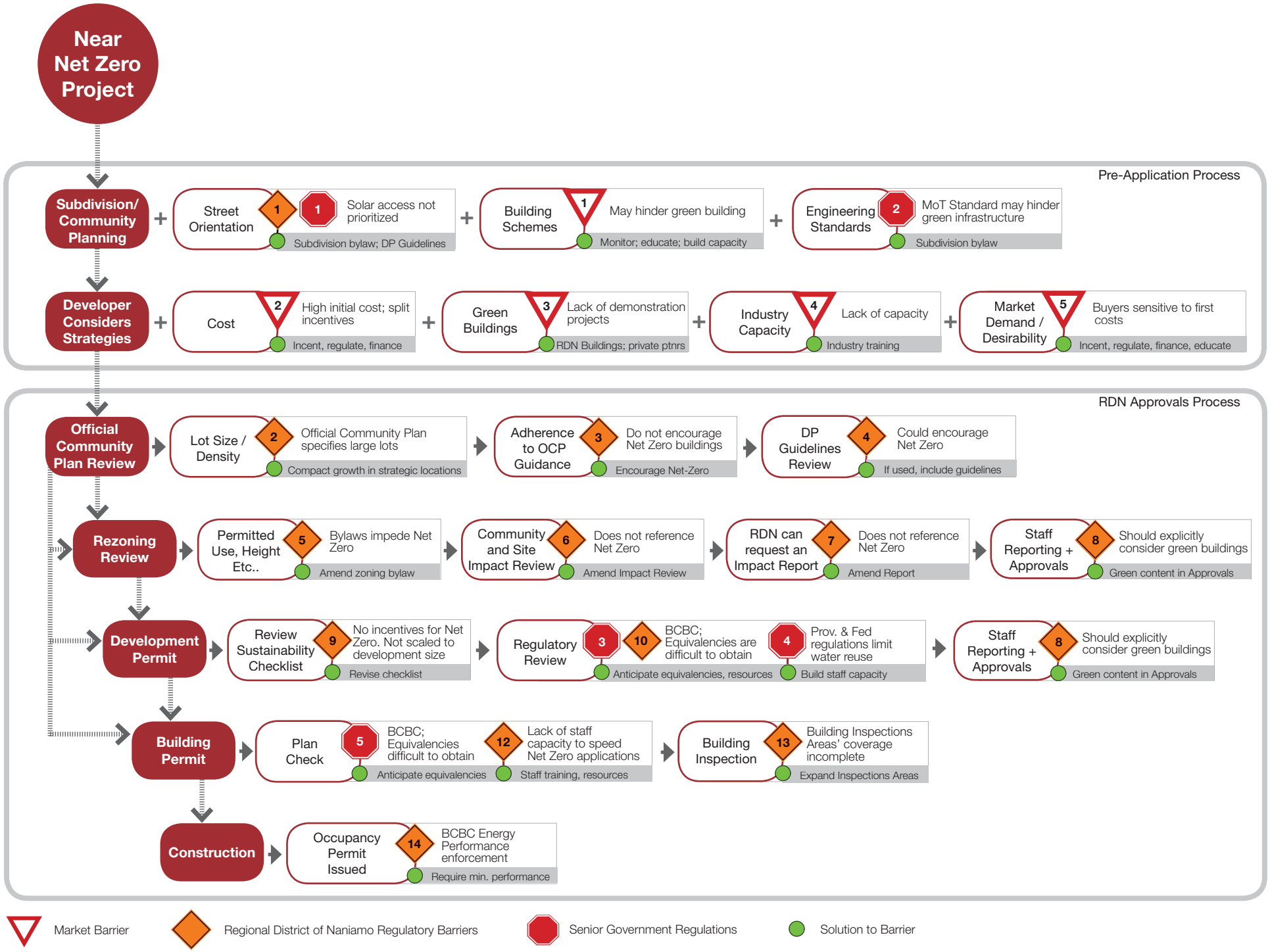
To realize these outcomes, it is important to reduce barriers to green building stemming from RDN regulations and approvals, senior government regulations and approvals, and market barriers. This report organizes such barriers along a 'Compliance Pathway' (see p. 3). The Compliance Pathway follows a Net Zero building as it move through community planning, developers' decision making, and the RDN's development approvals process. Barriers to Net Zero buildings are identified along the way. Barriers were identified by RDN staff, stakeholders, and the consultant team.

For each barrier, potential solutions are suggested. Recognizing that the RDN does not possess limitless resources, RDN staff and the consultant team worked to identify the most high-impact solutions, which comprise this report's recommendations. It is recommended that the RDN:

- Implement a Staff Green Building Capacity Development Program, involving industry when possible
- Implement a public Outreach Program
- Amend bylaws to remove barriers to green building
- Implement policies in Electoral Area OCPs and Zoning related bylaws that concentrate development in appropriate locations such as Village Centres, while limiting development outside of the Growth Concentration Boundary
- Develop a Subdivision Standards Bylaw, to address barriers during the Ministry of Transportation and Infrastructure's subdivision approvals process
- Expand building inspection areas to cover all Electoral Areas in order to enforce green building requirements in the BC Building Code
- Initiate a Green Building Incentive Program, providing building permit fee rebates, and/or other incentives for green developments. Provide incentives for:
  - Part 9 construction (single family and low-rise residential) – An EnerGuide rating (or equivalent energy performance) and proof of water efficiency performance
  - Part 3 construction (high-rise residential and commercial) – Third party verification that the development has implemented a "Green Strategy" outlining strategies that go beyond the BC Building Code
- Revise the Sustainable Community Builder Checklist
- Develop Energy and Water Conservation Development Permit Areas Guidelines

In addition to these recommendations, it should be noted that good land use planning may have the greatest impact on buildings' environmental impacts, and facilitate environmentally appropriate, low-carbon development in general. The RDN should continue to emphasize compact, complete and connected Village Centres while planning land uses in Electoral Areas.

Implementing these recommendations will reduce barriers, and make green building a more attractive development proposition in the RDN. Net Zero buildings will not become the industry norm in the RDN overnight, nor will implementing these recommendations ensure their adoption. However, these recommendations reduce regulatory barriers to Net Zero practices, lessening hindrances to industry leaders keen to develop greener buildings. Moreover, these recommendations can set the RDN on a path to transform its markets and facilitate the adoption of substantially greener buildings in the coming decades.



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PLANNING DESIGN SUSTAINABILITY

Contents

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1. Introduction

Developing greener, less resource intensive buildings is critical to providing healthier places to live, stimulating local economies, and addressing climate change and other environmental challenges. To realize these benefits, local governments can play a vital role in encouraging and facilitating green buildings. The Regional District of Nanaimo (RDN) has recognized this opportunity, and has taken leadership in developing its Green Building Action Plan, adopted in 2007. The Plan outlines a variety of objectives and actions aimed at increasing the number of green buildings in the RDN.

In the Plan, the RDN notes that regulatory and market barriers are slowing green buildings' widespread adoption. The Plan calls for the identification of barriers to green buildings in the Region, and means of overcoming these barriers.

In September 2009, the RDN commissioned a consultant team, led by HB Lanarc and Michel Labrie Architect, to undertake a study of barriers to green buildings. This study focuses on regulatory and market based opportunities to reduce the barriers to adoption of 'Net Zero' (or near Net Zero) building systems in new residential and mixed-use developments.

This *Overcoming Barriers to Green Buildings* report presents the findings of this study. It:

- Describes archetypal building systems that allow for [Near] Net Zero, energy and water use, and liquid waste production
- Identifies barriers to such [Near] Net Zero systems
- Recommends actions to help overcome these barriers

Strategies that can allow buildings to achieve [Near] Net Zero energy, water and liquid waste are defined in Section 4 of this report. Barriers to these archetypal strategies are then identified in Section 5. Recommendations of high priority actions to overcome barriers are made in Section 7.

1.1 Net Zero

A wide array of rating systems and performance standards are used to judge the merits of green building. The RDN has chosen to use the metric of 'Net Zero' as its preferred means of assessing green buildings' performance.

- 'Net Zero' means that for a given resource, such as energy or water, no net input is required from external utilities
- Buildings may also be 'Net Zero carbon', releasing no carbon dioxide from fossil fuels during operations, but using some zero-carbon energy from off-site renewable sources
- 'Net Zero waste' implies that wastes, such as wastewater, are treated on-site

Buildings and communities that approach Net Zero energy, water and wastewater are widely recognized as achieving the highest environmental performance. For example, Net Zero performance is a central metric to the Cascadia Green Building Council's Living Building Challenge, one of the most prestigious and stringent green building rating systems.

It should be noted that the RDN does not expect all new construction in the Region to immediately adhere to a Net Zero performance standard. Rather, Net Zero is intended to serve as a long-term goal, to be pursued in the coming decades[1]. The RDN's Net Zero aspirations should not make new development uneconomical, nor should it undermine other priorities for sustainability, such as effective land use policy.

The goal of this project is to identify and advise strategies to reduce barriers to Net Zero systems, and thereby green building efforts in general.

1.2 the barriers to Net Zero

[Near] Net Zero buildings have been proven in a variety of developments throughout British Columbia and other jurisdictions (see Appendix 1: Net Zero Construction Case Studies). However, [Near] Net Zero buildings' widespread uptake is limited by key barriers. These barriers can be organized into two broad categories: market barriers and regulatory barriers.

[1] The RDN may consider adopting the Architecture 2030 Challenge's goals for 2030 – that all new buildings are zero carbon. Given BC's relatively clean electricity supply, it is possible to achieve this goal through the use of electric heat pump heating on an even shorter time frame. See: http://www.architecture2030.org/

Market Barriers
A variety of factors limit green buildings' market penetration. Perceived and real additional costs; a lack of understanding of the advantages of green buildings amongst the development community and building users; immature markets and a lack of installer capacity – all present barriers to green buildings' uptake. Key market barriers that have been noted in various jurisdictions include:

- *High first costs for some systems* – while many green building strategies provide no additional first costs, and some can even reduce costs, other strategies come at a premium. Often, operations, maintenance, and utilities savings present an attractive life cycle economic case for green buildings. However, homeowners and/or developers may not understand the value of these savings, nor have the capital resources to pay for first costs.

- *Split incentives* - Green buildings face a split incentive: developers or builders pay for the capital costs of greater energy efficiency, while owners or occupants reap the benefit of lower energy bills. Even small first cost premiums can deter developers from pursuing green buildings.

- *Lack of demand or desirability* - While there is a growing demand from buyers for green buildings, it frequently does not translate to an appropriate valuation of green buildings' true life cycle benefits. Buyers and renters often do not have a full appreciation for the life cycle energy savings associated with green buildings, nor the value of occupant health and productivity. Moreover, while the appeal of going green is growing, many buyers do not associate innovative green features with quality of life or status. These buyers are currently unwilling to pay premiums for green features, but will pay for luxury symbols, like granite counter tops.

- *Lack of industry capacity in green design and construction* - Green building markets and products are evolving rapidly. Developers, designers, contractors and trades all require greater knowledge and skills constructing green buildings.

    - *Lack of skills amongst builders* - Contractors and trades require training in green building technologies. Advanced framing methods, solar hot water installation, blow-in and rigid insulation, advanced window installation, in-floor radiant heating, geo-exchange heat pumps – all require skills that, while not particularly sophisticated, are under-represented in the industry. If builders are not equipped with these skills, options are dropped or installation quality suffers, and there can be significant public and industry backlash against green technologies.

    - *Lack of knowledge amongst designers* - Developers and design professionals would benefit from a greater understanding of the Integrated Design Process – where all members of the design team meet early in the process, to determine the most financially and ecologically optimal building options. Additionally, designers and builders may be unaware of new green building products availability, or increasing affordability.

Regulatory Barriers
Regulatory barriers add time and costs to green development, or prohibit certain green elements altogether. The added time, and risk of rejection, often means that many developers do not include innovative green building strategies in their building plans.

Regulatory barriers stem from both local government regulations and approvals processes, as well senior government regulations. Such barriers may include:

Local Government Barriers
- Protracted development and building permitting time lines for buildings incorporating innovative green building methods. This barrier is intricately tied to senior government building regulations and codes, which local governments must enforce. Local government concerns regarding liability and a lack of permitting staff experience with green building practices can slow approvals time lines for innovative green building strategies
- Zoning, land use and/or design guidelines that, often unintentionally, hinder green development
- Lack of enforcement of minimal Building Code energy standards

Senior Government Barriers

- Prescriptive building codes, and other regulations. For example, the BC Building Code is largely prescriptive, requiring 'equivalencies' for building practices not specified in the code. This lengthens local government approvals time lines for innovative green building practices that are not specified in the code
- Regulations that limit the use of financing instruments to overcome split incentives

Section 5 describes a variety of the barriers that hinder green building in the RDN. Please see Appendix 2 – Barriers to Green Building Case Studies for examples of barriers to green building found in other local government jurisdictions.

1.3 leadership on green, Net Zero buildings

The market and regulatory barriers identified in the RDN crop up repeatedly in local governments across BC, and North America more broadly. By taking action to reduce these barriers, the RDN can position itself as a leader in green building action, providing a model for other mid-sized municipalities to emulate. Indeed, some of the recommendations within this report include liaising with other local governments, senior government, the development community, and the public to arrive at solutions to barriers. The following section outlines the case for action on green buildings, to help the RDN building momentum in its green building efforts.

2. The Case for Action

Getting traction on new policy agendas involves establishing a compelling imperative for action, and underscoring the risks of inaction. As the RDN reduces barriers to green building, it will be important to articulate a persuasive case for action to the Board, municipal councils. staff, the development community, and the public at large.

Fortunately, green buildings and communities provide not only environmental benefits, but a variety of health, social, and fiscal benefits as well, providing many points of appeal for various stakeholders. These should be emphasized as the RDN engages stakeholders, and implements new policy and procedures to reduce barriers to green buildings.

2.1 addressing climate change

The balance of scientific evidence unequivocally shows the climate is changing, and the cause of this change is the surge in greenhouse gas emissions from human activity. The Intergovernmental Panel on Climate Change (IPCC) is the world's preeminent authority on climate science. The IPCC's 2007 *Fourth Assessment Report*, based on extensive review of the latest peer reviewed science, concluded global emissions need to peak around 2015, with 50% to 85% reductions below 2000 levels by 2050, if we are to avoid tipping points with dangerous disruptions such as severe agricultural collapses, water shortages, droughts, and sea level rise[1].

The economics is also increasingly clear. Commissioned by the British Government and authored by former World Bank Chief Economist Nicholas Stern, the *Economics of Climate Change* estimated the costs of reducing greenhouse gas emissions to a safe level were one percent of global gross domestic product; compared to a loss of up to 20% of global GDP if we do nothing. Stern concluded that 'the benefits of strong, early action on climate change outweigh the costs' [2].

In light of the international consensus on the dangers of climate change, the BC Government announced in 2007 a commitment to reduce provincial GHG emissions 33% below current levels by 2020 and 80% by 2050. While many factors influenced development of these targets, the most important from a risk management perspective is their consistency with scientific evidence on the scale of reductions necessary to avoid dangerous, runaway climate change. Bill 27 amendments to the Local Government Act require the RDN to incorporate "targets for the reduction of GHGs… and policies and actions of the local government proposed with respect to achieving those targets".

Moving to Net Zero building systems is essential to reducing emissions to levels deemed necessary by the climate science community and Provincial decree. Residential buildings account for approximately 10% of community greenhouse gas emissions in the RDN [3]. Encouraging Net Zero energy homes will significantly impact community emissions in the coming decades and can comprise part of the RDN's policy and action response to Bill 27 requirements. Moreover, it will set a critical precedent for other jurisdictions to emulate.

2.2 energy security

Over and above the threat of global climate change, green buildings can help strengthen energy security, by reducing dependence on conventional energy sources. This protects community members from rising energy prices due to:

Constrained supply and increasing demand

- The International Energy Agency's World Energy Outlook 2008 indicates global energy demand will increase 45% between now and 2030[4], largely due to the growth in demand in Asia and the Middle East
- Supplies of many conventional energy forms, notably oil, are declining, and new sources of conventional energy have higher production costs, due to inaccessibility, e.g. tar sands, or tighter socio-economic and environmental standards, e.g. coal

[1] IPCC. Climate Change 2007: Synthesis Report. http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm
[2] HM Treasury. Stern Review on the Economics of Climate Change. http://www.hm-treasury.gov.uk/sternreview_index.htm
[3] BC CEEI Initiative. April 2009. Nanaimo Regional District Community Energy & Greenhouse Gas Emissions Inventory: 2007.
[4] International Energy Association. World Energy Outlook 2008 Fact Sheet: Global Energy Trends.

Volatile energy prices
Volatile energy prices are arguably as detrimental as price spikes because it creates great uncertainty about the future, compromising budget forecasting and long term planning. Owners and tenants of buildings are especially impacted by changes to natural gas and electricity prices, the two primary energy sources used to heat and provide power to buildings.

Natural Gas
The natural gas markets of Canada and the US are fully integrated, with major pipelines delivering gas to the US market at multiple points along the border. As such, the price of natural gas in British Columbia is closely connected to the North American market, and price forecasts for the wellhead price of natural gas for the North American Market are applicable to the British Columbia context. The price that residential and commercial customers in the RDN pay for natural gas is determined partly by the wellhead price, but also by a number of additional factors including local delivery costs and the price Terasen has paid, which is comprised of current prices and futures that is has purchased.

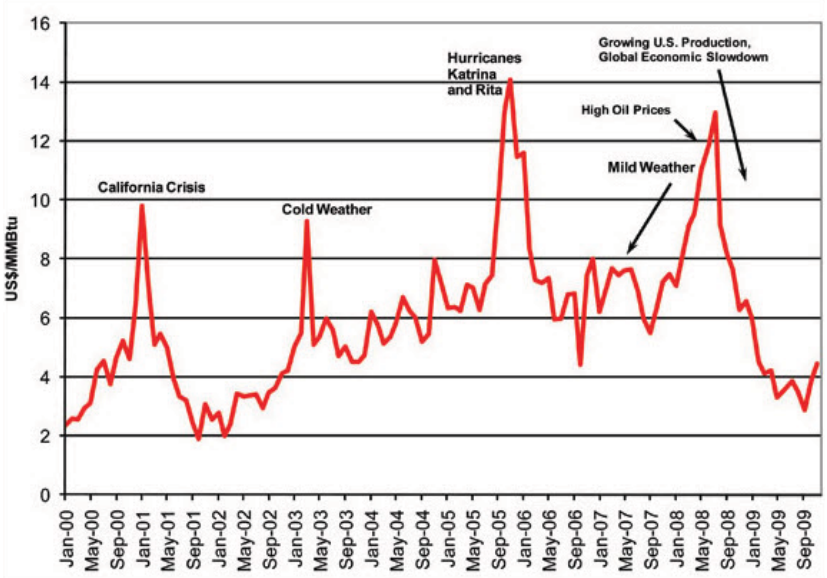


Figure 1: Natural gas price trends over the past decade.
Source: National Energy Bureau of Canada. 2009.
http://www.neb-one.gc.ca/clf-nsi/rnrgynfmtn/prcng/ntrlgs/cndnmrk-eng.html

The price of natural gas has been very volatile this decade with, severe weather events exposing the vulnerability of the North American supply and distribution network to disruption (Figure 1). Also illustrated in Figure 1 is the connection of the natural gas market to oil price and production and general global and US economic patterns. Because of the vulnerabilities in the natural gas market, wellhead prices could continue to fluctuate in the future.

Electricity
BC Hydro (BCH) currently supplies electricity at nearly the cheapest rates in North America. BCH has recently implemented a two-tiered 'Conservation Rate', charging more per kWh for customers consuming 11,000 kWh/ year (average BC consumption) or more. As many of Nanaimo's homes are electrically heated, increasing electricity prices stands to impact community energy spending substantially. An electrically heated home using 22,000 kWh/ year will be charged $169 more per year under this scheme.

BCH's infrastructure is aging. BCH anticipates a growth in BC's electrical demand of 25-40% to 2030, to be met by pursuing a variety of new power sources as well as conservation and efficiency programs[5]. BCH's average rates across BC will increase by 11% between 2008 and 2010[6] . Further modest rate increases are widely anticipated under this plan.

[Near] Net Zero buildings can reduce the RDN's community energy expenditures, buffering residents and businesses from volatile, rising energy prices.

[5] BC Hydro. The Long-term Plan to Meet BC's Future Electricity Needs. http://www.bchydro.com/etc/medialib/internet/documents/planning_regulatory/iep_ltap/lighting_the_way.Par.0001.File.BCH-Lighting+The+Way+for+web.pdf
[6] BC Hydro. 2009. Residential Rates. http://www.bchydro.com/youraccount/content/residential_rates.jsp#h_r

2.3 water scarcity

Green building strategies play a crucial role in water conservation. While a summary of the RDN's water supply and security is out of the scope of this project, it should be noted that reducing consumption can reduce long term Regional District expenditures on civic water supply and wastewater conveyance infrastructure, as well as insure against the long term threats of water shortages.

2.4 supporting local business and development

Encouraging Net Zero buildings and broader energy and water conservation efforts creates positive economic spin-offs. It also prepares the development community for coming changes to the BC Building Code, and senior governments' climate action and building related initiatives.

Local Economic Development
BC communities typically spend $2500 to $4000 on energy per capita per annum. The vast majority of this capital leaves town, bound for large utilities. Investing in energy conservation and efficiency creates four times as many jobs as providing new supplies of conventional energy[7]. Much of this latter job creation is from the re-spending effect of avoided energy costs – supplying revenue to local businesses.

Staying ahead of the Regulatory Curve
Increasingly stringent energy performance requirements are expected to be integrated in building codes over the coming decades. The Ministry of Housing and Social Development has informally indicated that it will follow energy efficiency requirements mandated in the City of Vancouver's Green Building Strategy. In its current draft iteration, this strategy includes plans to rapidly increase the energy efficiency performance requirements for Part 9 (low-rise residential) construction, perhaps halving energy intensity of new construction by the early 2020's.

Wise local governments, developers and builders recognize that it is better to be ahead of the regulatory curve than behind it. The RDN can lessen the difficulty of adjusting to future code changes by encouraging greater performance in buildings now.

2.5 encouraging healthy homes and buildings

Combined with other green building strategies, Net Zero homes can provide healthy indoor environments. These buildings out-perform typical new construction in terms of indoor air quality, and other environmental quality attributes such as daylighting. Occupant health resonates strongly with citizens, providing a powerful rationale for local governments' green building programs. Moreover, it can be a major marketing advantage for green buildings. The RDN can emphasize green buildings' positive impacts on health as it promotes its green building policies and actions.

[7] Hornung, Robert. 1998. Canadian Solutions: Practical and Affordable Steps to Fight Climate Change. David Suzuki Foundation; Hornung, Robert. 1997. Comparative Analysis of Employment from Air Emission Reduction Measures. Pembina Institute

3. The Role of Local Government

As the RDN looks to encourage green building and reduce barriers, it is important to consider what roles the RDN is best equipped to undertake, and what will make the greatest environmental impact community-wide. Different local governments and their departments play a variety of roles impacting buildings:

Land Use Planning
Land use planning is the traditional domain of local governments. Land use, and the building typologies different land uses induce, profoundly influences building energy performance. Buildings with less conditioned floor space per capita, and those which share walls between units, typically use less energy per capita energy than buildings with more floor space. Indeed, the GLOBE Foundation reports that townhomes in British Columbia use only 60% of the energy per capita of single family residences[1]. Likewise, a more compact single family home uses less energy than a large single family home.

What is more, compact land use further outperforms sprawl in terms emissions and other environmental variables, community health, and local government finance. For these reasons, good land use planning presents local governments' greatest tool to impact communities' buildings energy profiles.

Development and Building Approvals
The RDN is responsible for the review and issuance of development permits within Electoral Areas, and building permits for specified portions of the Region's Electoral Areas[2]. During development and building approval process, the RDN ensures that developments meet local planning and design standards, and enforces the BC Building Code. For subdivision, all applications in the region's Electoral Areas are subject to approval by the Provincial approving officer at the Ministry of Transportation and Infrastructure. Map 1 shows building inspection areas in the RDN.

[1] GLOBE Foundation. 2007. The Endless Energy Project: A Blueprint for Complete Energy Self-Sufficiency in British Columbia.
[2] Development permits are only required for Development Permit Areas established in Official Community Plans, and Building Permits are only required in Building Inspection Areas. In addition, planning for Electoral Area B is provided by the Islands Trust, not the RDN.

Delays during approvals present a powerful barrier to green building. Leading local governments are reducing delays and uncertainty for innovative green building strategies.

Approvals processes also provide an opportunity to enforce minimal Provincial standards. The BC Ministry of Housing and Development is expected to implement more stringent BC Building Code energy requirements in 2010 or 2011. These will likely specify performance equivalent to EnerGuide 80 in Part 9 construction, and the ASHRAE 90.1 2007 or 2010 building energy performance standard in Part 3 construction. The Ministry has indicated that further increases to code energy requirements can be expected in coming years.

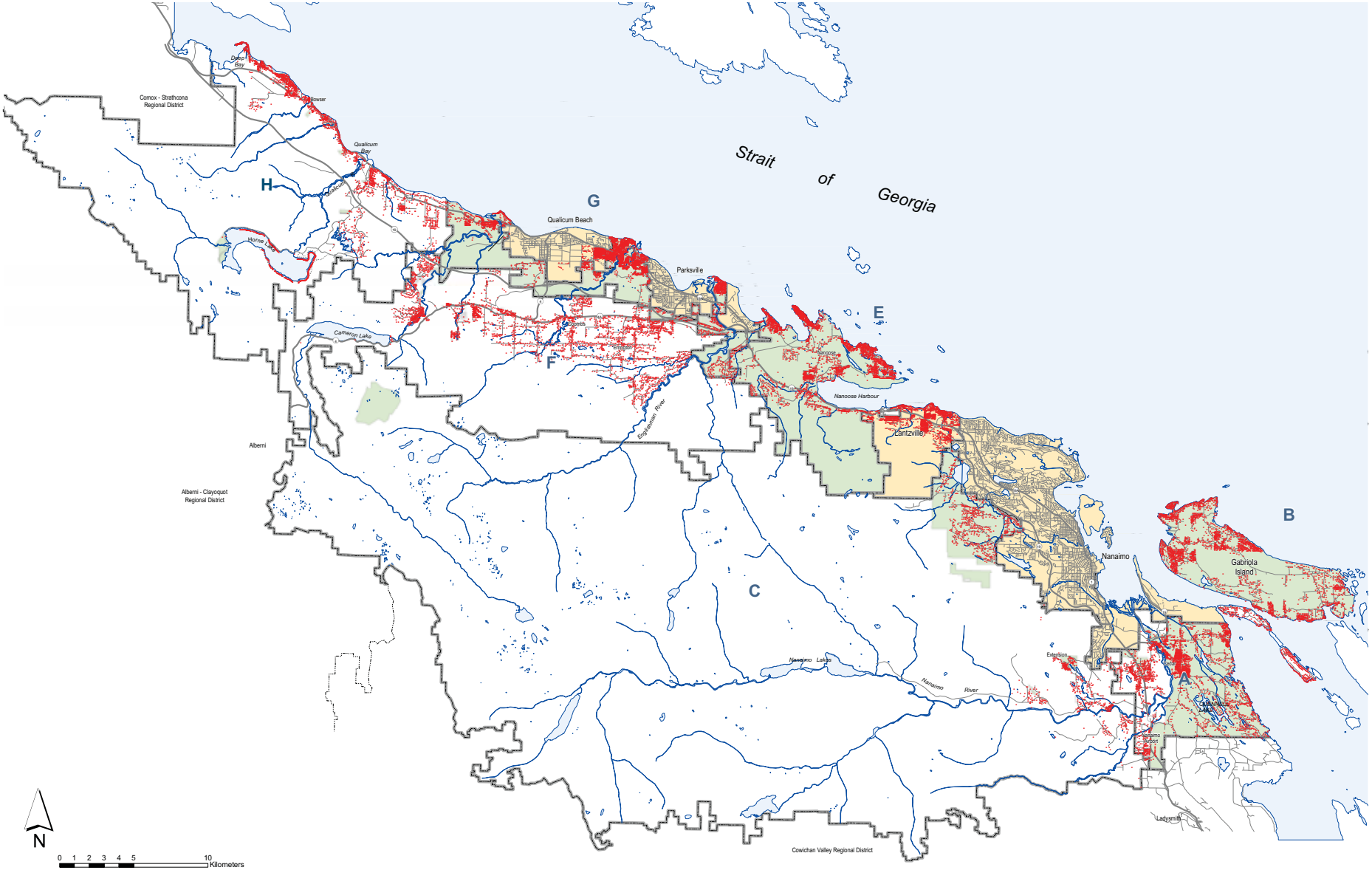
Evidence from BC jurisdictions that have implemented comparable energy performance requirements suggests that the majority of new construction is not meeting minimal requirements. It appears likely that buildings in the RDN will face similar challenges, if greater attention is not paid to more rigourous enforcement, and industry capacity building.

Providing Incentives and Regulating
Local Governments are not traditionally considered responsible for regulating building performance beyond the BC Building Code. However, they can provide incentives to green construction. Incentive tools used in BC include density bonusing, smarter development cost charge regimes, revitalization tax exemption bylaws, permit fee rebates, and others.

Some local governments are going further, using existing powers to effectively regulate green building attributes. Regulatory tools include: development permit area guidelines; and policies guiding green building expectations during subdivision or rezoning applications.

Capacity Building
One of the greatest barriers to widespread conversion to green, energy efficient buildings is the knowledge and capacity of building professionals. Continuous professional learning is vital to the advancement of green buildings[3].

[3] Canadian Urban Institute. 2008. Sustainable Building: Canada on the Move. http://www.canurb.com/media/pdf/SustainabilityReport_Canada.pdf



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Regional District of Nanaimo
BUILDING INSPECTION AREAS

LEGEND
- Building Inspection Area
- Electoral Area Boundary
- Municipality

February 2006

Map 1 - Building Inspection Areas in the RDN.

Local governments can encourage trades participation in programs designed to increase capacity in green technologies installation.

Education
The public needs to know the value of green buildings, to build markets for green buildings to drive widespread adoption. Leading local governments are engaging in education campaigns, often tied to local or senior government green building incentive programs.

Encouraging energy efficient retrofits in existing buildings is especially important to meeting emissions reductions and energy security objectives. Education about the value of energy efficiency can be combined with distributing information on 3rd party incentives for home energy retrofits. As a case in point, local governments that promote the Provincial LiveSmart BC Home Retrofit Incentive Program note approximately two times the uptake of such programs amongst their communities, compared to baseline averages.

Financing
Local governments can connect projects to capital, thereby financing the premiums of green construction. Loans are paid back through savings in energy and water costs. Local governments can serve as the lender, tying repayment to the properties' energy saving using tools like property taxes or local improvement charges. Alternately, local governments can connect building projects to third party sources of capital, such as banks, credit unions, senior government institutions, or Energy Services Companies (ESCOs).

3.1 strategic policy selection

There are many municipal green building programs; few are being actively implemented. In order to increase the likelihood of the RDN's success encouraging green buildings, the RDN should consider which of the above roles best align with its strengths, current initiatives, and available resources.

Section 6, and Appendix 4 provide greater detail on potential tools to forward Net Zero buildings. Section 7 outlines recommendations for the RDN to pursue.

3.2 market transformation

In addition to considering its own capacity, the RDN should frame its efforts using the principles of market transformation. Market transformation theory is based on observing how innovations are adopted and diffused through society and the marketplace. New technologies like hybrid electric vehicles, or new practices like smart growth will be taken up first by innovators, then early adopters and successively larger and larger percentages of the market.

Policies designed to overcome specific barriers can dramatically accelerate this process.

The market transformation curve in Figure 2 explains the intervention of some of these policies over time. Amongst many other design considerations, the context will determine what tool is most appropriate at what time with what constituency.

The different types of policies do not necessarily need to occur sequentially as shown in the market transformation curve. For example, local governments may choose to immediately regulate. However, experience shows that to be effective and successful, regulations need to be supported by industry and local government capacity – essential elements on the transformation curve.

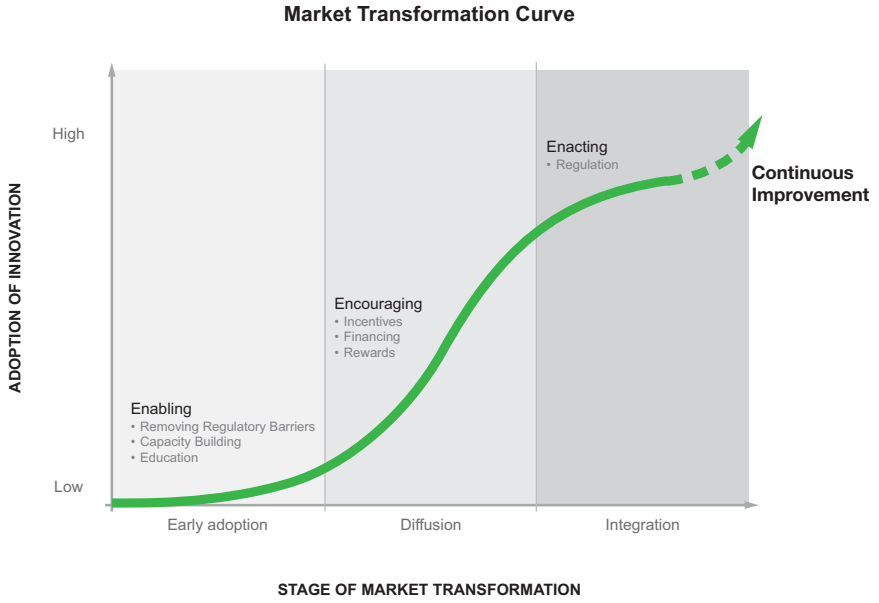


Figure 2: The Market Transformation Curve

4. Net Zero Archetypes

Net Zero Archetypes are a collection of building strategies and technologies that when appropriately combined will result in a Net Zero building. These archetypes were developed to guide the RDN in the sorts of building systems to encourage, and to test how regulatory and market barriers may hinder their implementation.

Net Zero Archetype strategies were identified separately for:

- Energy Systems
- Water and liquid waste systems

4.1 criteria for developing archetypes

The project team was asked to develop archetypal building strategies that come "as close to Net Zero for the consumption of energy and water, and Net Zero generation of liquid waste, as is reasonably possible." This definition is a pragmatic version of a Net Zero building – one that aspires to achieve Net Zero operation, but balances Net Zero goals with other important objectives.

The following objectives were developed by the project team to guide the development of reasonable [Near] Net Zero building archetypes:

1. Implementation and operation costs are within practical limits of most property developers and owners, though additional financing mechanisms may facilitate adoption more widely. Ideally, capital costs are justifiable based on life cycle cost reductions.

2. Multiple sustainability impacts of Net Zero design options are considered, as well as the relative impact of each option.

    - If the embodied energy of a building material is comparable to the energy it will save during operations, its inclusion should not be prioritized
    - Strategies that allow for Net Zero buildings' operations, but require large amounts of land, should not be prioritized. Net Zero buildings need to be compatible with walkable and transit supportive urban forms, that lessen vehicle requirements and emissions

3. Renewable electricity and heat supplies can account for much lower emissions than fossil fuels. If supplied by off-site renewables, buildings can be 'Net Zero Emissions' but not 'Net Zero Energy'. Priorities for developing buildings should come as close to Net Zero Energy as reasonably possible, then aiming to become Net Zero Emissions through the use of no-carbon fuel supply.

4. Scale is important to consider. A building can still be considered Net Zero, even if it relies on shared community facilities. In many instances, this is the most environmentally appropriate and cost effective means of developing green buildings.

These considerations are used to guide the selection of Net Zero archetypal design strategies, to ensure that pursuing Net Zero design strategies do not undermine overall community sustainability. The guidance these considerations provide should inform future green building efforts in the RDN.

4.2 tiers of design considerations to prioritize net zero strategies

The choices made during a building's planning, design, construction and occupancy all must align for it to achieve the highest possible environmental performance. Within the planning and design phase, different strategies should be considered sequentially, to maximize building performance. 'Tiers' of design strategies were specified within the Net Zero archetypes, reflective of different considerations in the design process:

1. Passive design
Reducing the need for energy and water supplied to a building.

2. Efficient systems
Delivering the energy and water needed most efficiently.

3. Alternative sources
Supplying the energy and water needed from on-site renewable sources on a net-annual basis.

When developing a green building policy, it is important to recognize that passive design and efficient systems are essential to approaching Net Zero. These strategies can be applied to all buildings, whether they feature traditional energy and water sources like a natural gas furnace, or alternate sources such as geo-exchange systems and on-site rainwater collection. Only once passive design and efficiency strategies are maximized can a building achieve Net Zero using alternate source technologies.

4.3 development scenarios

Net Zero strategies differ with building types. To determine the building type and scale of development applicable to the Archetypes the RDN chose to focus on two Development Scenarios:

- Single Family Parcel: Single family detached dwelling, potentially not serviced by community water or sewer, located on a acre parcel
- Mixed Use Community Core: Street oriented development, retail and office space at street level, residential units above. Retail unit size: 300 square metres, residential density, 20 units per hectare. Potentially not serviced with community sewer or water

These development scenarios are based on development patterns considered most applicable across the RDN. In particular, in 2006 single family detached dwellings made up over 85 per cent of residential dwellings in the Regional District, and will likely constitute a significant proportion of new construction for the foreseeable future. As such, it is essential to gain a better understanding of how to develop very low impact, [Near] Net Zero single family homes.

The mixed use community core scenario reflects a pattern of development that is especially well suited to the Village Centres across the region. While this type of development is less common today, it is envisioned that mixed use Village Centres will become more prevalent as the population in the region increases, as demand for local services and amenities outside urban areas grow, and as the Regional Growth Strategy is implemented over time.

With these two Net Zero archetypes providing the basis for development scenarios in the region, strategies to encourage these scenarios can be incorporated across a great deal of the new construction planned for the RDN.

4.4 net zero archetypes

The following four graphical representations illustrate the basic elements of the Net Zero archetypes. Archetypal strategies are illustrated for both development scenarios:

- Single family
- Mixed use community core

These development scenario illustrations are broken down into:

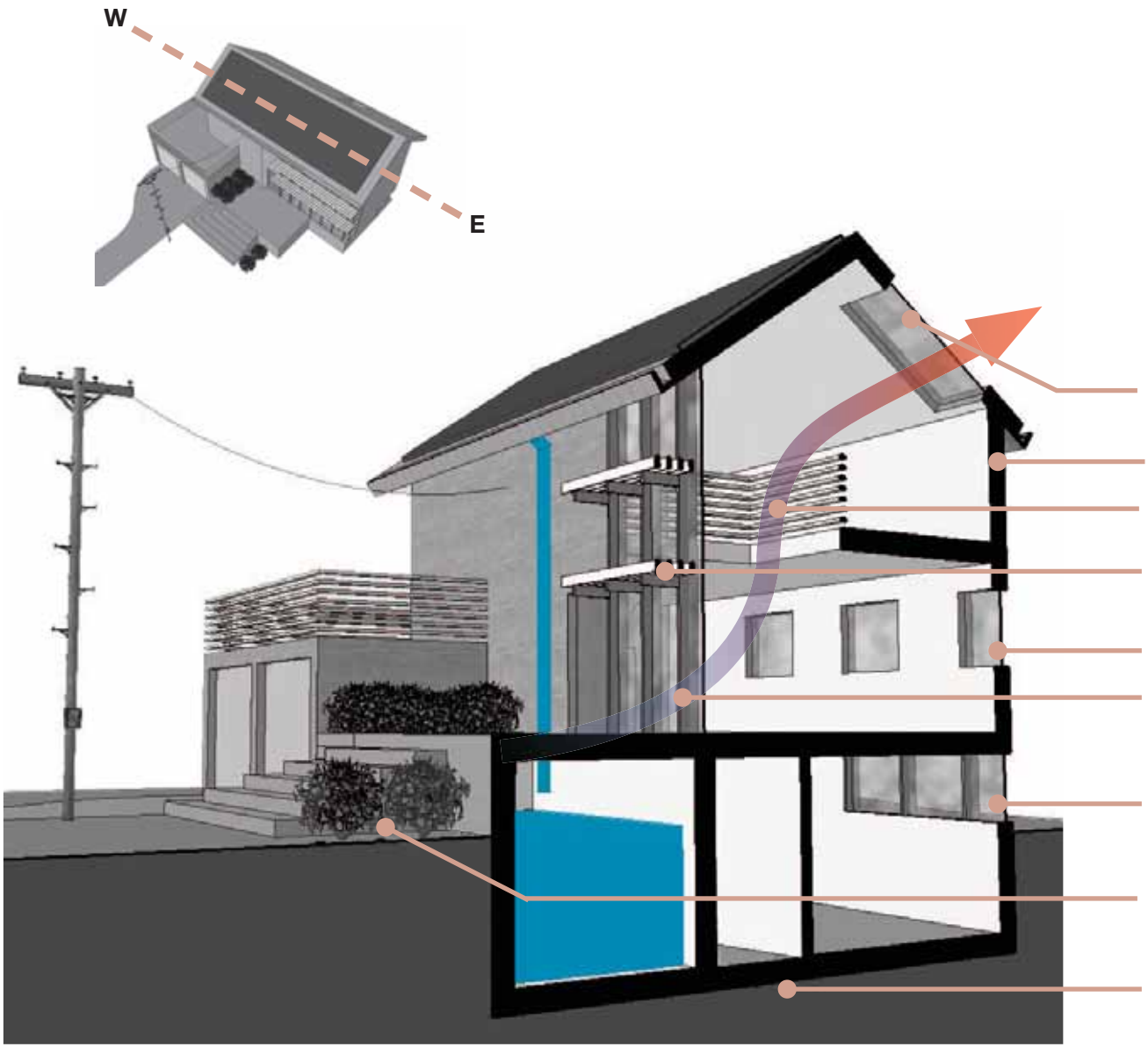
- Passive Design and Energy Efficiency Strategies, comprising Tiers 1 and 2 strategies
- Alternate Sources, comprising Tier 3 strategies

Strategies to achieve both [Near] Net Zero water and energy are included in the illustrations. These strategies represent a few of the possible strategies available to design teams and owners to aim at Net Zero. Each project requires its own assessment and design process to determine which strategies are best suited to site specific conditions. However, focussing on Tier 1 and 2 strategies first is typically best practice in moving towards Net Zero.

Appendix 3 – Archetypes Matrix outlines the complete archetype strategies associated with each development scenario and tier, for both energy and water/ liquid waste systems.

single family parcel

Passive Design + Efficiency Strategies



Possible Strategies

Solar Orientation
The home is oriented along an east-west axis to take full advantage of the southern sun and to limit the wall area exposed to the intense radiative heat gain of the west sun.

Compact Building Form
The building's form is compact, reducing the exterior wall area.

Air Tightness
Reduce air-leakage to an absolute minimum to improve energy performance and occupant comfort, without compromising indoor air quality.

High Efficiency Systems
- Compact fluorescent light bulbs
- High efficiency hot water tank
- Heat recovery ventilator
- EnergyStar appliance

Skylight with Vent
Provides natural light and aids in natural ventilation.

Super-Insulated Envelope

Natural Ventilation
Double height spaces take advantage of stack effect.

Solar Shading
To prevent overheating in summer and to provide passive solar heating in winter.

Triple Glazed Windows

Passive Solar Heating
Lots of glazing on the south facade.

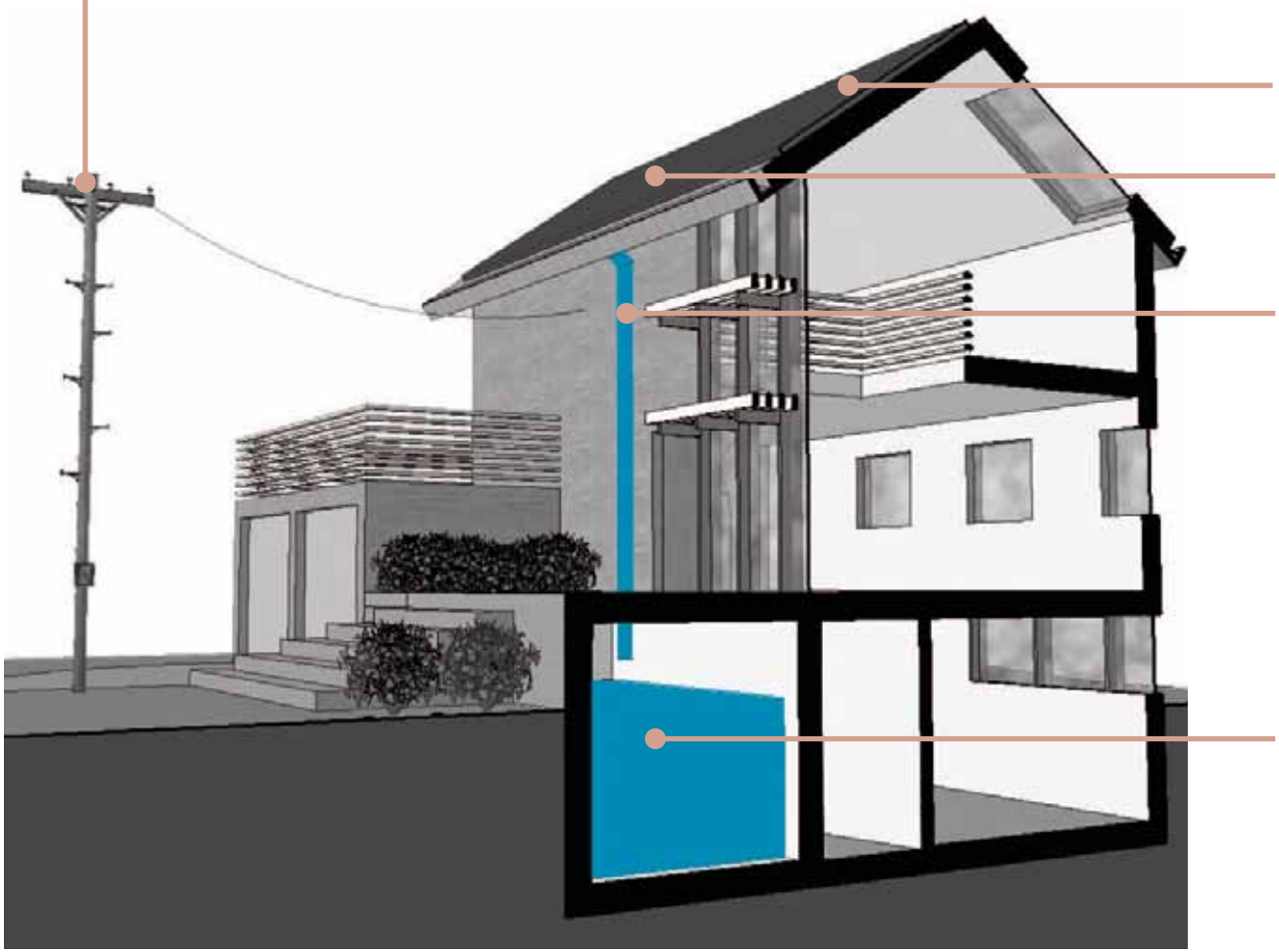
Natural Light in the Basement

Waterwise Landscaping
No irrigation required.

High R-Value Insulation Under Slab

single family parcel

Alternate Sources



Possible Strategies

Net-Metering
When the home generates more energy than it consumes, such as in the summer time, it sells the energy back to the grid. When it needs more energy than it can produce, such as in the winter, it draws from the grid. The absence of batteries significantly reduces the cost of photovoltaic systems.

Photovoltaic Panels
Electrical generation.

Solar Hot Water
Solar heated water is used for domestic uses. High efficiency electrical back-up installed.

Rainwater Collection
Use appropriate roofing materials to prevent contamination of rainwater runoff (metals with heavy metal-free finish).

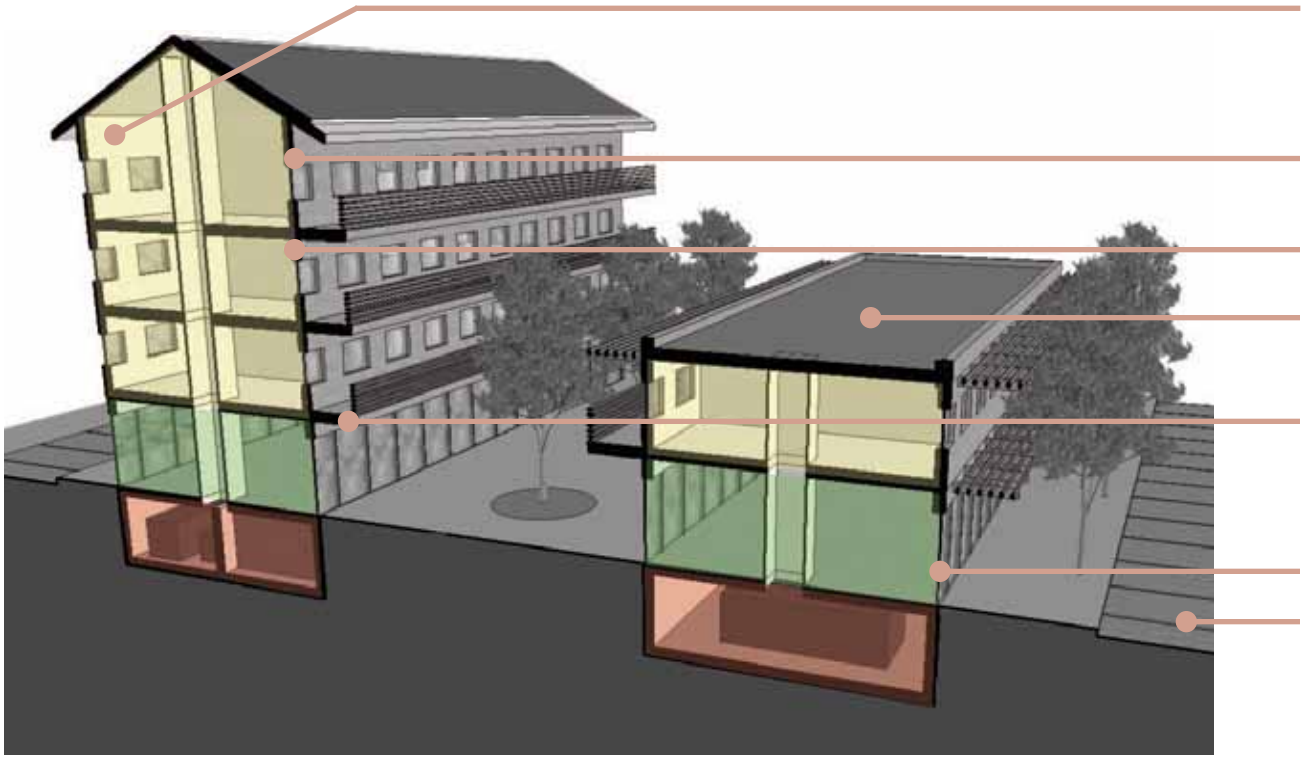
Grey Water Reuse
Waste water from fixtures such as showers and sinks is treated and reused.

Rainwater Collection Tank
Rainwater is collected from the roof and fed to an underground tank. It is used for showers, sewage conveyance and irrigation.

mixed-use community core

Passive Design + Efficiency Strategies

- Residential
- Commercial
- Mechanical



Possible Strategies

Solar Orientation
The development is oriented along an east-west axis to take full advantage of the southern sun and to limit the wall area exposed to the intense radiative heat gain of the west sun.

Building Form
The courtyard and exterior corridors allows for passive solar heating, enables natural ventilation for each unit and eliminates the heating demand for semi-public spaces.

Air Tightness
Reduce air-leakage to an absolute minimum to improve energy performance and occupant comfort, without compromising indoor air quality.

High-Efficiency Systems in Units
- Compact fluorescent light bulbs
- EnergyStar appliances
- Commissioning of systems

Natural Ventilation
Single-stacking the units permits cross ventilation.

Super Insulated Envelope

Green Roof
Reduce stormwater runoff, restores habitat and provides amenity.

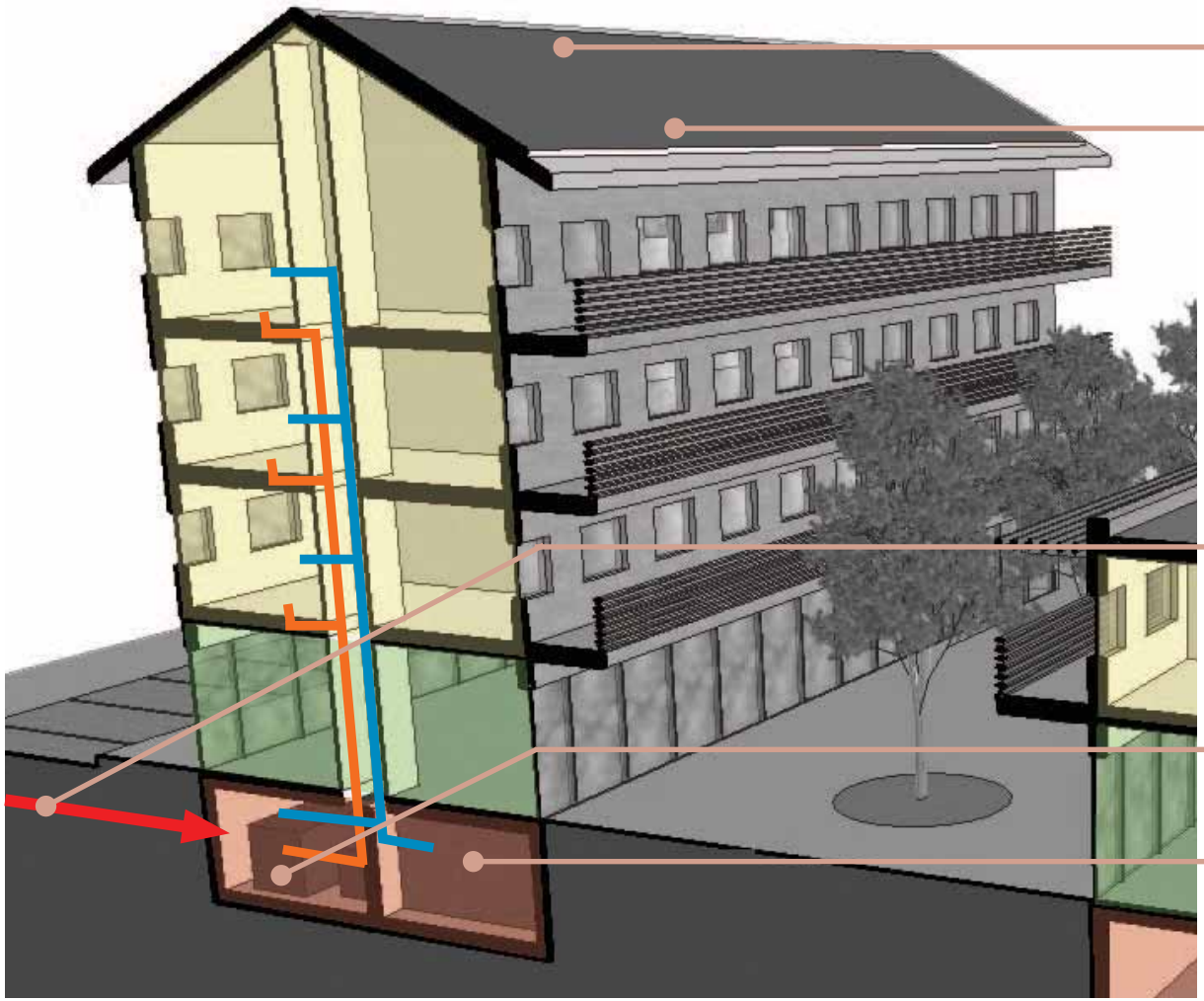
Solar Shading
Exterior access to suites acts as solar shading to prevent overheating in summer and to provide passive solar heating in winter.

Triple Glazed Windows

Permeable Paving
Parking spaces are paved with permeable paving to reduce stormwater runoff.

mixed-use community core

Alternate Sources



Possible Strategies

Net Metering

When the home generates more energy than it consumes, such as in the summer time, it sells the energy back to the grid. When it needs more energy than it can produce, such as in the winter, it draws from the grid. The absence of batteries significantly reduces the cost of photovoltaic systems.

Photovoltaic Panels

Electrical generation.

Rainwater Collection

Use appropriate roofing materials (metals with heavy metal-free finishes) to prevent contamination of rainwater runoff.

District Heat and Hot Water

Energy in the form of steam or hot water is delivered to the development from a local energy utility which uses sustainable forms of heat generation, such as biomass.

Packaged On-Site Waste Treatment

Tertiary treatment of wastewater for reuse in toilets.

Rainwater Collection Tank

Rainwater is collected from the roof and fed to an underground tank. It is used for showers, sewage conveyance and irrigation.

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5. Identifying Barriers to Net Zero Building

This section identifies barriers to Net Zero buildings that exist in the RDN. Barriers to the Net Zero Archetypes are organized into a Compliance Pathway. The Compliance Pathway is a graphic tool, situating barriers and potential solutions within the RDN's approvals process, the broader planning process and the development market.

5.1 identifying barriers: methodology

The following tasks were undertaken to identify barriers to green buildings, and their potential solutions.

1. Research Common Barriers
The project team identified barriers that commonly hinder green buildings in British Columbia. Barriers and potential solutions were identified through a literature review[1]; polling local governments and building professionals for case studies of barriers; and the consultant team's own professional experience.

2. Review Development Approvals Documents
Important documents in the development approvals process were reviewed. These included the RDN's:

- Amendment Application for rezoning
- Community and Site Impact Review Form
- Sustainable Community Builder Checklist
- Development Permit Application

Opportunities within these documents and processes to encourage Net Zero buildings, and potential barriers, were assessed.

[1] Valuable sources include: Deborah Curran. 2002. Cutting Green Tape: An Action Plan for Removing Regulatory Barriers to Green Innovations. West Coast Environmental Law; David Eisenberg & Sonja Persram. 2009. Code, Regulatory and Systemic Barriers Affecting Living Building Projects. Cascadia Region Green Building Council. ; Susan Rutherford. 2006. The Green Buildings Guide: Tools for Local Governments to Promote Site Sustainability. West Coast Environmental Law.

3. Review Regulatory and Approvals History
The RDN supplied anecdotal approvals process histories, outlining the length of approvals time typical for green building projects. Time is money in the development industry, and length of time during approvals is often a barrier to green building. These historical trends were further discussed during the Barriers and Opportunities Identification workshop with staff.

4. Barriers and Opportunities Identification Workshops
On November 26th, two 2.5 hour workshops were hosted, one with RDN staff and one with the local stakeholders. Both staff and the stakeholders were given the opportunity to voice barriers and opportunities they perceive to green building in the RDN. These discussions centered on what aspects of the RDN's development and building approvals processes currently hinder green building practices. Staff were asked to verify the draft Compliance Pathway, and suggest further additions of barriers and steps in the process. Input from staff and stakeholders has been incorporated into the current draft iteration of the Compliance Pathway.

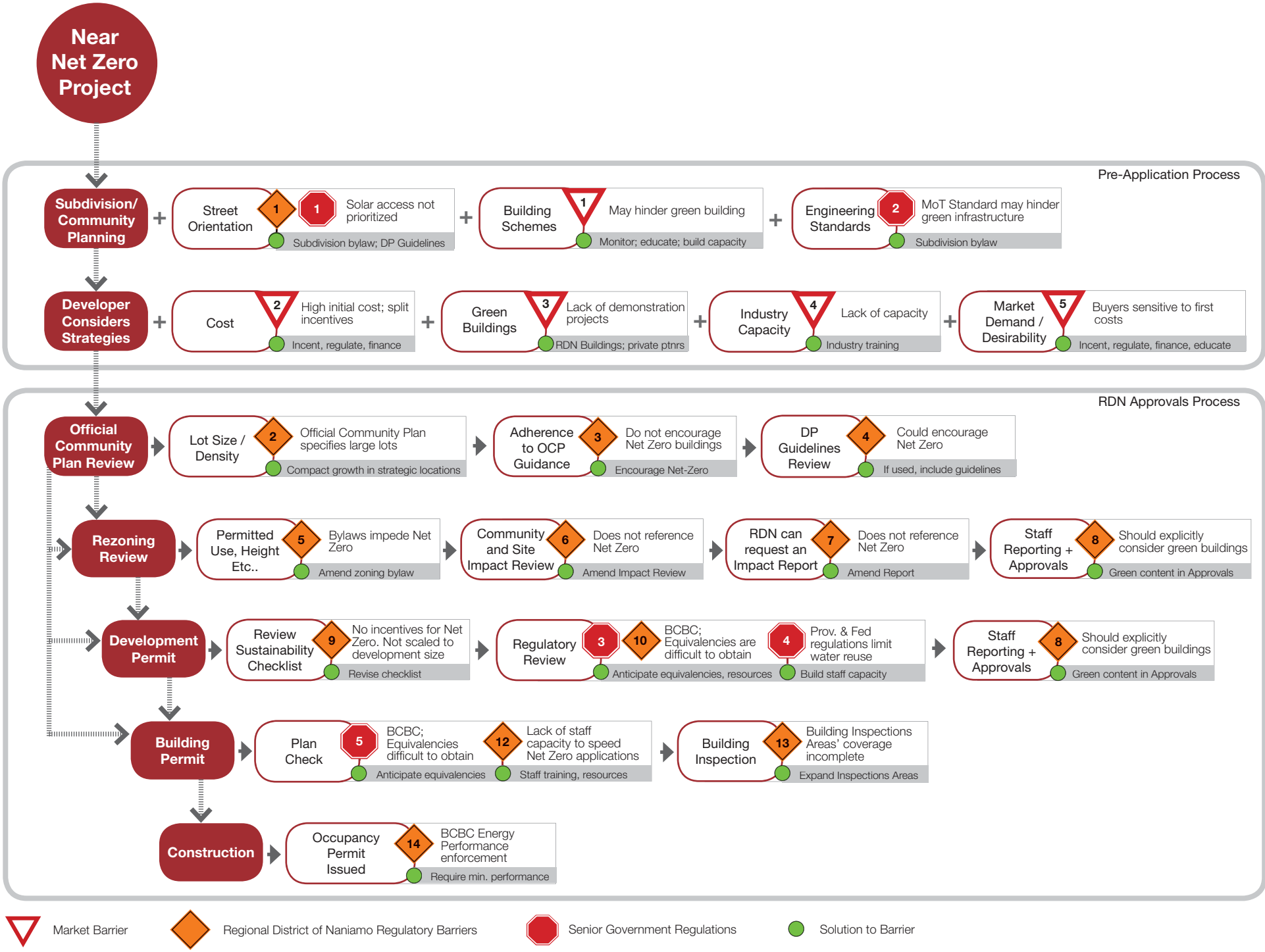
5.2 compliance pathways, barriers + potential solutions

Based on these sources of information, this draft Compliance Pathway was developed. The Compliance Pathway follows a [Near] Net Zero project as it proceeds through neighbourhood planning and market decisions, then through the RDN's approvals process. The Approval process consists of an Official Community Plan Review, then Rezoning Review (if applicable), Development Permit (if applicable), Building Permit (if applicable), and lastly construction.

The Compliance Pathway notes barriers, and potential solutions, identified during the workshops and background research. Barriers are categorized:

- RDN Regulatory Barriers
- Senior Government Regulatory Barriers

Barriers within each category are numbered, referring the reader to descriptions of each barrier in the following subsections. These subsections provide context for each barrier and potential solutions. These potential solutions serve only as a description of means to address barriers, not necessarily recommendations - various potential solutions are further developed as Recommendations in Section 7.



Michel Labrie Architect

HB LANARC

5.3 market barriers

1 Building Schemes may Hinder Green Building

CONTEXT

Building schemes are covenants between developers and property owners registered at the time of subdivision. Building schemes guide the appearance and character of buildings. During the Barriers and Opportunities Workshop, Planning staff noted building schemes could present barriers to green building, by specifying characteristics that prohibit strategies such as water wise landscaping, passive design features, renewable energy, and others. They may also specify overly large lots. Schemes vary between developments, so the extent of barriers will vary with different schemes.

POTENTIAL SOLUTIONS

Liaise with developers, designers, the Home Builders Association, the Real Estate Foundation, and the Vancouver Island Real Estate Board, to remove any barriers, potentially including:

- Height limitations potentially hindering renewable energy
- Roofing material schemes that prohibit white roofs, green roofs, or renewable energy
- Roof slope limiting solar potential
- Planting incompatible with xeriscaping
- Unsustainable material specifications

Encourage developers to promote environmentally appropriate Building Schemess as selling features - ‘Green Schemes’.

2 Costs; Split Incentives

CONTEXT

Many green building technologies come at no premium cost. However, especially for residential buildings, greater energy performance comes at a premium. Nevertheless, these higher initial costs are often paid back over the life of the building, even for advanced systems found in exceptionally high performance, net-zero buildings.

Unfortunately, Net Zero buildings suffer a split incentive: Developers pay for added capital costs, while residents/occupants reap the benefits of lower utility bills and other benefits (health, productivity, etc). Both RDN Staff and stakeholders noted this key barrier.

Incentives, regulatory measures, and financing all serve to reduce the problem of higher initial costs split incentives.

POTENTIAL SOLUTIONS

Incent greener buildings

- Incentives should be implemented in conjunction with a revised sustainability checklist
- Incentive options include:
    - Development and Building Permit fee rebates
    - Permit Fast-tracking
    - Density Transfers and Bonuses where appropriate

Regulate greener buildings

Finance energy efficiency

- Explore Property Assessed Clean Energy Financing, tying repayment of energy efficiency loans to property taxes, local improvement charges, etc.
- Third party financing opportunities may be sought with senior government lenders, Energy Service Companies, or private lenders as green loan programs come online.
    - Encourage large developments to seek 3rd party financing
    - Advertise financing schemes supporting home energy retrofits, such as Home Renovation Loan programs
    - Continue to monitor opportunities in the rapidly evolving world of green building finance

3 Lack of Demonstration Projects

CONTEXT

Demonstration projects are important to catalyze the uptake of green building. Precedent projects provide approvals staff confidence in innovative technologies' safety, and provide builders and developers with feasible examples of their application.

POTENTIAL SOLUTIONS

Encourage [Near] Net Zero RDN building projects, or innovative community developments, to advance green building practices. Use these opportunities to address barriers to green building in the RDN's approvals process, to streamline subsequent applications.

Determine opportunities for future demonstration projects. Liaise with leading developers, RDN capital planning

- Seek industry expertise on promising technology that faces regulatory barriers, and consider incorporation into project
- Develop a green design and building competition

Involve permitting staff closely in the approvals process for these projects

- Develop experience and acceptable equivalencies
- Fast-track projects to as great an extent as practical, building capacity for future green fast-tracking initiatives

4 Lack of Industry Capacity

CONTEXT

Contractors and trades require new knowledge and skill-sets to build green. Examples of green building techniques include: Advanced framing, solar hot water installation, blow-in or rigid insulation installation, geo-exchange installation, extensive air-sealing etc. While these techniques are not especially difficult, they do differ from conventional practice. Lack of workforce training contributes to high costs and under performance of green buildings. Stakeholders at the Barriers and Opportunities workshop noted the lack of industry capacity as a critical barrier to Net Zero building.

POTENTIAL SOLUTIONS

Organize/sponsor events for industry capacity building

- Combine with staff capacity building initiatives

5 Buyers Sensitive to First Costs

CONTEXT

Buyers and renters frequently do not recognize the life cycle costs and health value of green buildings, and are limited in their decision-making to first cost considerations. Staff and stakeholders at the Barriers and Opportunities Workshop noted that buyers need to be educated about life cycle costing, the health impacts of green buildings, and its environmental import.

Stakeholders noted the great sensitivity of mid-market buyers to first costs. Even 2-3% premiums on more energy efficient buildings deters many buyers, despite their attractive life cycle-cost case. Education, combined with incentives, regulations, and/or financing, can help overcome first cost sensitivities.

POTENTIAL SOLUTIONS

Reduce first costs to buyers using incentives, regulatory tools and/or green building financing

- See Market Barrier 2 for methods of reducing first costs

Buyer education

- Public responds best to appeals to status, health
- Life cycle cost considerations should also be emphasized
- Coordinate with the Vancouver Island Real Estate Board. Real estate professionals should understand the value of green buildings, and convey these values to buyers

5.4 RDN regulatory barriers

1 Solar access not prioritized during subdivision and community planning

CONTEXT

Solar access is crucial to buildings' passive solar heating. Passive solar can provide substantial portions of the annual heating load in our climate, significantly reducing energy use. Community planning and subdivision are the most important stages to ensure that blocks are laid out so that buildings have adequate orientation and solar exposure for passive design. Ideally, streets will be oriented lengthwise along an east west axis, maximizing Southern exposure for buildings along these streets.

During subdivision and community planning, solar orientation could be better prioritized. Currently, it may be too readily sacrificed in favour of other considerations, such as road access, servicing conduits, and views.

POTENTIAL SOLUTIONS

Prioritize solar access during subdivision and community planning. Tools include:

- Subdivision standards
- Development Permit Area Guidelines

2 Official Community Plan policies and Zoning Bylaws are not effective at Concentrating Development in Village Centres

CONTEXT

Despite high-level OCP guidance to reduce sprawl and encourage compact communities, large lots and low average densities persist in Village Centres, while relatively small lots and subdivision outside Village Centres is common. Many Village Centres are not serviced with wastewater treatment and other infrastructure, encouraging individual septic systems and the associated large lots septic systems require.

Besides increasing transport related energy use and emissions, low-density communities also engender large homes, increasing building energy consumption.

POTENTIAL SOLUTIONS

The RDN should continue its efforts to concentrate growth in Village Centres within the Growth Concentration Boundary.

3 Regional Growth Strategy and Official Community Plans' guidance does not encourage Net Zero buildings

CONTEXT

The RDN's RGS and various OCPs do not expressly encourage Net Zero design. Without including high level guidance and encouragement of such green building strategies, green building and Net Zero goals may be considered a lesser priority.

POTENTIAL SOLUTIONS

Provide high level support for [Near] Net Zero building strategies in the RGS and OCP

Include in RGS and OCP revisions:

- Generic support for green building
- Net Zero as a long term performance goal, and philosophy to guide design, construction and operations
- Support for any performance standards (BuiltGreen, R2000, LEED, etc) that will be associated with incentives
- Reference to Energy and Water Conservation Development Permit Area Guidelines, specifying passive design (Tier 1) features

4 Development Permit Area Guidelines could encourage Net Zero

CONTEXT

New provisions in the Local Government Act provide greater powers to impact buildings' environmental performance using DPA Guidelines. DPA guidelines may specify landscaping, building siting, building form and exterior, and equipment exterior to the building. These provisions allow local governments to mandate passive design, xeriscaping, and potentially renewable energy installations, rainwater capture, and other green building features in new developments.

POTENTIAL SOLUTIONS

Amend OCPs to include Energy and Water Conservation DPA Guidelines. Provide high level support for [Near] Net Zero building strategies in the OCP.

5 Bylaws impede Net Zero

CONTEXT

The RDN's Zoning and Building bylaws:

- Calculate floor area from the outer wall, disincenting thicker walls with greater insulation
- Specify low maximum building heights, limiting the efficacy of rooftop solar collection
- Measure build-to-lines from building projections, not walls, potentially dis-incenting long overhangs used in passive design.

POTENTIAL SOLUTIONS

Amend zoning bylaws to remove barriers.

6,7 The Community and Site Impact Review, and Impact Report, do not reference Net Zero criteria

CONTEXT

During rezoning, developers are obliged to complete a Community and Site Impact Review, outlining environmental, social and economic effect of developments on the surrounding neighbourhood. RDN staff can request that developments complete an additional Impact Report during rezoning, to expand on the Impact Review.

The Review, and the Impact Report, do not reference Net Zero buildings, nor community energy use. This omission sends a signal that building energy and water performance is not a priority for the RDN. The Site Impact Report is largely comprised of the RDN's Sustainability Checklist, also used at the Development Permit stage.

POTENTIAL SOLUTIONS

- Amend the Community and Site Impact Review and the Impact Report. Provide more appropriate criteria within the Site Impact Review's checklist, tailored appropriately to the scale of development (see RDN Regulatory Barrier 9)

8,11 Staff reporting, RDN Board, and Electoral Area Planning Committee, approvals do not explicitly reference Net Zero performance during rezoning or development permit

CONTEXT

Staff submit a report on all rezonings and development permit applications, which is considered by the RDN Board and the EAPC. The RDN lacks the necessary Board Directives, DPA Guidelines, and other policy tools to make [Near] Net Zero buildings an explicit priority during these approvals.

POTENTIAL SOLUTIONS

- Develop a Board policy to encourage green building performance at the time of rezoning. Coordinate with the Ministry of Transportation and Infrastructure to encourage similar performance during subdivision considerationsDevelop Energy and Water Conservation DPA Guidelines
- Embed a building performance placeholder in staff report templates

9 The RDN's Sustainability Checklist lacks incentives for green building performance. The checklist applies to all development scales and is open ended, reducing its utility.

CONTEXT

The RDN uses a Sustainability Checklist, which developers are required to fill out at development permitting and rezoning as part of the Community and Site Impact Review. Both RDN Staff and the stakeholders noted problems with the Sustainability Checklist. The current iteration of the Checklist:

- Is not tied to any incentives nor regulation for greener development
- Is based on an open response format that does not specify performance criteria, and does not provide substantial guidance for developers
- Asks the same questions for all sorts of developments, over burdening smaller projects. This leads to frustration with the process

All these factors lead many developers and builders to only cursorily complete the checklist. The checklist misses an opportunity to provide meaningful performance metrics and guidance to the development community, and to tie performance to regulatory or incentive tools. Indeed, a number of BC local governments have developed stronger checklists. Some tie performance to incentives or regulation. For these reasons, RDN staff are considering revisions to the checklist.

POTENTIAL SOLUTIONS TO BE DISCUSSED DURING PHASE 4

- Revise the checklist
- Tie incentives to checklist performance, subject to post-construction verification

10 BC Building Code prescriptive; equivalencies difficult to obtain.

CONTEXT

Many requirements in the BC Building Code are prescriptive, not performance based. Frequently, innovative green building systems are absent from the Code.

Local governments have the authority to certify 'equivalencies', allowing approvals of green building systems not specified in the Code. However, staff are often hesitant to certify systems, due to liability concerns. Typically, the onus falls to developers to make a case for, and document, equivalent performance. The additional studies and expert advising necessary for a developer to attain equivalencies can be costly and time consuming. Frequently, green building technologies will be dropped from submissions once difficulties with approvals occur.

Staff and stakeholders noted such barriers particularly to onsite water treatment and reuse technologies, including:

- Rainwater harvesting for non-potable applications
- Greywater reuse
- Onsite or community scale sewage treatment

The latter two face additional Senior Government regulatory barriers (see Senior Government Barrier 4). Rainwater use is discussed below.

Rainwater

- Rainwater use in non-potable applications (e.g. toilet flushing, landscape and garden irrigation, and clothes washing) can significantly reduce household potable water consumption, and presents minimal risks to health. Rainwater connections are currently not specified in the BCBC. The BCBC has provisions for dual-plumbing for non-potable applications; however, the code does not specify a definition of non-potable water quality or appropriate water uses. Provisions for quality and uses would have to be specified in equivalencies.
- RDN staff are amenable to approving rainwater use. However, preparing the equivalency may present a significant barrier to any developer interested in using such systems.

POTENTIAL SOLUTIONS

Anticipate rainwater use, provide equivalencies

- Liaise with the BC Ministry of Health, Metro Vancouver, Capital Regional District, and other local governments to develop an acceptable BCBC equivalency for rainwater treatment and reuse. These institutions are already active is this effort.
- Collate existing equivalencies for rainwater harvesting systems (e.g. City of Vancouver – Aquarium, Olympic Village, and False Creek Community Centre).

Resources to speed equivalencies

- Provide sufficient staff training, time and budgetary resources to speed equivalencies.

12 Lack of Staff capacity to speed [Near] Net Zero development applications

CONTEXT

In the development world, time is money; therefore, extra time spent during approvals of green buildings can reduce their uptake. RDN Staff note that historically development applications for energy and water efficient construction tend to be complete and well-developed, speeding approvals for most green residential developments. However, some innovative green technologies fall outside the Building Code or other regulations. Applications can take longer to process, due to:

- Lack of experience with new building technologies
- Concerns about liability when implementing equivalencies

Both RDN Building Permitting staff and stakeholders noted that these barriers could be addressed by providing staff with:

- More training in green building systems and technologies
- More time and resources devoted to green applications
- More authority to accept or reject a green building technology

POTENTIAL SOLUTIONS

Staff capacity building program

- Knowledge of green building systems is required for both development planning and building permitting staff to facilitate green buildings
- Consider pairing with/sponsoring industry for training

Improve approvals efficiency, to provide additional time/resources for green applications & associated equivalencies. Explore the following strategies:

- Charge for excess inspections, so that builders will be deterred from requiring multiple inspections
- Require clear, performance based metrics in the checklist, simplifying staff considerations and reducing ambiguities

Delegate approval authority to staff for buildings designed to achieve a specified performance standard (eg. EnerGuide 80, or 3rd Party Building rating system).

13 Buildings Inspections Areas do not cover all of the RDN

CONTEXT

The RDN's Buildings Inspection Areas do not cover Electoral Areas H, F, and large part of C, and A. Buildings Inspections are the RDN's tool to ensure that buildings are code compliant, meeting energy and water requirements as well as health and safety regulations.

POTENTIAL SOLUTIONS

Expand Building Inspection Areas.

14 Building inspection does not include energy performance

CONTEXT

The RDN's building inspection procedures do not include energy performance testing. Anecdotal and unpublished data suggest that a large proportion of buildings constructed in BC do not meet minimum code energy standards. Buildings' actual energy performance is not enforced at the time of occupancy permit in the RDN, nor in other BC municipalities. BC Hydro has expressed interest in funding implementation of a building performance pilot. Such an effort requires a legal review of local government's authority to require performance for construction built to prescriptive requirements, and development of an implementation strategy.

An EnerGuide energy performance test provides a useful measure of energy consumption for Part 9 Buildings (low-rise residential), the large majority of the RDN's new residential development. Following minimal prescriptive requirements in the BC Building Code will result in EnerGuide scores of 69-74; the Code also specifies a performance path, whereby projects meeting EnerGuide 77 meet Energy requirements. The 2010 Code is expected to reference EnerGuide 80 for both prescriptive and performance paths.

Energy testing at occupancy permitting would allow the RDN to:

- Benchmark building performance
- Identify industry capacity building needs
- Link home performance with incentives or regulations
- Enforce minimum code requirements

POTENTIAL SOLUTIONS

Undertake an Energy Performance Enforcement Study, to determine whether the RDN should require performance testing as a condition of occupancy permit.

Monitor forthcoming revisions to the BC Building Code to determine whether performance testing will be required for Part 9 construction.

5.5 senior government barriers

1 Street orientation does not prioritize solar access

CONTEXT

The Ministry of Transportation and Infrastructure (MOTI) is the Subdivision Approving Office and the ultimate authority for subdivision approvals.

See RDN Regulatory Barrier 1 for discussion of solar orientation.

POTENTIAL SOLUTIONS

- Liaise with MOTI to prioritize solar orientation; collaborate on alternative standards
- Develop a Subdivision Services Bylaw addressing solar orientation of streets
- The RDN could assume Subdivsion Approvals responsibilities

2 Ministry of Transportation and Infrastructure Engineering Standards may hinder green infrastructure

CONTEXT

The MOTI's engineering standards dictate stormwater management infrastructure built during subdivision. Prescriptive requirements can deter development of other, potentially more sustainable, infrastructure/building systems if:

- The two are mutually incompatible, or
- The requirements are redundant to the green building system, adding additional costs if greener systems are also incorporated

Notably, the MoT requires the use of swales for rainwater conveyance and infiltration. Some members of the development community noted that this makes substantial onsite rainwater storage for reuse, and other onsite stormwater control strategies, redundant.

POTENTIAL SOLUTIONS

- Liaise with MOTI to adopt flexible, performance based standards for rainwater storage and onsite stormwater management strategies
- Investigate other barriers
- Develop a Subdivision Services Bylaw specifying green standards
- The RDN could assume Subdivsion Approvals responsibilities

3,5 BC Building Code prescriptive; equivalencies difficult to obtain.

CONTEXT

See RDN Barrier 10

POTENTIAL SOLUTIONS

Communicate with the Ministry of Housing and Social Development the need for a centralized database of code equivalencies in BC. Liaise with other local governments and the Union of BC Municipalities in this initiative.

4 Federal Plumbing Codes limit the distribution and application of reuse water within buildings; the Provincial Municipal Sewerage regulation presents onerous requirements for onsite water reuse and treatment

CONTEXT

There are two main drivers for small, decentralized wastewater treatment systems in the RDN context:

- Wastewater reuse to reduce overall water consumption (including greywater and mixed wastewater reclamation systems)
- Providing wastewater treatment where no sanitary sewer servicing exists

RDN staff noted they were hesitant to approve reuse systems in new developments. These hesitancies are legitimate - extensive research has demonstrated that greywater can contain a significant number of disease causing microoganisms presenting a health risk if untreated. As the technologies needed to treat greywater under present regulations are similar to those needed for mixed wastewater, and there are added plumbing costs to separate greywater from mixed wastewater, there is no clear justification to consider greywater reuse over mixed wastewater reuse.

Staff are engaged in developing recommendations for community wastewater treatment systems, as part of the Liquid Waste Management Plan Review.

BC's Environmental Management Act, through the Municipal Sewage Regulation (MSR), does allow treatment and reuse of wastewater originating from two or more dwelling units, thereby facilitating both greywater recycling and community sewers. However, significant barriers to meeting the MSR's requirements exist. Barriers include:

- Developers are unfamiliar with designing, constructing and operating community water reuse systems
- Developers are unfamiliar with the MSR requirements and the role of VIHA
- Local government approving authorities are unfamiliar with the MSR, adding time, costs, and the risk of rejection to approvals
- Developers or community users are obligated to meet the Financial Security Requirements of the MSR, greater than 100% of the capital replacement cost of the installed system
- An Environmental Impact study and Operations Plan must be prepared in support of the reuse Discharge Registration
- The Discharger must take responsibility for identifying, communicating with, and obtaining permission of all interested government stakeholders at the municipal, provincial, and federal levels
- 'Qualified Professionals' required to prepare the necessary support documentation are required to approve projects, and are in short supply

While some barriers stem from local governments and the requirements of the MSR, these barriers can be partly addressed through improved standards and guidelines for wastewater reuse. Such efforts are underway at the Federal level:

- Health Canada has recently prepared a national risk-assessment-based guideline document for water reuse with input from the Provinces, with a particular emphasis on small residential and commercial systems
- The Canadian Standards Association is currently developing standards for water reuse including dual plumbing standards, and certification standards for treatment systems

POTENTIAL SOLUTIONS

- Contribute to the development of CSA standards through active participation at the committee level and/or stakeholder review. The Canadian Standards Association is developing plumbing and treatment standards with respect to mixed wastewater and greywater reuse and rainwater harvesting systems
- Identify systems most suitable at building and community scales. For greywater systems, it is likely that systems scaled for individual homes are most pragmatic. Moving forward will require the involvement of VIHA

6. Tools and Potential Solutions

In the summary of barriers and potential solutions in Section 5, certain solutions address multiple barriers. The strategies below are referenced repeatedly as key to overcoming barriers to green building in the RDN:

- Staff capacity building
- Industry capacity building
- Financing
- Providing incentives for green building
- Regulating green building performance where possible

These needs are common to many jurisdictions and leading local governments have implemented a range of strategies aimed at addressing them. This project identifies a range of local government green building policy tools. These tools were presented to RDN staff and stakeholders who provided input on which tools are most appropriate in the RDN context.

6.1 identifying tools: methodology

The following steps were undertaken to identify market transformation tools applicable to the RDN:

1. Review of Available Tools
The project team conducted a literature review of tools used by local governments to facilitate community wide uptake of green buildings[1]. This literature review was augmented by an email survey of local governments, requesting input on their green building policy tools.

[1] Valuable resources include: The Canada Green Building Council. 2007. Municipal Green Building Toolkit. http://www.cagbc.org/mtk_document.php ; Fraser Basin Council & Community Energy Association. 2009. Energy Efficiency & Buildings: A Resource for BC's Local Governments http://www.fraserbasin.bc.ca/publications/documents/EnergyEfficiencyOnlineGuide2009.pdf ; Susan Rutherford. 2006. The Green Buildings Guide: Tools for Local Governments to Promote Site Sustainability. West Coast Environmental Law. http://www.wcel.org/wcelpub/2006/14252.pdf

2. Compile Tools
Based on the literature review and survey, appropriate tools were compiled and organized into the following categories:

- Market Transformation Tools
  - Financing
  - Capacity Building and Education
- Land Use Planning Tools
- Incentive Tools
- Regulatory Tools

The complete suite of tools is located in Appendix 4 – Green Building Policy Tools. It includes:

- A description of how the tools function
- A qualitative rating of the ease of implementing these tools
- An estimate of the potential impact of implementing tools on the uptake of green buildings in the RDN
- Examples of local governments that have used these tools

The ease of implementation and potential impact of the tools are provided as rough guidelines only. Conditions within local governments and regional markets will dictate their efficacy in any particular setting. Moreover, only a few local governments have implemented similar tools and most green building policy is fairly new. Therefore, very little data, beyond qualitative impressionistic assessments, exists to determine the impacts these tools are having.

3. Testing Tools with Staff and Stakeholders
During the first introduction workshops, staff and stakeholders were presented with the tools. The mechanism and strategic considerations pertaining to each tool were explained. Staff and stakeholders were encouraged to discuss the merits and applicability of each tool in the RDN context. The two groups then voted on the tools they felt the RDN should consider for the future. Results of voting are presented in Appendix 5: Voting and Feedback on Tools.

During the subsequent Workshop, RDN Staff were further consulted to identify the highest impact tools, and map out implementation considerations. Staff considerations were taken into account as recommendations and implementation tasks were developed (see Section 7).

6.2 achieving market transformation (the tool box)

Tools that received positive feedback from both staff and stakeholders during the first workshop are listed in Figure 5, organized according to where they fit along the market transformation curve. The tools are organized within the categories of: capacity building, financing, incentives, regulations, and land use planning (land use planning, being a core RDN responsibility, is represented as occurring at all stages of market transformation towards green building).

Again, it should be stressed that the steps along the market transformation curve do not necessarily represent sequential steps through time – The RDN could implement regulations, financing, incentives and capacity building concurrently, and be keeping with the tenets of market transformation. Indeed, the market transformation process is meant to be iterative, with the latest stages of integration and regulation feeding into new more advanced capacity building initiatives, financing and incentives.

The recommendations in Section 7 address each stage of the Market Transformation Curve.

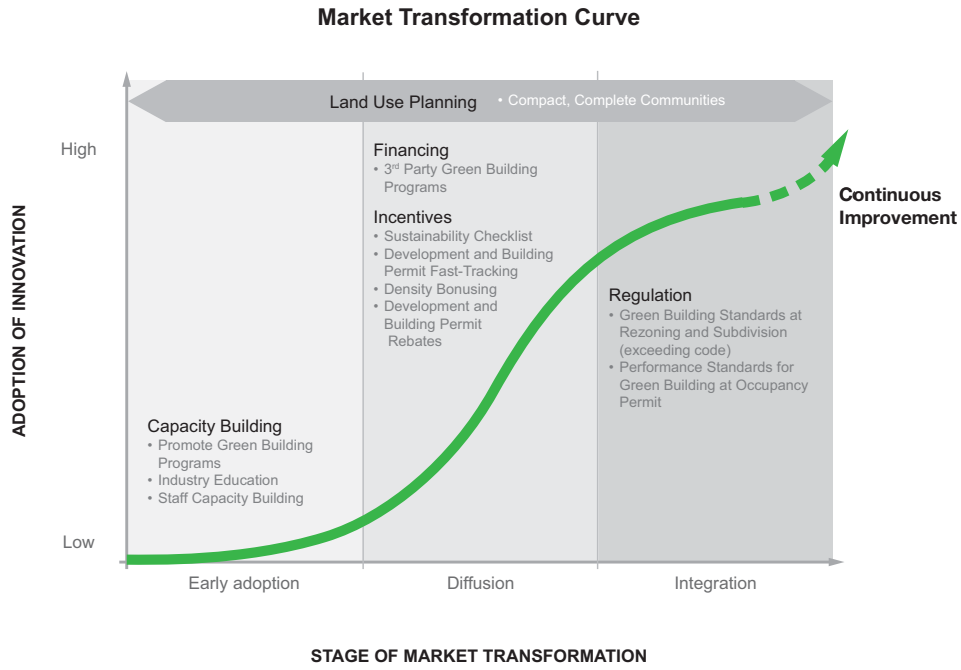


Figure 5: Potential Tools in the RDN Context

7. Recommendations

This section outlines recommendations for the RDN to reduce barriers to [Near] Net Zero buildings and implement market transformation strategies to encourage [Near] Net Zero buildings' uptake. The RDN does not possess limitless resources, and cannot immediately undertake every potential solution to barriers identified in Section 5. Therefore, the RDN must prioritize impactful, practically achievable strategies to encourage the development of Net Zero buildings. The following recommendations address a variety of barriers, using tools that RDN staff, stakeholders, and the consulting team identified as most appropriate to the RDN's context. Further detail on these recommendations is located in the subsections on the following pages. It is recommended that the RDN:

capacity building and public outreach programs

7.1 Capacity Development Program

Implement a Staff Green Building Capacity Development Program. Combine with opportunities for Industry Capacity Development whenever possible.

7.2 Outreach Program

Implement an Outreach Program, targeting participation in the LiveSmart home retrofit incentive program for existing buildings.

reduce RDN regulatory barriers

7.3 Remove Zoning Bylaw Barriers

Amend zoning and building related bylaws to remove barriers to green building. Bylaws should:

- Calculate floor area by measuring from the inner wall, not outer wall, to reduce barriers to greater insulation levels
- Calculate build-to-lines from the outer wall, not building projections, to facilitate passive shading
- Explicitly exempt rooftop renewable energy generation equipment from any height restrictions, to facilitate alternate energy sources ('Tier 3' strategies). Additionally, allow a portion of roof space to exceed current building height limits, allowing for 5/12 to 9/12 roof pitches - appropriate pitches for rooftop solar

7.4 Appropriate, Compact Growth

Implement Electoral Areas OCPs and zoning-related bylaws to allow for smaller lot sizes in appropriate zones within the Growth Concentration Boundary, to encourage more compact development, thereby reducing buildings' energy and water use.

enforce the BC building code

7.5 Expand Building Inspection

Expand building inspection areas to cover all Electoral Areas, thereby allowing the RDN to ensure that building performance standards are met, and more easily administer any incentives (see recommendation 7.7).

reduce senior government regulatory barriers

7.6 Subdivision Standards Bylaw

Modify existing subdivision regulations, or develop a new Subdivision Standards Bylaw(s), to encourage better solar orientation, facilitate green water management technologies, and specify other green building, infrastructure, transportation, and land use strategies. Coordinate with the MOTI to ensure standards are enforced; alternately, the RDN may consider assuming subdivision responsibilities.

green building incentives and revised building checklist

7.7 Incentive & Recognition Program

Initiate a Green Building Incentive Program. Incent [Near] Net Zero construction by providing building permit fee rebates for green building performance, and/or providing another pool of incentive funds thereby covering buildings outside of building inspections areas. Provide incentives for:

- Part 9 Construction – An EnerGuide rating (or equivalent energy performance) and proof of water efficiency performance, both in excess of BC Building Code requirements
- Part 3 Construction – Third party verification that the development has implemented a "Green Strategy" outlining green building strategies that go beyond the BC Building Code

As part of this initiative, issue a Board directive 'strongly encouraging' rezoning candidates to commit to meet or exceed the Green Building Incentive Program standards through a Section 219 Land Title Act covenant, or another suitable means of commitment. Coordinate with the MOTI to encourage similar commitments during subdivision.

7.8 Revise Checklist

Revise the Sustainable Community Builder Checklist currently applied during rezoning and development permitting applications, to reference performance based green building strategies and the Green Building Incentive Program.

development guidelines

7.9 Development Permit Areas

Develop Energy and Water Conservation Development Permit Areas (DPA) Guidelines, to encourage passive design and other green building strategies.

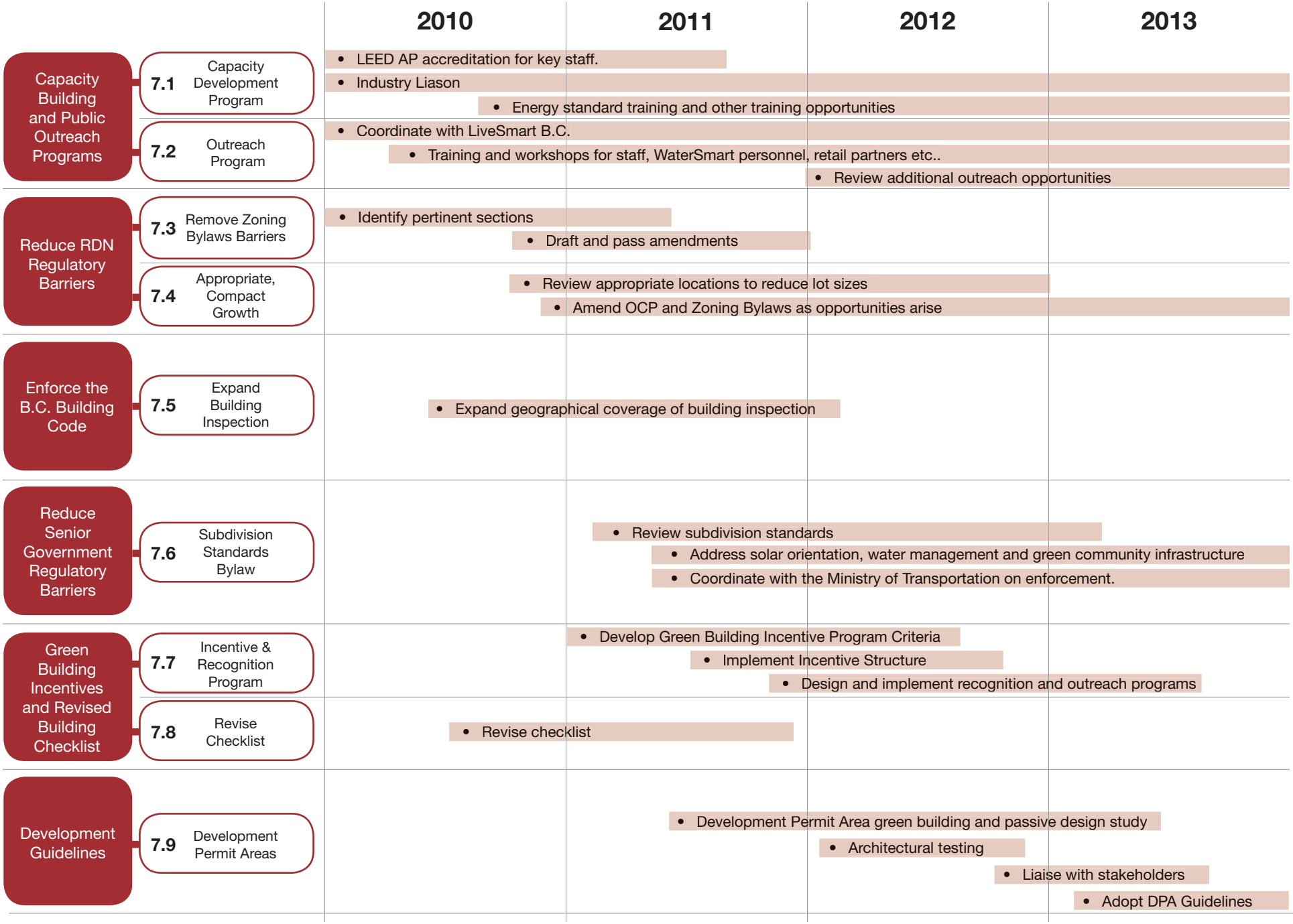
The table to the right estimates the cost and time to implement each recommendation, and their potential impact in forwarding [Near] Net Zero construction. These estimates are based from the Project Team's literature review; consultation with industry and other local governments; and professional expertise - they serve as rough guidance only. Costs and effectiveness will ultimately be dictated by the efficiency of implementation and future market conditions in the RDN.

The Gantt chart on the next page illustrates major implementation steps and timelines.

The following subsections list for each recommendation:

- The barriers addressed
- Discussion concerning the rationale for these recommendations
- Key implementation tasks
- Responsible departments

Cost & Impact Implications of the Recommendations				
Recommendation		Cost/ Time	Potential Impact	Priority
7.1	Capacity Development Program	$	Medium-High	Immediate
7.2	Outreach Program	$	Medium-High	Immediate
7.3	Remove Zoning Bylaw Barriers	$	Low-Medium	Immediate
7.5	Expand Building Inspection	$	Medium-High	Immediate
7.8	Revise Checklist	$	Low-Medium	Initiate Soon
7.4	Appropriate, Compact Growth	$$	Medium-High	Initiate Soon
7.7	Incentive & Recognition Program	$$	Medium-High	Initiate Soon
7.6	Subdivision Standards Bylaw	$$$	High	Initiate Soon
7.9	Development Permit Areas	$$$	High	Initiate Soon


2010
2011
2012
2013
Capacity Building and Public Outreach Programs
7.1 Capacity Development Program
• LEED AP accreditation for key staff.
• Industry Liason
• Energy standard training and other training opportunities
7.2 Outreach Program
• Coordinate with LiveSmart B.C.
• Training and workshops for staff, WaterSmart personnel, retail partners etc..
• Review additional outreach opportunities
Reduce RDN Regulatory Barriers
7.3 Remove Zoning Bylaws Barriers
• Identify pertinent sections
• Draft and pass amendments
7.4 Appropriate, Compact Growth
• Review appropriate locations to reduce lot sizes
• Amend OCP and Zoning Bylaws as opportunities arise
Enforce the B.C. Building Code
7.5 Expand Building Inspection
• Expand geographical coverage of building inspection
Reduce Senior Government Regulatory Barriers
7.6 Subdivision Standards Bylaw
• Review subdivision standards
• Address solar orientation, water management and green community infrastructure
• Coordinate with the Ministry of Transportation on enforcement.
Green Building Incentives and Revised Building Checklist
7.7 Incentive & Recognition Program
• Develop Green Building Incentive Program Criteria
• Implement Incentive Structure
• Design and implement recognition and outreach programs
7.8 Revise Checklist
• Revise checklist
Development Guidelines
7.9 Development Permit Areas
• Development Permit Area green building and passive design study
• Architectural testing
• Liaise with stakeholders
• Adopt DPA Guidelines

7.1 capacity development program

It is recommended that the RDN initiate a Staff Green Building Capacity Development Program. Staff capacity development opportunities should be integrated with building industry capacity development and outreach whenever possible.

barriers addressed

- RDN 10 - BCBC prescriptive; equivalencies difficult to obtain (pg. 39)
- Senior Government Barriers 3,5 – BCBC prescriptive; equivalencies difficult to obtain (pg. 45)
- RDN 12 – Lack of Staff Capacity to Speed Net Zero applications (pg. 40)
- Market Barrier 4 – Lack of Industry Capacity (pg. 29)

discussion

During workshops, staff and stakeholders both emphasized the importance of developing staff capacity. Also, stakeholders emphasized the need for industry capacity development. Developing capacity in green building is especially important for the following reasons:

Enforcing Energy Performance Requirements
In Building Inspection Areas, the RDN is obligated to enforce minimum BC Building Code energy performance requirements. Familiarity with energy performance standards referenced in the BC Building Code can help Building Services staff ensure compliance (the EnerGuide home energy rating system is referenced for Part 9; the ASHRAE 90.1 standard for Part 3). Evidence from many BC Local Governments indicate that a substantial proportion of new construction does not meet minimum energy performance standards. As the BC Building Code's energy requirements become more stringent, more rigorous enforcement will become increasingly critical.

Even training in green building techniques not directly tied to codes (such as the R2000 energy efficiency standard for low-rise residential construction) can also aid staff in code enforcement, by increasing their knowledge of energy efficient building techniques. Furthermore, such training has proven to aid staff in suggesting alternate strategies to designers and builders, and aid in approving appropriate Code equivalencies.

Streamlining Approvals of Green Building Technology
Increased approvals timelines, and the uncertainty associated with using innovative technologies, is one of the greatest barriers to green building. Providing staff training in innovative green building technologies increases familiarity with such systems, and can thereby decrease approvals timelines. Joint capacity development can put staff and industry on the same page regarding appropriate building systems and installation techniques, further facilitating implementation and an expedient approvals process.

Developing Local Building Industry Capacity
Industry capacity development is critical to green building design and (especially) construction. Many builders and trades-people do not possess sufficient experience with green building construction technologies and techniques (for example, proper air sealing, advanced insulation installation, etc). This leads to more expensive and lower quality construction. Indeed, as many Canadian jurisdictions are discovering, not only do some builders not have the skills to implement advanced green building techniques, but many new buildings fail to meet minimum energy performance requirements.

Local building professionals can benefit from many of the same programs recommended for Building Services staff.

implementation tasks

1. **LEED AP Credential for Planning Approvals Staff**
   Ensure at least one Current Planning staff member holds LEED Accredited Professional status. Hire LEED accredited staff, or support existing staff in pursuing accreditation.

2. **Organize Energy Performance Standard Training for Buildings Inspections Services Staff**
   All Building Inspections Services staff should undertake training related to enforcing energy performance requirements in the BC Building Code. Recommended training programs are listed in the following table.

Building Type	Course	Web Address
Part 3	ASHRAE 90.1 Standard Professional Development	http://www.ashrae.org/education/page/1834
Part 9	EnerGuide Builder Training	http://oee.nrcan.gc.ca/residential/business/builders-renovators-trades/building/evaluation.cfm?attr=12
Part 9	R-2000 Training -Builder Workshop (minimum – other training options exist)	http://oee.nrcan.gc.ca/residential/business/builders-renovators-trades/r-2000/training.cfm?attr=12#builder-w

3. Industry Outreach

Include building industry members in training opportunities whenever appropriate and Invite local building professionals to staff training events. Target:

- Builders
- Trades people
- Architects and other design professionals

Liaise with local industry organizations, representing building professionals active in RDN to recruit participants, including:

- Canadian Home Builders Association – Central Vancouver Island
- Local Trade Unions

Maximizing participation of all involved by:

- Poll local building professionals on green building programs they wish to participate in. Include a form, where builders will provide a written commitment to participate in future training. Once training is organized, remind builders of their commitment
- Provide participant recognition on RDN website page, 'RDN Green Builder' certificates, and other forms of recognition
- Consider a discounted fee for industry participants, subsidized by the RDN

4. Facilitate Additional Green Building Capacity Development

Provide training for staff and potentially industry in green building strategies in excess of minimum code requirements (e.g., geo-exchange heating and cooling; solar hot water systems). Such capacity development would ideally focus on:

- Best practices in design
- Best practices in construction
- Expedient approvals

A variety of green building training opportunities exist across Canada, organized by various institutions. New programs are frequently coming online. The table below lists some current opportunities. RDN Staff should monitor future opportunities.

Courses	Organization	Web Address
Inspector Training; Installer, Designer Training	Canadian GeoExchange Coalition	http://www.geo-exchange.ca/en/cgc_geoexchange_training_program_geothermal_trc42.php
Solar Hot Water Inspector Training (Saanich May 28th; or the RDN may host)	Solar BC	http://www.solarbc.ca/learn/training-opportunities
Various Training Programs; updated links to other training opportunities	Natural Resources Canada – Office of Energy Efficiency	http://oee.nrcan.gc.ca/commercial/newbuildings/training-workshops.cfm

Implementation Roles and Responsibilities	
Responsible Departments	**Role**
Energy and Sustainability and/or Building Services	Program and development coordination

7.2 outreach program

It is recommended that the RDN undertake an outreach program, targeting homeowner participation in the LiveSmart Home Energy Retrofit Program for existing housing. Tie outreach to current RDN Team Water Smart education and outreach initiatives. Once the outreach program is established, promote other Federal, Provincial and utility green building programs, as well as RDN incentives.

barriers addressed

- Market Barrier 2 - Costs; Split Incentives (pg. 26)
- Market Barrier 5 - Buyers Sensitive to First Costs (pg. 30)

discussion

Programs such as the Province's renewed LiveSmart Retrofit Program are being offered to incent energy efficiency and facilitate quality construction; the RDN's role will be to increase participation. Ideally, outreach will also emphasize the 'prestige' qualities and environmental benefits of green building.

Many municipal green building outreach programs provide information that is too general. Effective social marketing programs clearly identify target audiences, behavior objectives, and communications strategies to encourage these behaviours. As the RDN develops its outreach program, it is important to:

- Identify strategic target audiences to participate in programs
- Use effective communications and marketing strategies to reach and influence decision makers in these sectors

The RDN already administers the Team WaterSmart Public Education and Outreach Program, as well as a Toilet Replacement Rebate Program. The RDN can build from these existing initiatives and internal expertise, to more readily promote the LiveSmart program, and provide residents with consolidated sources of information.

The LiveSmart Home Energy Retrofit Program has recently been renewed by the Ministry of Energy, Mines and Petroleum resources. In brief, engagement with the LiveSmart program works as follows:

1. Homeowners arrange a pre-retrofit assessment from a licensed service organization
2. The service organization provides the homeowner with a report of recommended retrofits
3. The homeowner organizes retrofits
4. After a second performance assessment, the homeowner is eligible for rebates on implemented energy efficiency building features

While results vary building to building, retrofits in BC lower energy consumption 34% on average. Program uptake rates vary substantially community to community - Local Governments that actively promote LiveSmart/EcoENERGY (including the Cities of Terrace, Medicine Hat, North Vancouver and Vancouver) typically experience 2-3 times Provincial rates of program uptake.

implementation tasks

Coordinate with LiveSmart BC. Request outreach materials.

Use current WaterSmart personnel to conduct LiveSmart outreach. If WaterSmart funding cannot be used on home energy efficiency outreach, consider other funding sources, while still using WaterSmart personnel, events, and outreach channels to promote LiveSmart. Outreach strategies include:

- A page on the RDN website, with information and links to LiveSmart BC
- Prepare line staff to deliver information on the LiveSmart program to renovators inquiring about building permits
- Familiarize Team WaterSmart personnel with the LiveSmart program and promote during regular outreach activities
- Hold regular workshops (perhaps once every two months) conducted by a Certified Energy Advisors and/or staff, to explain the program. Ensure that events are well advertised. Consider workshops in a variety of locations throughout the RDN
- Coordinate with local hardware retailers. Hold workshops with sales staff, requesting that they refer clients to LiveSmart
- Coordinate with local realtors. Request they refer buyers of existing homes to LiveSmart

Additional utility, Provincial and Federal building efficiency incentive and financing programs are available, and more may come online in the future. The RDN should monitor such programs, and expand the scope of outreach as appropriate.

Information on incentive and financing programs are located at City Green's Affordable Warmth program website: http://www.affordablewarmth.ca.

Implementation Roles and Responsibilities	
Responsible Departments	**Role**
Water and Wastewater Services and/or Energy and Sustainability	Program Development and Implementation

7.3 remove zoning bylaw barriers

Amend Land Use and Subdivision Bylaw No. 500, 1987 and Zoning and Subdivision Bylaw No. 1285, 2002 to remove barriers to green building. The bylaws should be amended to:

- Calculate floor area by measuring from the inner wall, not outer wall, to reduce barriers to greater insulation levels
- Calculate build-to lines from the outer wall, not building projections (troughs, eaves, etc), to facilitate passive shading
- Explicitly exempt rooftop renewable energy generation equipment from any height restrictions, to facilitate alternate energy sources ('Tier 3' strategies). Additionally, allow a portion of roof space to exceed current building height limits, allowing for 5/12 to 9/12 roof pitches - appropriate pitches for rooftop solar

barriers addressed

- RDN 5 - Bylaws Impede Net Zero (pg. 35)

discussion

The recommended amendments will reduce regulatory barriers to common [Near] Net Zero energy building strategies.

In the case of facilitating rooftop renewable energy, this may be necessary to ensure buildings can meet new requirements in the revised BC Building Code - it is expected that the 2010 Code will require 'Solar Readiness'. One of the conditions of solar readiness is appropriate roof pitches. Some RDN zones feature low building height limits, which effectively restrict building roof pitches to 4/12 or shallower. The optimal pitch for rooftop solar at in the RDN is 9/12, though 5/12 to 12/12 are viable pitches.

implementation tasks

1. **Identify all sections of Land Use and Subdivision Bylaw No. 500, 1987 and Zoning and Subdivision Bylaw No. 1285, 2002 requiring amendments.**

2. **Amend all appropriate sections of bylaws.**

Implementation Roles and Responsibilities	
Responsible Departments	**Role**
Current Planning, Long Range Planning and/or Energy and Sustainability	Documents Review, analysis, drafting amendments

7.4 appropriate, compact growth

It is recommended that the RDN implement policies in its Electoral Area OCPs and Zoning related bylaws that encourage smaller lot sizes in detached housing developments and multi-family developments in appropriate locations such as Village Centres.

barriers addressed

- RDN 2 - Official Community Plan and Zoning Bylaws are not effective at concentrating development in village centres (pg. 32)

discussion

Larger single detached homes engender greater total energy use than smaller homes or multifamily developments. Moreover, sprawling development requires greater landscape irrigation requirements per capita and engenders other negative environmental impact due to reliance on automobile transport and the loss of agriculture and wild lands.

The RDN's Regional Growth Strategy and Electoral Areas OCPs generally specify 'smart growth' principals, concentrating growth within Village Centres while minimizing development outside of the RDN's Growth Concentration Boundary (GCB). However, development has continued outside the GCB, and inappropriately large lot developments have occurred within designated Village Centres. This trend is due to a lack of implementation of OCP policies, as well as a lack of infrastructure servicing within Village Centres, necessitating large lots for septic system based wastewater management.

implementation tasks

1. **Continue to implement land use planning wastewater management policies and initiatives that encourage compact, complete development.**

Implementation Roles and Responsibilities	
Responsible Departments	**Role**
Current Planning, Long Range Planning, Water & Wastewater Services	Implementation

7.5 expand building inspection

It is recommended that the RDN expand building inspection areas, to facilitate BC Building Code enforcement and other regulations, and to administer any building permit rebate incentives.

barriers addressed

- RDN 13 - Building Inspection Areas do not cover all of the RDN (pg. 40)

discussion

Parts or all of Electoral Areas A, C, F, and H are not subject to building inspection and permitting. Building inspection and permitting are the RDN's primary tools to enforce the BC Building Code, including minimum energy and water efficiency requirements. Moreover, building permit fees may be rescheduled to provide incentives for [Near] Net Zero buildings (see Recommendation 7). Non-universal building inspection and permitting will reduce the impact of a building permit fee rebate system (however, other means of supplying rebates are available).

implementation tasks

1. **Amend Building Regulation and Fees Bylaw No. 1250, 2001 to extend building inspection areas.**

Implementation Roles and Responsibilities	
Responsible Departments	**Role**
Current Planning, Long Range Planning, Building and Bylaw Services, Water & Wastewater Services	Documents Review, analysis, drafting amendments

7.6 subdivision standards bylaw

It is recommended that the RDN modify existing subdivision regulations, or develop a new Subdivision Standards Bylaw(s), to encourage better solar orientation and encourage other green building, infrastructure, transportation and land use planning strategies. Coordinate with the Ministry of Transportation and Infrastructure (MOTI), Ministry of the Environment (MOE), and Vancouver Island Health Authority (VIHA) to ensure standards are enforced; alternately, the RDN may consider assuming subdivision responsibilities.

barriers addressed

- RDN 1 - Solar access not prioritized during subdivision and community planning (pg. 31)
- Senior Government Barrier 1 - Street orientation does not prioritize solar access (pg. 43)
- Senior Government Barrier 2 - Ministry of Transportation and Infrastructure Engineering Standards may hinder green infrastructure (pg. 44)

discussion

The MOTI is the approving authority for subdivisions in the RDN. The RDN specifies zoning and Development Permit Area Guidelines that regulate development within subdivided land. VIHA regulates small wastewater systems (less than 22,700L/ less than 20 lots), while the MOE regulates larger systems (greater than 22,700L, greater than 20 lots).

Current Subdivision Standards
RDN staff and stakeholders noted that the lack of subdivision standards hindered some green building practices. The following barrier was noted:

Solar Orientation
Currently, there are no standards that prioritize appropriate solar streets orientation. Street layout typically dictates the orientation of houses. Streets oriented on an east-west axis, plus or minus 15 degrees, will maximize buildings' solar access.

Other Opportunities
Other barriers, not revealed in this analysis, may be at play during subdivision. The RDN should further review subdivision barriers internally, with the MOTI, and stakeholders as it develops a Subdivisions Standards Bylaw. Moreover, such a Bylaw presents an opportunity to encourage a variety of green building, infrastructure, water management, transportation, and land use strategies. While outside the scope of this analysis, the RDN should examine opportunities to encourage such green neighbourhood elements as it develops a Subdivision Standards Bylaw. Green community elements to consider include:

- District energy
- On-site renewable energy generation
- On-site wastewater management
- Transportation infrastructure that supporting a range of transport choices (walking, biking, transit, etc)
- Mixed use communities

implementation tasks

1. **Review green subdivision standard opportunities**
   Coordinate internally, with the MOTI and with stakeholders, about the scope and opportunity to encourage greener subdivision practices.

2. **Draft and Adopt Bylaw**
   At minimum, address issues of solar orientation. Incorporate other green standards where applicable.

Implementation Roles and Responsibilities	
Responsible Departments	**Role**
Long Range Planning , Current Planning, Water and Wastewater Services	Standards review, consultation, drafting

7.7 incentive & recognition program

It is recommended that the RDN initiate a Green Building Incentive Program (GBIP). Incentives may be comprised of building permit fee rebates and/or another pool of incentive funds, thereby covering buildings outside of Building Inspections Areas. Provide incentives for:

- Part 9 construction (single family and low-rise residential construction) – An EnerGuide rating (or proof of equivalent energy performance), and validation of water efficiency performance, both in excess of BC Building Code and other requirements
- Part 3 construction (high-rise residential and commercial construction) – Third party verification that the development has implemented an "RDN Green Strategy" outlining near Net Zero/green building features that go beyond the BC Building Code and other requirements

Incentives should be subject to post-construction audit and verification by a third party. The RDN should publicly recognize successful projects.

It is further recommended that the RDN Board issue a directive 'strongly encouraging' rezoning candidates to commit to meet or exceed the Green Building Incentive Program standards through a Section 219 Land Title Act covenant, or another suitable means of commitment, and coordinate with the MOTI to encourage similar commitments during subdivision.

barriers addressed

- Market Barrier 2 - Costs; Split Incentives (pg. 27)
- Market Barrier 5 - Buyers Sensitive to First Costs (pg. 30)

discussion

Various leading Canadian local governments (including the District of Saanich, City of Calgary, and others) rebate a portion of building permit fees for green building performance. Providing monetary incentives for [Near] Net Zero performance is a means of reducing the split-incentive facing developers, and of generating market demand and public interest in green buildings. Likewise, public recognition of high performance and [Near] net-zero projects has proven to be a worthy strategy of generating awareness of the import and opportunity to construct greener buildings.

Incentives must be tied to building performance - nominally energy and water efficiency (the key accounts for near Net Zero performance), but potentially broader (for example LEED performance categories). Performance standards should be referenced in the Community Builder Checklist (see recommendation 7.8). Performance standards should be differentiated between Part 9 and Part 3 buildings.

Part 9 - single family & low-rise residential construction

Part 9 buildings' success in approaching Net Zero energy and water can be measured using an EnerGuide rating and water savings projections beyond a typical baseline, respectively.

Energy efficiency measures - EnerGuide

The EnerGuide home energy rating system is a well established means of benchmarking homes' energy performance. The rating can apply to single family homes, as well as low-rise residential buildings with multiple units. Ratings from 0 to 100 are generated using computer modeling of building components, combined with real building air leakage measurements. In general, the higher the EnerGuide rating, the more efficient the home. The 2010 BC Building Code is expected to include standards for Part 9 construction that achieve an EnerGuide rating of 80 when good construction practices are followed. Table 1, on the next page, lists EnerGuide ratings of different construction types, including proposed incentive thresholds (thresholds are outlined in greater detail in the implementation tasks section - p. 63).

Water efficiency measures

The RDN could develop a baseline water efficiency performance standard that new homes must exceed to qualify for incentives. Performance could be calculated on a customized spreadsheet tool, whereupon applicants enter actual fixture flow rates, applicances, and landscaping strategies.

Typical EnerGuide Ratings	
Type of House	**Rating**
Older Home	0-65
Current B.C. Building Code - Prescriptive Path	69-74
Current B.C. Building Code - Performance Path	77
Anticipated 2010 B.C. Building Code	80
Proposed 30% Building Permit Fee Rebate Threshold	83
Proposed 50% Building Permit Fee Rebate Threshold	85
Proposed 100% Building Permit Fee Rebate Threshold	90
Net Zero Energy Home	91-100

Table 1: EnerGuide Ratings (proposed rebate thresholds are outlined in greater detail in the implementation tasks section - p. 63)

Administering Incentives for Part 9 Developments
Following is a summary of the recommended process for Part 9 projects pursuing incentives:

1. Upon completion of construction, a Certified Energy Advisor conducts an EnerGuide audit of the home. In attached or multiunit residential buildings, random representative sample EnerGuide ratings could be averaged by floor space. (Note: the RDN may consider developing internal capacity to provide EnerGuide inspections, to serve as an additional option for applicants in case private sector Advisors are not available. In the future, this may be a required to test BC Building Code energy performance compliance.)
2. The applicant completes the RDN's Water Efficiency Spreadsheet
3. The applicant submits both the EnerGuide audit and the Water Efficiency Spreadsheet to the Buildings Inspections Services desk
4. Rebates/incentives based on a simple formula (described below) are issued. Successful applicants should also be recognized by the RDN (recognition program components are described below)

Part 3 - high-rise residential and commercial construction
A variety of whole building performance rating systems, incorporating energy and water performance measures, are applicable to Part 3 buildings. The most well known of these systems is LEED. However consultation with the development community, and observations of local market conditions, indicate LEED may not be an inappropriate standard for the RDN at this time. Specifically:

- Costs and learning curves associated with LEED certified buildings are too onerous for the RDN market
- High certification fees, plus consultant fees
- LEED Canada for New Construction, developed primarily for office and institutional buildings, does not apply seamlessly to retail nor residential apartment building types, common Part 3 building types in RDN

For these reasons, it is anticipated that uptake of LEED in RDN would be limited in the short term. To encourage greater uptake of green building technologies and practices, it is recommended that the RDN adopt a 'Green Strategy Program' that is flexible, less onerous and inexpensive for developers, but begins to encourage green building innovation in Part 3 buildings.

Green Strategy Requirements
The structure of the Green Strategy (GS) provides flexibility to parcel developers in how the project contributes to green building and sustainability objectives. The performance categories, objectives and example strategies could be informed by the LEED Canada 1.0 New Construction rating system. To correspond with key Net Zero Building goals, minimum Energy and Water performance categories would be included. The RDN may wish to take a broader green building approach, and include most or all of the LEED categories.

To qualify as a candidate Green Strategy project, the GS would need to satisfy these overall criteria:

1. Green building features proposed must address, at minimum, energy and water performance and must go beyond minimum regulatory requirements, including the BC Building Code

2. The GS must specify the supporting documents or plans in the application for each feature, and specify the development project team member responsible for design of that feature – for example:

    - Green Building Consultant
    - Architect
    - Landscape Architect
    - Mechanical Engineer

Performance Categories
The RDN may choose to expand the scope of the GS, for example by referencing additional (or all) the performance categories in LEED:

- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality

If a broad green building approach is to be taken, then it may be appropriate to link the incentives to a LEED equivalency score. Or, a simplified set of performance targets and requirements may be developed that is informed by LEED but adjusted for the RDN context. Figure 3, right, provides an example of a customized approach informed by LEED, showing only one performance category.

Administering the Green Strategy Program for Part 3 Developments
Following is a summary of the recommended process for a project pursuing RDN Green Strategy designation.

1. On a voluntary basis, the parcel developer submits a completed GS with a building permit application (or only the GS if outside Building Inspection Areas). The GS specifies the green building features and performance levels that will be implemented as part of the proposed development project, and how these are documented in the application. The GS requirements are not prescriptive, but allow developers to create

Performance Category: 2.0 Reduce Potable Water Consumption

Objectives:

- Maximize water efficiency within buildings to reduce potable water consumption and the production of wastewater
- Reduce or eliminate the use of potable water for landscape irrigation

Example Technologies and Strategies:

- Use xeriscaping techniques, water-wise or drought tolerant plant species
- Install no irrigation system or specify the landscape irrigation system to be highly efficient and/or removed from use after 2-3 years
- Concentrate plants in larger landscaped clumps near to buildings rather than in middle of parking lots
- Collect and re-use rain water for irrigation
- Install high efficiency (low flush/dual flush) toilets
- Waterless or ultra-low flow urinals in commercial bathrooms
- Low flow faucets, shower heads, pre-rinse heads for restaurant kitchens, etc.
- Specify high efficiency appliances for residential suites
- Install water sub-metering

No.	Proposed Features (exceeding minimum code requirements)	Target Performance	Reference Documents	Responsibility
1.1	Water-wise landscaping, no irrigation.	75% of landscaped areas	Landscape Plan Irrigation Plan	Landscape Architect
1.2	Dual flush toilets in all washrooms	Decrease indoor water consumption by 20% compared with typical use		Mechanical Engineer

Figure 3: Green Strategy Example. This example illustrates the content of a "customized" Green Strategy showing only one performance category.

their own strategy that meets GS performance objectives. In the case of a developer intending to utilize a recognized 3rd Party Green Building System certification, such as LEED, this could also qualify as at least equivalent to the GS, and be eligible for any associated incentives.

2. The parcel developer or the RDN assigns a Green Strategy Auditor (a qualified consultant). The Auditor reviews the GS and supporting documentation prior to submission, and submits a letter indicating that the review has been completed, which is attached to the GS.

3. Following construction, the Auditor verifies that the green building features listed in the GS have been implemented, and issues a letter confirming that this has been completed. The Auditor will also issue a short project profile using a template provided by the RDN, highlighting the relevant Net Zero/ green features of the project. The letter and profile will be submitted to the RDN by the Auditor.

4. Once the letter has been received and other appropriate regulatory requirements have been met, the RDN will:

    - Issue a rebate to the developer
    - Recognize the project

The rebate should at minimum cover the incremental cost of the writing the GS and all auditor costs. It is provisionally estimated that the cost to developers of writing the GS and having the Auditor execute the tasks described above would be in the range of $5,000 and $20,000, varying with the size of projects and extent of the GS.

Green Strategy Guidance
The RDN should develop a Green Strategy Guidance document to aid development of the Green Strategy by developers/designers. For each performance category, guidance should:

- Outline objectives
- Provide example technologies/strategies
- Include a strategy documentation template

The Value of Incentives
The incentive levels proposed in the Implementation Tasks section (below) are comparable to those offered by the District of Saanich and City of Calgary. These values will not cover the full incremental cost premiums of achieving the associated EnerGuide scores, and may only cover a portion of the costs of GS commitments. However, such incentives will provide a platform for the RDN to conduct outreach encouraging greener buildings in the community, and will improve the economic case for green buildings. The RDN should review incentive levels after a few years, to assess whether they are increasing uptake of green buildings at current levels. The RDN may also examine whether additional financing and/or incentive tools can further increase the uptake of green building.

implementation tasks

1. Develop Green Building Incentive Program Criteria
Part 9

- Finalize EnerGuide scoring requirements for various incentive levels
- Develop Water Efficiency Spreadsheet and efficiency criteria

Part 3

- Finalize scoring requirements for GS program
- Finalize policy to implement GS program
- Develop GS Guidance document
- Develop Auditor criteria; consider an RFQ to identify qualified auditors

2. Implement Green Building Incentive Program Building Permit Fee Rebates and/or Other Incentives
It is recommended that the RDN implement a system of Building Permit Fee Rebates for projects within Building Inspection Areas. Outside of Building Inspection Areas, a separate pool of rebate funding may be offered. Alternately, all rebates may be sourced from this separate fund.

The RDN can increase building permit fees to encourage a revenue neutral permit fee program. Assuming that the Green Plan is adopted by 20% of permit applications by value, a 10% increase in fees would make permitting rebates roughly revenue neutral.

Potential permit fees and incentive levels are listed in Table 2 below. Current Building Permit fees are listed, as well as proposed future fees and rebates.

Incentive thresholds should be adjusted in coming years, as best practices and code becomes more rigorous. The RDN should consider switching from the GS to a LEED standard in the future.

Proposed Green Building Fee	2010 Fees	Potential Fee / Incentive Structure
Building Permit Fees	1% of value of construction	1.1% of value of construction
Part 9 Rebates		
EnerGuide 83 + 10% water savings	n/a	0.3% of value of construction
EnerGuide 85 + 20% water savings	n/a	0.6% of value of construction
EnerGuide 90 + 40% water savings	n/a	1.1% of value of construction
Part 3 Rebates		
Green Strategy Verification (could also be tiered based on scoring criteria)	n/a	$5,000 + 0.3% of value of construction

Table 2: Proposed fee and incentive structure.

3. Consider a contingency or cap
Should the GBIP system experience substantial uptake, funding may not be sufficient to cover rebates. The RDN could address this in two possible ways:

- Create an additional contingency fund, and/or
- Create a funding cap, with supporting policy indicating that should funds be exhausted, the rebate program may be suspended

4. Design and Implementation Public Recognition Framework
The RDN should include the following elements in its public recognition system:

1. The RDN issues a letter to the parcel developer confirming that the project has qualified for the GBIP
2. The project profile is included on the RDN's web site
3. The RDN may also consider creating a plaque/decal for qualifying buildings; and/or may consider other promotion methods such as an annual Council Award for outstanding projects

5. Encourage [Near] Net Zero Building at Redesignation and Subdivision
The RDN Board should consider issuing a directive 'strongly encouraging' applicants for rezoning to commit to achieving the minimum GBIP criteria in all buildings developed on the parcel.

Implementation Roles and Responsibilities	
Responsible Departments	**Role**
Current Planning and/or Sustainability and Energy	Program development and implementation.

7.8 revise checklist

It is recommended that the RDN revise its Sustainable Community Builder Checklist currently applied during rezoning and development permitting applications, to reference performance based green building strategies and the Green Building Incentive Program (GBIP).

barriers addressed

- RDN 6, 7 - The Community and Site Impact Review, and Impact Report, do not reference Net-Zero criteria (pg. 36)
- RDN 9 - The RDN's Sustainability Checklist lacks incentives for green building performance. The checklist applies to all development scales, and is open ended, reducing its utility (pg. 38)

discussion

During workshops, stakeholders and staff noted that the Sustainable Community Builder Checklist is:

- Open-ended, lacking performance metrics to guide developments
- Focused on large developments, providing inappropriate criteria for smaller developments. Criteria within the checklist's Community Character and Design and Economic Development sections do not pertain to small redevelopments
- Not tied to any form of incentive or penalty, limiting attention to criteria and fostering cynicism

For these reasons, the Checklist is often cursorily completed and has not contributed substantially to the uptake of green building, missing an opportunity to encourage greener building practices.

implementation tasks

1. Revise the Review Form and Checklist

The Checklist should be revised to:

- Reference specific performance criteria – if the GBIP is adopted, its criteria should be referenced and explained. Additional criteria could also be referenced, serving an education purpose
- Be tiered according the type of building (Part 9 vs. Part 3), and to the scale of development. To tier applications to the scale of development, consider using some floor area or unit number threshold, at which point criteria relating to transportation, Community Character and Design, Economic Development, and other broader community impacts apply

Implementation Roles and Responsibilities	
Responsible Departments	**Role**
Current Planning	Checklist revisions

7.9 development permit areas

It is recommended the RDN adopt new Energy and Water Conservation Development Permit Areas (DPA) Guidelines, applied to areas currently with and without development permit areas.

barriers addressed

- RDN 3 - Regional Growth Strategy and Offical Community Plans' guidance does not encourage Net Zero buildings (pg. 33)
- RDN 4 - Development Permit Area Guidelines could encourage Net Zero (pg. 34)

discussion

In the 2008 Bill 27, the Local Government (Green Communities) Statutes Amendment Act, the Provincial Government granted Local Governments new powers with regards to DPA Guidelines. Local governments may designate development permit areas for the purposes listed under new subsections 919.1 (h), (i) and (j) of the Local Government Act (LGA):

- Establishment of objectives to promote energy conservation
- Establishment of objectives to promote water conservation
- Establishment of objectives to promote the reduction of greenhouse gas emissions

Development permits for land designated under these new subsections may now include requirements respecting:

- Landscaping
- Siting of buildings and other structures
- Form and exterior design of buildings and other structures
- Specific features in the development
- Machinery, equipment and systems external to buildings and other structures

Encouraging Passive Design

Siting, building form, exterior design, and landscaping strategies comprise key elements of Tier One Passive Design Strategies – they are hallmarks of [Near] Net Zero buildings. The RDN can 'hardwire' requirements for such strategies into Development Permit Guidelines.

There is precedent for such work - the District of Saanich has adopted form and character guidelines encouraging passive design strategies.

Exploring Other Green Building Features

The LGA states that 'specific features' and 'machinery, equipment and systems external to buildings' can be specified in DPA Guidelines. This provision may provide opportunities to require [Near] Net Zero archetypal strategies, potentially including:

- Renewable energy generation
- District energy connection compatibility
- Alternate heating systems, such as heat pumps
- Rainwater collection and reuse
- Other opportunities

The full range of green features that could be considered in development permit areas remains to be established. The RDN is advised to seek formal legal advice before initiating development of DPA Guidelines prescribing such features.

implementation tasks

1. Initiate a study of Energy and Water Conservation DPA Guidelines

The RDN should undertake a study to develop Energy and Water Conservation Guidelines. Consider undertaking the study in partnership with other local governments.

Guidelines to encourage passive design should include:

- Optimal solar orientation
- Optimal building siting, to facilitate solar access
- Optimal glazing (window) ratios on south, west, east and north walls
- Provisions of thermal mass in walls to facilitate passive solar heating
- Building projection (eaves, patios, etc) guidelines to facilitate passive shading of windows during the summer, and solar access during the heating season
- Other exterior shading features
- Landscaping strategies to encourage increased solar exposure during the heating season, and shading during the cooling season
- Water-wise landscaping strategies

Seek legal counsel regarding requiring:

- Renewable energy generation
- District energy readiness
- Alternate heating systems
- Rainwater capture and reuse

2. Liaise with stakeholders regarding DPA Guideline Development

The RDN should test its DPA Guidelines with developers, builders and the public. Undertake architectural testing of guidelines, to determine impacts on buildings form and character.

Implementation Roles and Responsibilities	
Responsible Departments	**Role**
Current Planning, Long Range Planning and/or Building Inspection Services	Development and Implementation

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Appendices

1. Net Zero Construction Case Studies
2. Barriers to Green Building Case Studies
3. Archetypes Matrix
4. Green Building Policy Tools
5. Voting and Feedback on Tools
6. Local Governments Green Building Policy Case Studies

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Appendix 1

Net Zero Construction Case Studies

Austria Passive House

Function	Headquarters of the Austrian Olympic Committee for the 2010 Winter Olympics
Location	7390 Fitzsimmons Road South, Whistler, British Columbia
Architect	Martin Treberspurg
Completed	2009
Cost	$1,330,000 (w/ $150,000 grant from Resort Municipality of Whistler)
Floor Area	250 m^2 (2,691 ft^2)
Energy	
- Consumed	13 kWH/m^2a (space heating)
- Produced	0 kWH/m^2a

description

Although not a true net-zero home, the Austria Passive house is the only home in Canada designed to meet the stringent energy efficiency requirements of a passive house. Passive Homes cannot use more than 15 kWh/ m^2 per annum in heating and cooling energy, and not more than 120 kWh/m^2 per annum in total energy consumption (space heating, water heating, electrical). The house achieves this through super-insulation, The polystyrene insulation used in the home is 250 mm thick, which is 3 to 4 times thicker than an average Canadian home. Due to the extremely low energy use, the potential for on-site renewable energy to supply enough energy to power the home on an annual basis is quite high.

The extraordinary cost of the Austria Passive house is a result of the fact that nearly all the building materials and systems were imported from Austria. Walls, windows, roof, ventilation and air circulation systems were built in Austria and shipped to Whistler in September 2009. While the house functions as a promotional tool for Austrian products and ingenuity, not all of the products used have equivalents in Canada. The OPTIWIN windows used in the project have a U-Value of 0.14 Btu/h/ft^2/°F .

The building's intended post-games use is a rental shop for cross-country ski gear in the winter and bicycles in the summer, as well as a public indoor gathering space for various Whistler outdoor clubs.

Image from austria-passive-house-whistler-2010.blogspot.com

Image from austria-passive-house-whistler-2010.blogspot.com

Works Cited:

austria-passive-house-whistler-2010.blogspot.com

Riverdale Net-Zero Project

Function	One of Canada's First 15 Net-Zero Homes, EQuilibrium Housing Project
Location	Edmonton, Alberta
Designer	Peter Amerogen
Completed	2008
Cost	$85,000 - $110,000 above a 'standard' house of equal size.
Floor Area	234 m^2 (2,519 ft^2)
Energy	
- Consumed	61.51 kWH/m^2a
- Produced	63.01 kWH/m^2a

description

Riverdale Net-Zero Project is one of the first Net-Zero homes funded by the Canadian Mortgage and Housing Corporation as part of a demonstration and research project. The core principles of EQuilbrium housing are Health, Energy, Resources, Environment and Affordability. The semi-detached duplex produces 1.5 kWH/m^2a more energy than it requires to operate. It achieves this outstanding performance in the harsh climate of Edmonton through super-insulation of the building envelope, maximizing passive heating strategies, improving efficiency of all systems and appliances, and installing on-site renewable energy. It does not achieve net-zero water, although it has taken some steps towards water use reduction through low-flow fixtures.

The home has R-100 ceiling insulation, R-54 basement walls and an R-24 basement floor. The R-56 walls are 16" thick double stud construction, layered with three types of insulation: expanded polystyrene (R8), isocyanurate (R13), and cellufibre (R33). The walls perform 70% better than a 2 x 6 stud wall. Windows on the south, east and west facades are triple-glazed, while windows on the north facade are quadruple glazed. All windows are argon filled with low-E glazing. Riverdale achieved an EnerGuide Rating for Building Envelope energy efficiency of 86. The total EnerGuide rating for the house is 100. Sources of heat for Riverdale are as follows:

- 40% from passive solar gain
- 28% from internal gains
- 21% from active solar
- 11% from photovoltaic panels

Each unit has a 22 m^2 water-based solar thermal array on the roof. Heat collected from the array is stored in either a 300 L domestic hot water tank, or a 17,000 L space

Image from riverdalenetzero.ca

Image from riverdalenetzero.ca

Works Cited:

CMHC. "Riverdale NetZero Project: Technical Summary." ND. http://www.cmhc-schl.gc.ca/en/inpr/su/eqho/rinezepr/index.cfm

riverdalenetzero.ca. "Riverdale NetZero Energy Home Presentation." 2008. www.riverdalenetzero.ca/PRESENTATIONS/Riverdale_NetZero_energy_home_--_presentation.pdf

riverdalenetzero.ca. "Technical Proposal to CMHC." 12 January 2007. www.riverdalenetzero.ca/RiverdaleNetZeroProject-TechnicalProposal.pdf

Riverdale Net-Zero Project (cont...)

heating tank. Water in the larger tank is run through a radiator, which in-turn is used to provide heat for the home's forced-air fan-coil heating system. At capacity, the 17,000 L cistern can store enough heat to keep the house warm for two months. Back-up electric resistance heating is used in the middle of winter. Natural gas was avoided because of high annual service charges. Water heating is augmented by drain- water heat recovery. Radiant heating was avoided as it was too expensive.

For electricity generation, each unit features a 5.6 kW grid-connected photovoltaic system, generating 6,200 kWh of electricity per annum. Solar energy is the most scarce when we need it the most and is quite expensive to harvest. It is necessary to reduce energy consumption- to conserve energy- until the cost of further conservation, on the basis of cost per unit of energy saved, exceeds the cost of collecting solar energy.

Riverdale Net-Zero Project (cont...)

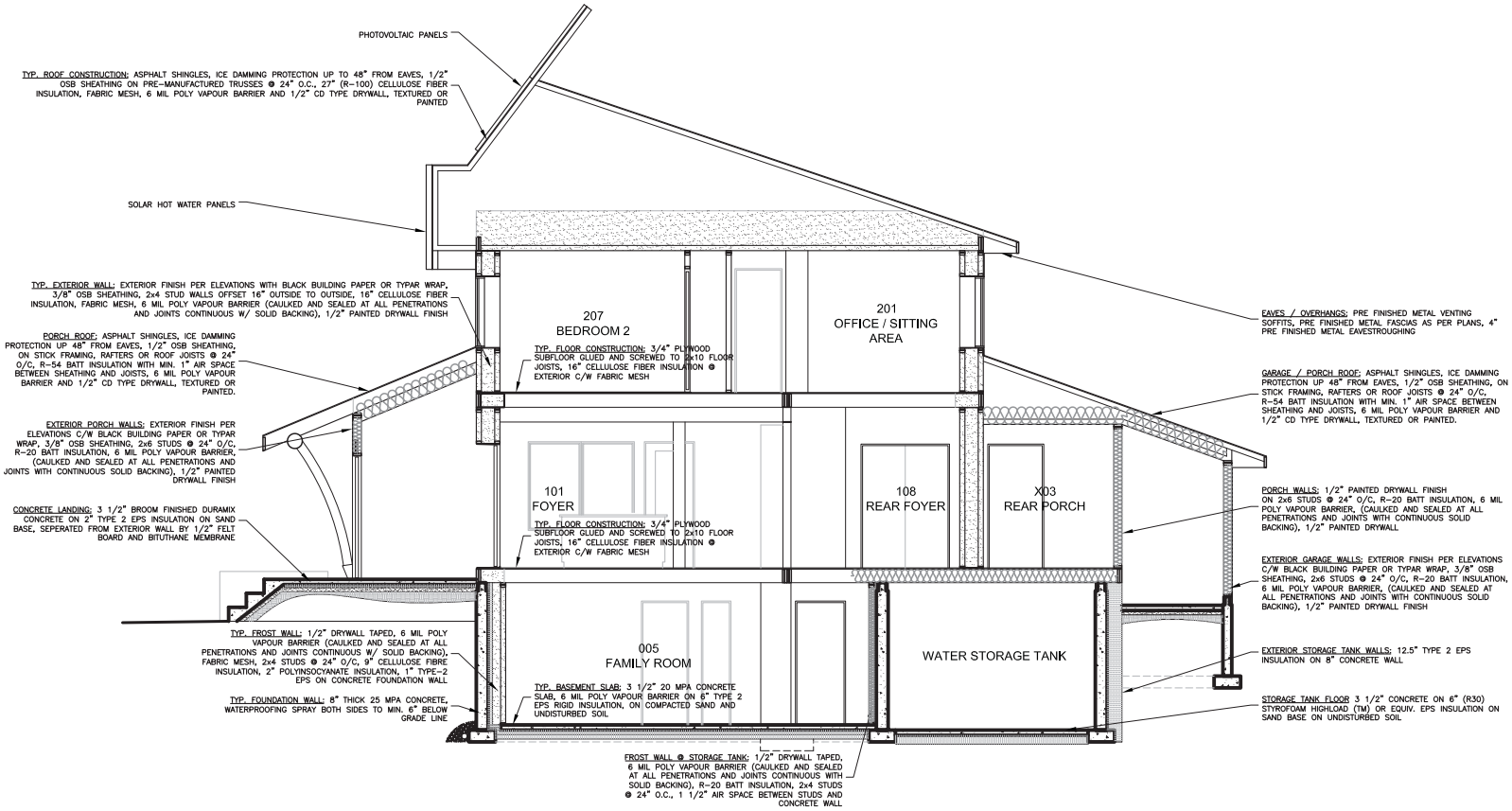


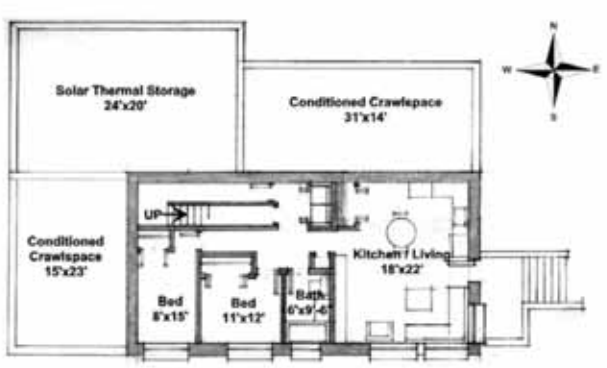
Image from riverdalenetzero.ca

Harmony House

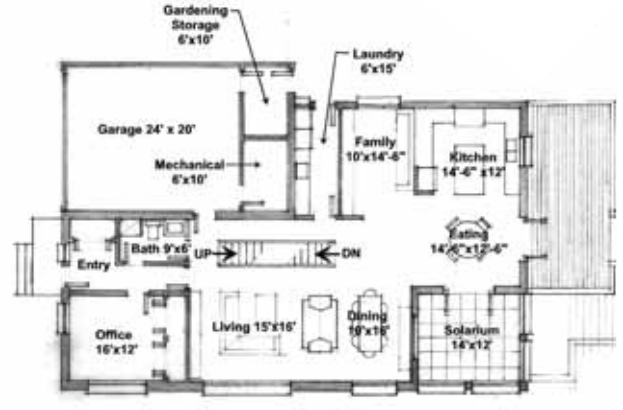
Function	One of Canada's 15 Net-Zero Homes, EQuliibrium Housing Project
Location	7990 Joffre Avenue, Burnaby, British Columbia
Designer	Habitat Design + Consulting Ltd.
Completed	Under construction. To be completed in 2010.
Cost	n/a
Floor Area	325 m^2 (3,500 ft^2)
Energy	
- Consumed	n/a
- Produced	n/a

description

Harmony house is a two storey home designed to provide two housing units and a basement in-law suite. It intends to achieve 0.75 ACH @ 50 Pa with an air-tight drywall approach. Walls are R-40 double stud walls. Roof insulation is R-60. Envelope windows are triple glazed, double low-e, argon filled with a U-Value of 0.16 Btu/h/ft2/°F.



Basement Plan from CMHC.



Main Floor Plan from CMHC.

Works Cited:

CMHC. "Project Overview: Harmony House - Burnaby, British Columbia." 24 November 2009. http://www.cmhc-schl.gc.ca/odpub/pdf/66407.pdf.

Beddington Zero-Energy Development

Function	Mixed-Use Development
Location	Beddington, England
Architect	Bill Dunster Architects, Arup
Completed	2002
Cost	n/a
Floor Area	3.5 acres, 100 housing units. 75 m2 (807 ft2) / unit (average)
Energy	
- Consumed	34.3 kWH/m^{2}a (electricity)
- Consumed	48.0 kWH/m^{2}a (space heating and hot water) (BioRegional).
- Consumed	82.4 kWH/m^{2}a (total)
- Produced	11.7 kWH/m^{2}a (total)

description

Beddington Zero Energy Development, or BedZED, is a 100 unit housing development in England constructed on a brownfield site. One third of the units are low-income, shared-ownership (rent-to- own) units, and two-thirds are outright ownership. It also has workspace, with the intent of reducing automobile trips by occupants. Resale value for units is 15% higher than similar sized properties in the area.

The development's low energy consumption can be attributed to its super-insulation (300 mm thick), triple glazed windows, low-air leakage, passive ventilation with heat recovery and passive solar design. Energy was designed to be produced by a 777 m^2 solar array and an on-site combined heat and power (CHP) plant designed to turn wood waste from a near-by municipality into energy. However, the CHP was too unreliable, and gas boilers were installed in its place before the first winter. The photovoltaic panels, which generate 88,000 kWh annually, were originally intended to supply power for recharging electric vehicles (EV) but due to the slow uptake of EV's, and the failure of the CHP, it's electricity has been redirected to the dwelling units.

BedZED also attempted to achieve net-zero water with a local living machine. As of July 2009, the living machine has been out of service for seven months due to difficulty finding an affordable operator. On average, each resident uses 72 L of water per day, of which 15 L is recycled graywater or harvested rainwater. BedZED also makes use of green roofs for storm-water management and urban agriculture. 39% of residents grow food.

Development manager Peter Wright, in an interview with British newspaper The Guardian, attributes some of the performance issues with the project's high ambitions, the use of untested technology and its complicated wastewater treatment system. "I don't think BedZed was properly understood [before it was commissioned]," Wright says. "It was a demonstration project. We're a charity, formed to house people in need, rather than to subsidise the biomass industry" (Qtd. In Slavin).

Image by Flickr user One Planet Living in Sutton

Image by Flickr user hotzeplotz

Works Cited:

BioRegional. "BedZED seven years on." July 2009.

Slavin, Terry. "Living in a dream." The Guardian. 17 May 2006.

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Appendix 2

Barriers to Green Buildings Case Studies

Vancouver Breaks Down Barriers to Energy Efficiency

Vancouver amended its zoning and development bylaw to remove barriers to greater insulation, solar hot water, and passive design shading features.

background

A variety of barriers to green building can exist within municipal bylaws. Oftentimes, green building features are not anticipated in building design guidelines or regulations. This can lead to green developments being disadvantaged, either through delays during permitting processes, or restrictions on buildings' saleable floor space or height.

Such was the case with Vancouver's Zoning and Development Bylaw.

policy framework

Vancouver amended its Zoning and Development Bylaw, to incorporate the following changes:

- Provide explicit relaxations of built-to-line regulations for overhangs, for external shading features such as canopies awnings and overhangs. This allowed for passive building cooling, without penalizing projects in terms of their total buildable square footage
- Included roof mounted renewable energy technologies in the list of features for which discretionary height increases may be granted. Prior to this provision, rooftop solar panels of wind energy systems could run afoul of height restrictions
- Excluded walls with greater-than-code insulation levels from floor space area and FSR calculations. Prior to this change, floor space was calculated from the exterior wall, penalizing projects with extra insulation and thicker walls. The new policy actually incentivizes greater-than-code insulation levels, by eliminating the entire exterior wall from the calculation when it exceeds code levels

results

Vancouver has seen a more ready uptake of green features since eliminating these barriers.

> **"Vancouver has seen a more ready uptake of green features."**

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Delta's Comprehensive Review of Building Bylaws

The Corporation of Delta commissioned a review of all its building related bylaws, to identify supportive elements and barriers to green building.

policy framework

The Corporation of Delta commissioned a review of all its building related bylaws, to identify supportive elements and barriers to green building. The study identified a number of areas to improve green building policy, and reduce barriers. Specifically, the study noted the following:

OCP
Delta's Official Community Plan did not reference energy efficiency and climate change mitigation opportunities within the buildings, missing an opportunity to provide high level guidance regarding the inclusion of green features in the project.

Zoning Bylaw
The Zoning Bylaw contained many elements supportive of green building, but also some barriers. The bylaw:

- Mandated that no building elements extend outside the vertical building envelope, impacting the legality of rooftop renewable energy systems
- Measured floor space area from the exterior wall, penalizing projects with thicker walls and greater insulation
- Allowed for few areas with densities that support district energy, frequent transit, or a healthy supply of local community amenities.
- Barred 'power generation' from many zones, legally hindering the incorporation of renewable electricity generation in neighbourhoods

Building/Plumbing Bylaw
The Building/Plumbing Bylaw does not specifically outline solar hot water systems' classification, providing confusion as to whether SHW systems might require a sight survey by a BC Lands Surveyor or professional engineer. Such a surveyor visit provides excessive regulations and added costs.

> **"Delta's goal is to reduce emissions by 20% by 2015."**

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Appendix 3

Archetypes Matrix

Energy - Archetypal Near Net Zero Systems

Development Scenario 1

Single Family Parcel: Single family detached dwelling, serviced (or not) by municipal water or sewer, located on a 1/4 acre parcel.

Components Integral to All Development	Today's Common Responses to Integral Components	Responses Common to Net Zero Developments		Effectiveness of Net Zero Responses			Cost	Regulatory Barriers to Net Zero Responses	Notes
		House/Property Scale	Community Scale	Energy GHG	Water	Liquid Waste			
Tier 1 – Passive Design									
Insulation Levels and Envelope Performance	**Walls:** 2 x 6 studs (R20 and up) **Vented Attic**: R30 with Radiant barrier) **Under slab:** Continuous R12. **Basement Walls:** R20 and up at 100% of height. **Thermal Bridges:** Construction with thermal bridges.	**Walls:** 2 x 6 studs (R30 and up) **Vented Attic:** R50 with Radiant barrier. **Under slab:** Continuous R12. **Basement walls:** R30 and up at 100% of height. **Thermal Bridges**: Construction free of thermal bridges (≤ 0.01 W/m²K	-	++	n/a	n/a	$$$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Window Performance	**Windows:** Maximum U-value = 2.0 W/m²K **Skylights:** Maximum U-value = 3.10 W/m²K **Sliding glass doors:** Maximum U-value = 2.0 W/m²K (Jan 01 2011) (BC Energy Efficiency Act).	**Window:** U-value ≤ 0.8 W/m²K	-	++	n/a	n/a	$$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Air Tightness	Typical air changes for new construction is between 3 ACH and 5 ACH. (Varies)	Airtight building shell ≤ 0.6 ACH @ 50 Pascal pressure, measured by blower-door test.	-	++	n/a	n/a	$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Passive Cooling / Solar Shading	Internal solar shades.	External solar shades.	Building lots can be oriented to favor optimal solar orientation.	+	n/a	n/a	$	By-laws may restrict the use of external shading devices	No direct incentives
Natural Ventilation	Operable windows for natural ventilation.	Designed to contribute to passive cooling.	-	+	n/a	n/a	$	None	No direct incentives
Passive Solar Heating	Minimum attention given to this strategy.	Careful orientation and placement of windows to contribute to passive solar heating.	Building lots can be oriented to favour optimal solar orientation.	+	n/a	n/a	$	By-law may restrict the possibility of passive solar heating by favoring non-optimal solar orientation	No direct incentives
Daylighting	Daylighting strategies not coordinated with lighting controls.	Lighting controls designed to work with daylighting advanced strategies.	-	+	n/a	n/a	$	None	No direct incentives
Tier 2 – Systems Efficiency									
Heating and Cooling	**Furnace:** BC mandates high efficiency furnace. **HRV:** Not required in B.C **Heat Pump Systems:** Ground-source and air-source systems used.	**Furnace:** High-efficiency 95+ **HRV:** High-efficiency (over 80%). **Heat Pump Systems:** Ground-source and air-source systems used.	District Energy Systems: Renewable district energy systems such as biomass or other renewables. Threshold: Systems decrease in expense per unit with increased density.	++	n/a	n/a	$$$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Domestic Hot Water	**DHW Tank system:** Efficiency between 80 and 95% **DHW Tankless system:** Not often used	**DHW System:** High efficiency systems (95+) combined with solar hot water heating	Threshold: Systems decrease in expense per unit with increased density.	++	n/a	n/a	$$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Lighting Load	Changing bulbs to CFL or LED lights.	High Efficiency Fixtures combined with daylighting controls.	-	++	n/a	n/a	$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Electrical Plug Load	Energy Star Appliances and Electronics	Plug load reduced to about 30 kWh/m² per year.	-	++	n/a	n/a	$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Commissioning	Not usually provided	Comprehensive commissioning in place to verify performance of many components including building envelope.	-	++	n/a	n/a	$	None	No direct incentive
Tier 3 – Alternate Sources									
Renewable Electricity, On-site Production	Few systems in place	On-site generation: PV Panels Small Scale wind turbines Micro hydro Etc.	Community Renewable Energy generation. **Threshold:** systems decrease in expense per unit with increased density.	++	n/a	n/a	$$$	None	May be able to partner with other organizations
Behaviour Changes									
Operation and Maintenance Manual	Not usually provided	Part of user training on building systems.	Part of user training on building systems.	++	n/a	n/a	$	None	-
Conservation Strategies from Behavior Changes	Rely on Educational Strategies provided by internal or external organizations	Can be encouraged with energy and water usage display units.	Would benefit from a community approach.	++	n/a	n/a	$	None	May be able to partner with other organizations

Energy - Archetypal Near Net Zero Systems

Development Scenario 1

Single Family Parcel: Single family detached dwelling, serviced (or not) by municipal water or sewer, located on a 1/4 acre parcel.

Components Integral to All Development	Today's Common Responses to Integral Components	Responses Common to Net Zero Developments		Effectiveness of Net Zero Responses			Cost	Regulatory Barriers to Net Zero Responses	Notes
		House/Property Scale	Community Scale	Energy GHG	Water	Liquid Waste			
Performance Measure									
Building Energy Intensity	Typical new construction is above 300 kwh/m2 per year.	Total energy consumption (energy for heating, hot water and electricity) around 50 kWh/m² per year.	-	n/a	n/a	n/a	n/a	None	-

Energy - Archetypal Near Net Zero Systems

Development Scenario 2

Medium Density Residential Block: 15-20 units per hectare, serviced (or not) by municipal sewer or water.

Components Integral to All Development	Today's Common Responses to Integral Components	Responses Common to Net Zero Developments		Effectiveness of Net Zero Responses			Cost	Regulatory Barriers to Net Zero Responses	Notes
		House/Property Scale	Community Scale	Energy GHG	Water	Liquid Waste			
Tier 1 – Passive Design									
Insulation Levels and Envelope Performance	**Walls:** 2 x 6 studs (R20 and up) **Vented Attic**: R30 with Radiant barrier **Under slab:** Continuous R12 **Basement walls:** R20 and up at 100% of height. **Thermal Bridges:** Construction with thermal bridges	**Walls:** 2 x 6 studs (R30 and up) **Vented Attic:** R50 with Radiant barrier) **Under slab:** Continuous R12 **Basement walls:** R30 and up at 100% of height. **Thermal Bridges**: Construction free of thermal bridges (U Value ≤ 0.01 W/m²K)	-	++	n/a	n/a	$$$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Window Performance	**Windows:** Maximum U-value = 2.0 W/m²K **Skylights:** Maximum U-value = 3.10 W/m²K **Sliding glass doors:** Maximum U-value = 2.0 W/m²K Jan 01 2011 (BC Energy Efficiency Act)	Window: U-value ≤ 0.8 W/m²K	-	++	n/a	n/a	$$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Air Tightness	Typical air changes for new construction is between 3 ACH and 5 ACH. (Varies)	Airtight building shell ≤ 0.6 ACH @ 50 Pascal pressure, measured by blower-door test.	-	++	n/a	n/a	$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Passive Cooling / Solar Shading	Internal solar shades	External solar shades	Building lots can be oriented to favor optimal solar orientation	+	n/a	n/a	$	By-laws may restrict the use of external shading devices.	No direct incentives
Natural Ventilation	Operable windows for natural ventilation	Designed to contribute to passive cooling	-	+	n/a	n/a	$	None	No direct incentives
Passive Solar Heating	Minimum attention given to this strategy	Careful orientation and placement of windows to contribute to passive solar heating	Building lots can be oriented to favor optimal solar orientation	+	n/a	n/a	$	By-law may restrict the possibility of passive solar heating by favoring non-optimal solar orientation.	No direct incentives
Daylighting	Daylighting strategies not coordinated with lighting controls	Lighting controls designed to work with daylighting advanced strategies	-	+	n/a	n/a	$	None	No direct incentives
Tier 2 – Systems Efficiency									
Heating and Cooling	**Furnace:** BC mandates high efficiency furnace **HRV:** Not required in BC **Heat Pump Systems:** Ground-source and air source systems used	**Furnace:** High efficiency 95+ **HRV:** high-efficiency (over 80%) **Heat Pump Systems:** Ground-source and air source systems used	**District Energy systems:** Renewable district energy systems such as biomass or other renewables **Threshold:** systems decrease in expense per unit with increased density.	++	n/a	n/a	$$$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Domestic Hot Water	**DHW Tank system:** Efficiency between 80 and 95% **DHW Tankless system:** Not often used	**DHW System:** High efficiency systems (95+) combined with solar	**Threshold:** systems decrease in expense per unit with increased density.	++	n/a	n/a	$$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Lighting Load	Changing bulbs to CFL or LED lights.	High Efficiency Fixtures combined with daylighting controls	-	++	n/a	n/a	$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Electrical Plug Load	Energy Star Appliances and Electronics	Plug load reduced to about 30 kWh/m² per year.	-	++	n/a	n/a	$	None	**Incentives available from:** - Federal Government - Provincial Government - Utilities
Commissioning	Not usually provided	Comprehensive commissioning in place to verify performance of many components including building envelope.	-	++	n/a	n/a	$	None	No direct incentive
Tier 3 – Alternate Sources									
Renewable Electricity, On-site Production	Few systems in place	**On-site generation:** PV Panels Small Scale wind turbines Micro hydro Etc…	Community Renewable Energy generation **Threshold:** systems decrease in expense per unit with increased density.	++	n/a	n/a	$$$	None	May be able to partner with other organizations
Behaviour Changes									
Operation and maintenance manual	Not usually provided	Part of user training on building systems	Part of user training on building systems.	++	n/a	n/a	$	None	-
Conservation Strategies from Behavior Changes	Rely on Educational Strategies provided by internal or external organizations	Can be encouraged with energy and water usage display units	Would benefit from a community approach	++	n/a	n/a	$	None	May be able to partner with other organizations

Energy - Archetypal Near Net Zero Systems

Development Scenario 2

Medium Density Residential Block: 15-20 units per hectare, serviced (or not) by municipal sewer or water.

Components Integral to All Development	Today's Common Responses to Integral Components	Responses Common to Net Zero Developments		Effectiveness of Net Zero Responses			Cost	Regulatory Barriers to Net Zero Responses	Notes
		House/Property Scale	Community Scale	Energy GHG	Water	Liquid Waste			
Performance Measure									
Building Energy Intensity	Typical new construction is above 300 KWh/m2 per year.	Total energy consumption (energy for heating, hot water and electricity) around 50 kWh/m² per year.	-	n/a	n/a	n/a	n/a	None	-

Water & Liquid Waste - Archetypal Near Net Zero Systems

Development Scenario 1

Single Family Parcel: Single family detached dwelling, serviced (or not) by municipal water or sewer, located on a 1/4 acre parcel.

Components Integral to All Development	Today's Common Responses to Integral Compontents	Responses Common to Net Zero Developments		Effectiveness of Net Zero Responses			Cost	Regulatory Barriers to Net Zero Responses	Notes
		House/Property Scale	Community Scale	Energy GHG	Water	Liquid Waste			
Tier 1 – Passive Design									
Landscaping	Lawn	Xeriscaping - Xeriscaping involves planting with native plants that have minimal irrigation requirements and are drought tolerant.	-	n/a	++	n/a	$	None	Water efficient landscaping design standards will assist in implementation.
Roofing and Roof Water Collection	Building Roof and Perimeter Drainage to Storm Sewer	Bottomless drainage sumps and leaching chamber storm connections to maximize opportunity to infiltrate stormwater to ground onsite.	-	n/a	++	++	$	Building Code	Need for development of design standards to protect foundations and ensure adequate site drainage to protect property without liability exposure. Requires water balance analysis and modeling.
	Conventional Roofing	Irrigated Green Roof	-	n/a	++	++	$	Building Code	Need for design standards for residential applications. Where irrigation is required, this should be done with non-potable (reused) sources. Green roofs can also reduce energy consumption where mechanical cooling is needed.
Tier 2 – Systems Efficiency									
Fixtures	Industry Standard Fixtures	Ultra-low flow fixtures (specifications of fixture flow rates for lavatories, kitchen sinks, showers, toilets and urinals)	-	+	+	++	$	Building Code	Need product certification (CSA) and performance labelling. Product performance varies and should be selected carefully; some products are WaterSense labeled.
Appliances	Conventional Appliances	Low water use washing machines and dishwashers	-	n/a	+	++	$$	None	Products with EnergySTAR ; ultra-efficient appliance ratings may also be utilized.
Tier 3 – Alternate Sources									
Water Supply	Municipal Potable Water Connection	Desalination	-	high energy cost	++	+	$$$	Building Code	High energy cost. High cost and need for maintenance. Up to forty percent (40%) reject filtrate and need for disposal. Brine content likely to adversely affect soil structure and/or impact freshwater resources (if discharged).
		Potable Rainwater Harvesting - from Rooftops	-	n/a	+	n/a	$$	Building Code	General health concerns regarding the ability of a homeowner to operate and maintain a household water treatment system. Building Code modifications are required. Lack of Standards (e.g. roofing materials, first flush diversion, etc.). Concern for contamination from pesticide & herbicide applications nearby, dustfall, industrial activity, bird/animal feces, metal solublization, etc.
		-	Potable Stormwater Harvesting	n/a	++	n/a	$	Water Regulation	Variable seasonal water quality adversely impacts treatment costs and ability to maintain minimum water quality standards (e.g. loading due seasonal suspended sediment and algae growth). Subject to contamination if drainage basin not protected.
		Urban Ground Water	-	n/a	++	n/a	$	Building Code	Groundwater sources are largely overlooked in urban environments. Could use groundwater injection (recharge) to reduce impacts of storm runoff and use aquifer to meet storage requirements. Soil matrix provides natural passive water treatment and water quality protection.
		-	Urban Ground Water	n/a	++	n/a	$	Water Regulation	Groundwater sources are largely overlooked in urban environments. Could use groundwater injection (recharge) to reduce impacts of storm runoff and use aquifer to meet storage requirements. Soil matrix provides natural passive water treatment and water quality protection.
		Non-Potable Rainwater/Stormwater Collection - from pavement Minimal treatment involves filtration and disinfection.	-	n/a	+	+	$	Building Code	Requires a dual-plumbing system within the building and changes to plumbing code to meet CSA Standard. Health Authorities moving to requiring filtration and disinfection as minimum treatment standard.

Water & Liquid Waste - Archetypal Near Net Zero Systems

Development Scenario 1

Single Family Parcel: Single family detached dwelling, serviced (or not) by municipal water or sewer, located on a 1/4 acre parcel.

Components Integral to All Development	Today's Common Responses to Integral Compontents	Responses Common to Net Zero Developments		Effectiveness of Net Zero Responses			Cost	Regulatory Barriers to Net Zero Responses	Notes
		House/Property Scale	Community Scale	Energy GHG	Water	Liquid Waste			
Tier 3 – Alternate Sources									
Waste and Stormwater Conveyance	Municipal Wastewater & Stormwater System	Direct Greywater Reuse - Drainage from lavatories, bath/tub and laundry is filtered and immediately discharged through subsurface drip irrigation systems for landscaping applications.	-	n/a	+	+	$	Building Code, Sewerage System Regulation	Irrigation uses only apply to dry weather conditions. Conventional onsite wastewater treatment and disposal must be provided for full design flow (i.e. no savings in treatment and disposal costs despite reuse application. Cost of subsurface irrigation system and need to maintain and clean filters. Can only apply to individual household systems. Requires Standards development and significant revisions to building code.
		Package treatment plant to treat greywater to a water quality standard suitable for non-potable water reuse - Greywater defined as drainage from showers/tubs, lavatories, and laundry. Water treated to a standard that is safe for the public to come into contact.	-	n/a	++	++	$$$	Building Code, Sewerage System Regulation, Municipal Sewage Regulation	Requires additional cost for separate greywater drainage system as well as advanced wastewater treatment, rigorous operation and monitoring to ensure water quality is maintained. Requires a dual-plumbing system within the building and changes to plumbing code to meet CSA Standard. Good experience in Australia. Greywater represents about 65 percent of water demands within a residence.
		Package treatment plant to treat mixed wastewater to a water quality standard suitable for non-potable water reuse - Mixed wastewater defined as greywater plus toilet/urinal and kitchen sink sources. Water treated to a standard that is safe for the public to come into contact	-	n/a	++	++	$$$	Building Code, Sewerage System Regulation, Municipal Sewage Regulation - Building code modifications are needed to facilitate non-potable dual-plumbing systems. Individual dwellings are exempt from MSR (which permits reuse), but SR does not permit reuse and defines any surface application of wastewater effluent as a health hazard. MSR is rather onerous in application to small systems.	Needs CSA Standard development and National Building Code changes, as well as development of onsite water reuse performance standards. Additional cost of wastewater treatment due to more rigorous water quality standard and requires onsite disposal options for those water uses that are not amenable to non-potable sources. Not all potential reuse water applications are likely to be acceptable to local health authorities (i.e. laundry, water features, bathing/showers, vehicle washing, fire suppression, etc.). Mixed wastewater represents about 90 percent of the water demand within a residence.
		-	Non-Potable Mixed Wastewater Reuse - Treated non-potable water returned through distribution pipeline for residential and commercial applications including irrigation and toilet/urinal flushing under the Municipal Sewage Regulation.	n/a	++	++	$$	Building Code, Municipal Sewage Regulation	Needs CSA Standard development and National Building Code changes, along with transmission design standards. There is an additional cost for treatment as well as a cost to distribute reuse water back into the community in non-potable transmission pipelines, and additional building costs for dual plumbing. Community scale water reuse systems can supply large-scale irrigation demands (e.g. parks, golf courses, agricultural, cemeteries, commercial/industrial non-potable demands, etc.).
Sewage Conveyance & Treatment	Municipal Sewage Conveyance and Treatment	Composting toilet	-	n/a	++	++	$$	Building Code, Sewerage System Regulation	System performance is only as good as the dedication of the owner to operate and maintain. Odour control can be problematic. Need for separate urine collection and wastewater treatment and disposal for other liquid waste streams (laundry, lavatory, bath/tub and kitchen sink). Net benefit is to reduce water consumption within the building (i.e. excluding irrigation) by only about 20 percent.
		-	Small Diameter Forcemain Community Sewer - small sewage collection system for small low density communities. Lower infrastructure costs.	n/a	+	+	$$	None	Requires house/property level primary treatment and maintenance. Eliminates groundwater and stormwater infiltration flows to sewer. Reduces cost of sewage collection and transfer due to elimination of solids, small diameter pipe, and shallow burial. No effect on reducing potable water consumption.
		Vacuum Collection - wastewater transported by vacuum pressure through community sewer.	-	n/a	++	++	$$	Building Code	Often used in vessel and recreational applications with restricted water supplies. Eliminates groundwater and stormwater infiltration flows to sewer. Reduces cost of sewage collection and transfer due to elimination of solids, small diameter pipe, and shallow burial. Significantly reduces potable water demand needed for flushing (25 percent of water demand within the residence).
		-	Vacuum Collection - wastewater transported by vacuum pressure through community sewer.	n/a	++	++	$$$	None	Restricted to small to moderate sized cluster developments. Eliminates groundwater and stormwater infiltration flows to sewer. Reduces cost of sewage collection and transfer due to elimination of solids, small diameter pipe, and shallow burial. Significantly reduces potable water demand needed for flushing (25 percent of water demand within the residence).

Water & Liquid Waste - Archetypal Near Net Zero Systems

Development Scenario 2

Mixed Use Community Core: Street oriented development, retail and office space at street level, residential units above. Retail unit size: 300 square meters, residential density, 20 units per hectare. Not serviced with municipal sewer or water.

Components Integral to All Development	Today's Common Responses to Integral Compontents	Responses Common to Net Zero Developments		Effectiveness of Net Zero Responses			Cost	Regulatory Barriers to Net Zero Responses	Notes
		House/Property Scale	Community Scale	Energy GHG	Water	Liquid Waste			
Tier 1 – Passive Design									
Landscaping	Lawn	Water efficient landscape design and xeriscaping - e.g. planting with native plants that have minimal or zero irrigation requirements and are drought tolerant.	-	n/a	++	n/a	$	None	Water efficient landscaping design standards will assist in implementation.
Roofing and Roof Water Collection	Building Roof and Perimeter Drainage to Storm Sewer	Bottomless drainage sumps and leaching chamber storm connections to maximize opportunity to infiltrate stormwater to ground onsite.	-	n/a	n/a	++	$	Building Code	Need for development of design standards to protect foundations and ensure adequate site drainage to protect property without liability exposure. Requires water balance analysis and modeling.
	Conventional Roofing	Green roof	-	n/a	n/a	+	$	Building Code	Need for design standards for residential applications. Where irrigation is required, this should be done with non-potable (reused) sources. Green roofs can also reduce energy consumption where mechanical cooling is needed.
Tier 2 – Systems Efficiency									
Fixtures	Industry Standard Fixtures (meet building code low flow requirements)	Ultra-low flow fixtures (specifications of fixture flow rates for toilets, faucets, and showers).	-	+	++	++	$	Building Code	Need product certification (CSA) and performance labelling. Product performance varies and should be selected carefully; some products are WaterSense labeled.
	Flush Urinals (meet building code low-flush requirements)	Waterless urinals	-	n/a	+	+	$$	None	Greater cost than conventional urinals. Odour problems if not adequately maintained.
Appliances	Conventional Appliances	Low water use washing machines and dishwashers.	-	n/a	+	++	$$	None	Products with EnergySTAR ; ultra-efficient appliance ratings may also be utilized
Tier 3 – Alternate Sources									
Water Supply	Municipal Potable Water Connection	Potable Rainwater Harvesting	-	n/a	+	n/a	$$	Building Code	General Health concern regarding ability of homeowner to operate and maintain household water treatment system. Building Code modifications required. Lack of Standards (e.g. roofing materials, first flush diversion, etc.). Concern for contamination from pesticide & herbicide applications nearby, dustfall, indistrial activity, bird/animal feces, metal solublization, etc.
		Urban Ground Water	Urban Ground Water	n/a	++	n/a	$	Building Code (House/Property scale); Water Regulation (community scale)	Groundwater sources are largely overlooked in urban environments. Could use groundwater injection (recharge) to reduce impacts of storm runoff and use aquifer to meet storage requirements. Soil matrix provides natural passive water treatment and water quality protection.
		Desalination	Desalination	**High Energy Cost**	++	+	$$$	Building Code (House/Property scale); Water Regulation (community scale)	Only appropriate if no other potable water sources are available. High energy cost. High cost and need for maintenance. Up to forty percent (40%) reject filtrate and need for disposal. Brine content likely to adversely affect soil structure and/or impact freshwater resources (if discharged).DFO & fisheries concerns regarding water intake and filtrate (salt) release (community scale).
Wastewater and Stormwater Conveyance	Municipal Wastewater & Stormwater System	Non-Potable Rainwater/Stormwater reuse - minimum treatment involves filtration and disinfection.	-	n/a	+	+	$	Building Code	Requires a dual-plumbing system within the building and changes to plumbing code to meet CSA Standard. Note however it has been implemented in BC. Health Authorities moving to requiring filtration and disinfection as minimum treatment standard.
		Direct Greywater Reuse - Drainage from sinks, bath/tub and laundry is filtered and immediately discharged through subsurface drip irrigation systems for landscaping applications.	-	n/a	+	+	$	Building Code, Sewerage System Regulation	Irrigation uses only apply to dry weather conditions. Conventional onsite wastewater treatment and disposal must be provided for full design flow (i.e. no savings in treatment and disposal costs despite reuse application. Cost of subsurface irrigation system and need to maintain and clean filters. Can only apply to individual household systems. Requires Standards development and sigificant revisions to building code.
		Package treatment plant to treat greywater to a water quality standard suitable for non-potable water reuse - Greywater defined as drainage from showers/tubs, lavatories, and laundry. Water treated to a standard that is safe for the public to come into contact.	-	n/a	++	++	$$$	Building Code,Municpal Sewage Regulation	Requires additional cost for separate greywater drainage system as well as advanced wastewater treatment, rigorous operation and monitoring to ensure water quality is maintained. Requires a dual-plumbing system within the building and changes to plumbing code to meet CSA Standard. Good experience in Australia. Greywater represents about 65 percent of water demands within a residence. Pretreatment prior to discharge to sewer reduces costs for community sewage treatment.

Water & Liquid Waste - Archetypal Near Net Zero Systems

Development Scenario 2

Mixed Use Community Core: Street oriented development, retail and office space at street level, residential units above. Retail unit size: 300 square meters, residential density, 20 units per hectare. Not serviced with municipal sewer or water.

Components Integral to All Development	Today's Common Responses to Integral Compontents	Responses Common to Net Zero Developments		Effectiveness of Net Zero Responses			Cost	Regulatory Barriers to Net Zero Responses	Notes
		House/Property Scale	Community Scale	Energy GHG	Water	Liquid Waste			
Tier 3 – Alternate Sources									
Wastewater and Stormwater Conveyance	Municipal Sewage Conveyance and Treatment	Package treatment plant to treat mixed wastewater to a water quality standard suitable for non-potable water reuse - Mixed wastewater defined as greywater plus toilet/urinal and kitchen sink sources. Water treated to a standard that is safe for the public to come into contact	-	n/a	++	++	$$$	Building Code, Sewerage System Regulation, Municipal Sewage Regulation - Building code modifications are needed to facilitiate non-potable dual-plumbing systems. Individual dwellings are exempt from MSR (which permits reuse), but SR does not permit reuse and defines any surface application of wastewater effluent as a health hazard. MSR is rather onorous in application to small systems.	Needs CSA Standard development and National Building Code changes, as well as development of onsite water reuse performance standards. Additional cost of wastewater treatment due to more rigorous water quality standard and requires onsite disposal options for those water uses that are not ammenable to non-potable sources. Not all potential reuse water applications are likely to be acceptable to local health authorities (i.e. laundry, water features, bathing/showers, vehicle washing, fire suppression, etc.). Mixed wastewater represents about 90 percent of the water demand within a residence.
		-	Non-Potable Mixed Wastewater Reuse - Treated non-potable water returned through distribution pipeline for residential and commercial applications including irrigation and toilet/urinal flushing under the Municipal Sewage Regulation.	n/a	++	++	$$	Building Code, Municpal Sewage Regulation	Needs CSA Standard development and National Building Code changes, along with transmission design standards. There is an additional cost for treatment as well as a cost to distribute reuse water back into the community in non-potable transmission pipelines, and additional building costs for dual plumbing. Community scale water reuse systems can supply large-scale irrigation demands (e.g. parks, golf courses, agricultural, cemetaries, commercial/industrial non-potable demands, etc.)
Sewage Conveyance	Municipal Sewage Conveyance and Treatment	Composting toilets	-	n/a	++	++	$$	Building Code, Sewerage System Regulation	System performance is only as good as the dedication of the owner to operate and maintain. Odour control can be problematic. Need for treatment and disposal system for urine or leachate, as well as for other liquid waste streams (laundry, lavatory, bath/tub and kitchen sink). Net benefit is to reduce water consumption within the building (i.e. excluding irrigation) and wastewater by about 20 percent, and reduction of size of the on-site wastewater treatment system.
		-	Small Diameter Forcemain Community Sewer - small sewage collection system for small low density communities. Lower infrastructure costs.	n/a	+	+	$$	None	Requires house/property level primary treatment and maintenance. Eliminates groundwater and stormwater infiltration flows to sewer. Reduces cost of sewage collection and transfer due to elimination of solids, small diameter pipe, and shallow burial. No effect on reducing potable water consumption.
		Vacuum Collection - wastewater transported by vacuum pressure through community sewer.	-	n/a	++	++	$$	Building Code	Often used in vessel and recreational applications with restricted water supplies. Eliminates groundwater and stormwater infiltration flows to sewer. Reduces cost of sewage collection and transfer due to elimination of solids, small diameter pipe, and shallow burial. Significantly reduces potable water demand needed for flushing (25 percent of water demand within the residence)
		-	Vacuum Collection - wastewater transported by vacuum pressure through community sewer.	n/a	++	++	$$$	None	Restricted to small to moderate sized cluster developments. Eliminates groundwater and stormwater infiltration flows to sewer. Reduces cost of sewage collection and transfer due to elimination of solids, small diameter pipe, and shallow burial. Significantly reduces potable water demand needed for flushing (25 percent of water demand within the residence)

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Appendix 4

Green Building Policy Tools

Market Transformation Tools

Tool	Policy Tool	Short Term	Long Term	How Does it work?	Ease of Implementation	Potential Impact	Examples
Connect Green Projects to Capital	Revolving Fund	Vote Here	Vote Here	A Revolving Fund finances energy efficiency improvements in either new or existing buildings. Loans are repaid from energy savings.	**Difficult** - Requires inexpensive capital for fund - Quality assurance of building programs	**High** Financing a substantial barrier to green buildings	City of Toronto - Toronto Atmospheric Fund
	Support 3rd party Green Loan Programs	Vote Here	Vote Here	Local Governments can partner with lending institutions, to promote existing energy efficiency lending programs	**Easy** - Lending institutions have the capacity to manage loans - Focus on larger buildings; greater capital costs, potential gains & economies of scale	**High** Financing a substantial barrier to green buildings	VanCity Savings Credit Union- has been green lending packages for energy retrofits in businesses, stratas and single family homes.
	Local Improvement Charges	Vote Here	Vote Here	Local Government finances capital costs of energy efficiency. Energy savings paid back to Local Government through LIC.	**Difficult** - Have experience with LICs - Gauge Provincial response	**High** Financing a substantial barrier to green buildings	
Capacity Building	Industry Education	Vote Here	Vote Here	Market barriers (lack of installation capacity, lack of experience with rating systems, etc) hinders green development	**Easy** - Develop capacity with green building certification systems cited in policies (LEED, BuiltGreen, R2000 etc) - Address trades, builders, developers, designers	**Medium**	Solar BC Communities- Solar hot water installation training
	Build Staff Capacity	Vote Here	Vote Here	Permitting staff (plan checkers, etc) can benefit from training in green building strategies & rating systems	**Easy** - Develop capacity in systems with common barriers (Solar hot water, geoexchange) - Develop capacity with green building certification systems cited in policies (LEED, BuiltGreen, R2000 etc)	**Medium**	City of Red Deer
	Promote Retrofit Incentives	Vote Here	Vote Here	Promote Federal EcoEnergy Home Retrofit Program. Flyers, workshops, subsidizing home assessments, etc	**Easy**	**High** Allows greater energy efficiency gains than affecting new construction. Promotion garners 2 times higher uptake of retrofit programs.	City of Medicine Hat and the Resort Municipality of Whistler - promotes ecoEnergy City of Red Deer- promotes BuiltGreen for new homes

Incentive Tools

Policy Tool	Short Term	Long Term	How Does it work?	Ease of Implementation	Potential Impact	Examples
Sustainability Checklist	Vote Here	Vote Here	Part of development/rezoning permitting process. - Educational value - Associated with incentives -Regulatory - minimum score required	**Easy - Moderate** - Compatibility regulations/incentive schemes that can be made more stringent over time are important	**Varies** Checklists without regulations/incentives less effective	Town of Canmore (regulatory), District of North Vancouver, Resort Municipality of Whistler
Development Cost Charges	Vote Here	Vote Here	Levied on new developments to pay for infrastructure. - Reduced fees provide an incentive to offset incremental costs for green building	**Moderate** Cost schedules must be finely tuned to accurately reflect cost savings to the Local Government from reduced infrastructure costs, and to incentivize energy efficiency.	**High** Comprise a high proportion of development costs. Reductions provide a real incentive to developers.	City of Kelowna
Revitalization Tax Exemption Bylaw	Vote Here	Vote Here	Local Governments can partner with lending institutions, to promote existing energy efficiency lending programs	**Moderate**	**Varies** Sometimes little take-up.	Maple Ridge
Development and Building Permit Fast Tracking	Vote Here	Vote Here	Reduces taxes for green developments.	**Easy - Moderate** - Various fast-tracking protocols exist. Some automated. - Local Governments have multiple priorities. Green buildings must be prioritized to effect market pressure to go green. - Can work in conjunction with a sustainability checklist / Green Building rating system	**Medium-High** Developers often respond to fast-tracking more than cash incentives, or density bonusing	City of Calgary
Density Bonusing	Vote Here	Vote Here	Reduce approvals time for applications meeting green criteria. - Effective in markets with strong building demand	**Easy - Moderate** - Set acceptable uplift levels - Develop clear guidelines for development planners to negotiate density bonus - Can work in conjunction with a sustainability checklist / green building rating system	**Medium-High** Density should be allocated only in appropriate neighbourhoods; compact, complete, alternate transport accessible	Town of Okotoks
Development and Building Permit Fee Rebates	Vote Here	Vote Here	Return a portion of fees for applications meeting green criteria	**Easy - Moderate** - Works in conjunction with a sustainability checklist / Green Building rating system - Results in lost revenue, unless additional fees are added	**Varies** Depends on value of rebate. A greater incentive for larger projects, with higher fees	City of Calgary, Strathcona County

Land Use Planning Tools

Policy Tool	Short Term	Long Term	How Does it work?	Ease of Implementation	Potential Impact	Examples
Compact Complete Communities	Vote Here	Vote Here	Land use intensity can be increased using a variety of zoning tools & best practices. Compact, complete communities feature a range of unit sizes (with lesser average unit sizes overall). Less floor space typically means lower energy use per capita.	**Varies** Depends on many local factors. Primarily a longer term strategy. Appeal to community priorities in addition to energy efficiency - healthy neighbourhoods, options for walking or biking, local access to amenities, a range of housing, etc Density needs to be transit/alternate transport accessible.	**Very High** Probably the greatest impact of any strategies Local Governments can use to advance buildings' energy performance.	Many communities have policies to reduce sprawl and encourage compact growth.
Service Area Bylaw	Vote Here	Vote Here	Requires connection to a Neighbourhood Energy Utility.	**Difficult** Requires careful planning & coordination with many stakeholders. Local Government assumes the risk of operating the Neighbourhood Energy Utility	**Very High** Significant emissions reductions will only be achieved if heat is supplied from renewable sources.	City of North Vancouver, City of Revelstoke, and others Many communities are developing District Energy and Neighbourhood Utilities.
EcoIndustrial Park	Vote Here	Vote Here	Zoning and Development Guidelines encourage integrated systems and services; reduces energy, water and resource inputs	**Varies** Depends on many local factors. Primarily a longer term strategy.	**Potentially High** Depends on extent and type of local industries.	Hinton, AB, Eco-Industrial Park "Innovista"

Regulatory Tools

Policy Tool	Short Term	Long Term	How Does it work?	Ease of Implementation	Potential Impact	Examples
Development Permit Area Guidelines	Vote Here	Vote Here	Specify building forms and character, encouraging passive solar design. Specify onsite renewables.	**Moderate** - Some uncertainty around local government authority - Consider local environmental conditions (latitude, temperatures, etc). Energy modeling to determine best guidelines appropriate. - Guidelines for different building types (low-rise, high-rise, residential, commercial, high internal heat load, etc) are appropriate, allowing for best passive design applications	**Low - Medium** Does not address envelope performance and mechanical systems. However passive design can significantly affect energy performance.	District of Saanich
Statutory Building Schemes	Vote Here	Vote Here	Register covenants requiring green building performance. Typically at re-zoning or sub-division, especially at sale of Government owned land.	**Moderate to Hard** - Requires substantial legal work - Provincial regulations dictate possible provisions. - Implement policy support green building covenants generally; use when impact is high (ie large subdivision or rezoning)	**Medium - High**	
Rezoning- Green Building Policy	Vote Here	Vote Here	Adopt performance standards, to guide staff during rezoning negotiations.	**Easy** - Standards should evolve, to stay ahead of the Provincial/Federal regulatory curve. Green building rating systems (LEED, BuiltGreen, etc), or equivalencies, are appropriate. - Higher building performance demanded from properties with advantageous rezonings. - Generally guaranteed through a voluntary covenant	**Medium - High** Depends on the extent of demands at rezoning. Density should be allocated only in appropriate neighbourhoods; compact, complete, alternate transport accessible	Bowen Island Municipality
Performance Standard for Green Building Permits	Vote Here	Vote Here	Require a building performance rating (EnerGuide, BuildGreen, LEED, etc...) for occupancy permits	**Moderate** - Legality Unclear	**Medium - High**	Town of Canmore

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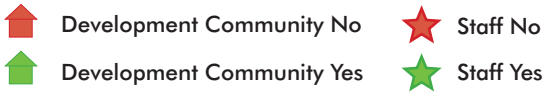
Appendix 5

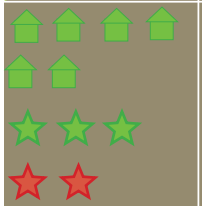
Voting and Feedback on Green Building Policy Tools

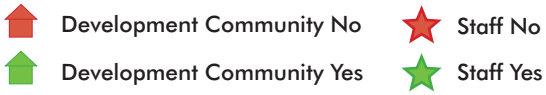
Market Transformation Tools

	Policy Tool	Short Term	Long Term	Feedback
Financing	Revolving Fund			Development Community (Applicable to all Financing Tools) - Have to address affordability issues - Market entry costs a major barrier - Concerns about paperwork; bureaucracy - Need clear terms of financing, ease of use
	Support 3rd party Green Loan Programs			
	Local Improvement Charges			
Capacity Building	Industry Education			Staff - Opportunities for partnership with Vancouver Island University Development Community - Home Builders Association a good resource for education & partnership
	Build Staff Capacity			Staff - Potential for solar hot water installation training for staff - Industry / staff training Development Community - Build capacity of counter staff; develop green specialist - Approve of dual industry & staff capacity building
	Promote Green Building Programs			Development Community - BC Hydro PowerSmart program useful - Have to address affordability issues - Minimize paperwork & logistical barriers



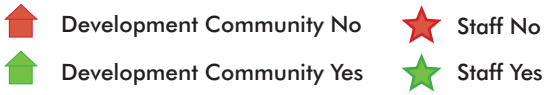
Incentive Tools

Policy Tool	Short Term	Long Term	Feedback
Sustainability Checklist			Staff - Intend to update; link to particular development types - Recognized opportunity to tie to incentives/regulation Development Community - "Link to something meaningful"; unhappy with current checklist
Development Cost Charges			Staff - DCCs not used in many areas of the RDN
Revitalization Tax Exemption Bylaw			
Development and Building Permit Fast Tracking			Staff - "Avoid slow-tracking" - Extra time for green building at permitting a concern - Requires appropriate staffing levels, resources, empowering staff to say 'no' - May require higher fees - Need clear criteria for applications; dovetail with efforts to increase application quality Development Community - Suggest "Green Guru" staff person to aid green projects - Continuity, integrated approvals team
Density Bonusing			Development Community - Not an incentive in the RDN context. Many develop centers already allow 8 stories; developers have not taken advantage of height allotments thus far.
Development and Building Permit Fee Rebates			Development Community - Buyers may be receptive; tie to public education



Land-Use Planning Tools

Policy Tool	Short Term	Long Term	Feedback
Compact Complete Communities			Staff - Ostensibly supported by OCPs; but, parcel sizes present a barrier - often overly large parcel sizes are specified in the OCP - Must ensure incentives encourage compact communities
Municpal Utility - Service Area Bylaw			
EcoIndustrial Park			Staff - Be cognizant of adjacent energy sources; example - industrial park potential, in city but supported by RDN



Regulatory Tools

Policy Tool	Short Term	Long Term	Feedback
Development Permit Area Guidelines			Staff - Several OCPs. Guidelines need to be aligned - Staff lack inspection capacity; can only serve a suggestive/guidance purpose, under present resources Development Community - Suggested set-back relaxation, perhaps linked to green performance - Capacity of plan checkers to evaluate green building components a concern
Statutory Building Schemes			
Rezoning- Green Building Policy			Staff - Link with subdivision green building policy Development Community - "Don't want to create a disincentive to new construction"
Performance Standard for Green Building Permits			Development Community - Compliance program appropriate

Development Community No
Development Community Yes
Staff No
Staff Yes

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Appendix 6

Local Governments Green Buildings Policy Case Studies

Calgary's Incentive Array

The City of Calgary is developing an array of complementary incentives for green buildings.

building permit rebates

Calgary provides a rebate on building permit fees for projects (both residential and commercial) that meet either LEED or BuiltGreen Standards. Rebates are:

- 10% for Silver Certification (either certification system)
- 20% for Gold
- 30% for Platinum

Building permit fees are about $7.50 per $1000 of construction costs. For single family and low-rise residential homes, Calgary's building permit rebates usually equate to about $200-$1000, depending on construction costs and green building performance. While rebates may equate to a small percentage of total project costs, they have proved successful at encouraging home owners to build green, and have seen substantial market uptake.

Multifamily or commercial projects stand to gain incentives of up to $100,000. There has been moderate uptake of the program amongst this sector.

implementation

Ensuring Fiscal Viability
Building permit rebates reduce revenues. Calgary is examining using an additional 'feebate', levied at permitting, to make up the shortfall. The feebate would be refunded to projects certified as LEED or BuiltGreen, while buildings not achieving certification would not be refunded. In this way. besides adding a revenue stream to pay for fee reductions for higher performance buildings, the feebate serves as an additional incentive to build green.

Considering Approvals Fast Tracking
Calgary did not stop at rebates. They recognized that the greatest incentive for developers, especially of larger projects, is rapid permitting approvals. Calgary has developed an approvals fast-tracking process, which they are considering for adoption.

Fast-tracking will be implemented alongside building permit rebates. It will be reserved for especially green projects, that meet stingent City of Calgary criteria in addition to LEED/ BuiltGreen performance.

> **"For most single family homes, these incentives range between $200 and $1000."**

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Maple Ridge's Revitalization Tax Exemption

The District of Maple Ridge has implemented a Revitalization Tax Exemption Bylaw.

policy framework

In 2006, Maple Ridge introduced a Tax Exemption Bylaw, providing property tax exemptions for the first four years of a development that meets the LEED Silver. The project exemption only applied to Part 3 construction, greater than five stories.

implementation

A Lack of Uptake
In the four years since the policy was introduced, there has been no uptake of the incentive. Most construction in the downtown revitalization area where the tax exemption applies has been below 5 stories. Moreover, property tax exemptions do not directly address the split incentive of more efficient builders. Strata councils or commercial property owners benefit from property tax breaks, while developers pay added costs for energy efficient construction.

Maple Ridge's experience suggests that incentives for green building should aim at a number of building types, and incent developers, not occupants, to properly address split incentives.

> "Incentives for green building should aim at a number of building types, and incent developers."

Toronto's Atmospheric Fund

The Toronto Atmospheric Fund provides $8 million in revolving funding for energy efficiency improvements. Loans improve energy efficiency in residential towers, and other sectors.

background

TAF was founded in 1991 by the City of Toronto, to finance and support research and projects addressing local air pollution and climate change. In 2004, Tridel, a condo development and property management company, approached TAF about financing green retrofits and new construction practices.

policy framework

In 2008, TAF approved $1.5million in loans to stratas, to finance energy retrofits in three buildings. Stratas used the loan to pay for energy retrofits, paying back the loan through energy savings. Tridel and the TAF organized the assessments and execution of retrofits, reducing management obligations for stratas, which typically have little experience in energy retrofits or construction management.

results

This Green Condo Loan program has proved very successful. Typical pay-back periods for the initial buildings were 2-3 years, with the loan rated as very low risk by the TAF. For such retrofits, energy use is reduced in the order of 25%, varying by building. The TAF is considering expanding the program to cover about 20-30 new and existing high rise towers annually.

"Projects financed by TAF loans have saved the City $17.5 million."

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HATsmart - Medicine Hat Gets Smart About Incentives

The City of Medicine Hat has initiated HATsmart, a community based social marketing program and incentive scheme, encouraging greater energy efficiency in their community.

policy framework

HATsmart (http://www.hatsmart.ca/) provides home owners and commercial ventures with information on energy conservation. Additionally, HATsmart administers a well structured incentive for home energy retrofits, and energy conservation and renewable production in the commercial sectors.

Home Energy Retrofits
HATsmart provides information on the Federal ecoEnergy Home Retrofit program and the additional Government of Alberta incentives provided for home energy retrofits. In some instances, HATsmart provides additional incentives. The process is simple for the homeowner, who only has to apply to the ecoEnergy program.

Home owners participating in the EcoEnergy program must first receive a home energy assessment. The assessment costs between $250-$350; homeowners can sometimes be wary of participation in the program, given this first cost, and a lack of knowledge about the program. To address this problem, HATsmart provides homeowners that attend an Energy Conservation Seminar with an extra $100 rebate on the costs of the home energy inspection. The Seminar takes two hours, and introduces home owners to the potential for home energy retrofits and the ecoEnergy program. The Seminar can be accessed online. This incentive could be replicated by any municipality promoting the ecoEnergy program, even those that don't offer other incentives.

Commercial Buildings
HATsmart also provides incentives to commercial institutions of up to $50,000 per organization. Businesses can access incentives for:

- Efficiency upgrades (up to 10% of costs)
- Renewable Energy (up to 50% of costs) – Applies both to electrical and thermal technologies
- Energy audit (up to 50% of costs) – This is an especially worthy incentive, as it is a relatively small fee for the City, but lowers the hurdles (real and perceived) for businesses to initiate energy retrofits of facilities

> "The process is simple for the homeowner."

HAT smart
A City of Medicine Hat Environmental Initiative