COASTAL FIRST NATIONS
GREAT BEAR INITIATIVE

NEW HOUSING **GUIDE**

A primer for building culturally appropriate, high-performance homes in the Great Bear Region

Contents

Introduction

The remote First Nations of the Great Bear Region share the goal of reducing dependency on fossil fuels. Each Nation is taking its own approach to achieving this goal, and is moving towards the conclusion that high-performance and culturally appropriate housing is a central component of energy independence.

In Great Bear Initiative (GBI) communities, roughly half of the energy consumed is used to power and heat homes. Within a home, the majority of that energy is used to heat the air and hot water. Reducing the amount of energy used to heat a home, and keeping that heat in the house for longer, reduces energy demand for the whole community.

When making a significant investment, such as building a new home, there is an opportunity to:

- Design and build to ensure that:
    - Unwanted moisture leaves the building while heat stays in.
    - Homes are resilient to climate change, including high winds, longer rain periods in the winter, and warmer temperatures in the summer.
- Make investments that will have multiple community benefits.
- Engage community members about the opportunities that come with investing in high-performance buildings.
- Train homeowners about managing their assets.

What is a High-Performance, Culturally Appropriate Building for Coastal First Nations?

In the context of Coastal First Nations, high-performance buildings use the minimum amount of energy derived by fossil fuels as possible, stand up to the winds and rain of the region, manage moisture to keep mould out of the building, and are designed to meet the cultural needs of occupants. While each community is different, these principles are foundational and shared between communities.

A high-performance building offers additional benefits to occupants, including:

- A more comfortable, healthy interior environment with less drafts and moisture.
- A quieter building, as thicker insulation results in less outside noise entering the building.
- Higher indoor air quality because well-ventilated buildings filter air regularly.

A culturally appropriate home is designed to suit the needs and lifestyles of the people who will live in it. This includes details like providing space to engage in preparation of traditional food, and accommodating a range of family living arrangements.

Developing an Approach to New High-Performance Housing

Each Nation will pursue high-performance, culturally appropriate homes in their own way depending on local needs and priorities. Energy efficiency and reduction of fossil fuel use is only one aspect of a high-performance home, and needs to be considered with a variety of other housing objectives, such as health, economic development, cultural expression, and others.

While some may see an opportunity to seed a local economy using local skills and resources, others may be in a short-term housing crunch requiring solutions from outside industry suppliers. Here are a few considerations when determining an approach to new high-performance housing:

- Do you have a housing strategy, including information on projected growth and on how many people in your community are under-housed? From this, do you know how many individuals and families you plan on housing over the next 1–5 years?
- Who are you trying to provide housing for in your community, and what are the size and functional requirements to meet their needs (e.g., individuals, families, seniors, small children, etc.)?
- What community resources are you interested in involving in new housing projects? Examples include:
    - Individuals that could play a role in construction, logistics, and management.
    - Young people that are interested in learning to build homes.
    - Local resources that can be used as building materials, such as timber, a mill, river rocks, a concrete mixer, aggregate, or heavy machinery.
- What are the cultural practices in your community that are not well accommodated by your current housing?

Answering these questions helps clarify your housing needs, goals, and requirements. With this knowledge, a community can begin to make decisions about how they would like to go about planning and building new homes over the short and long term. Helpful questions include:

- Are you looking for quick, short-term solutions (based on funding timelines)?
- Do you have some time to plan for future housing needs?
- Are you interested in and have the resources it takes to explore how your community could build your own homes?
- Is the band able to manage new home development during construction, able to manage mortgage costs, and able to recuperate costs through rent?
- Is there an opportunity to plan for new homes a year or two in advance, creating space for improving home design and leveraging partners?
- Can leadership get behind spending more per unit during construction if the homes are more durable, employ local people, are better suited to the climate and culture, and/or have reduced utility costs on a monthly basis? High-performance, culturally appropriate homes do not necessarily cost more to build on reserve, if you have the right people, resources, and knowledge in your community (see Nuxalk example below).
- Does your community have an interest in collaborating with others in the Great Bear Region who are taking a deeper look at how to build high-performance, culturally appropriate homes?
- What other community objectives, in addition to reducing fossil fuel use, can be met with new housing?
- How can housing maintenance (asset management) procedures be adapted to ensure new high-performance homes are properly maintained and keep performing well over time?

These questions are designed to help housing managers, band managers, and leadership re-imagine the role and process of housing in a community, and spark the creativity required to redefine a housing approach that meets multiple objectives, as well as generates a pride of ownership.

NUXALK NATION — DEVELOPING A LOCAL HOME-BUILDING ECONOMY

The Nuxalk Nation developed a New Housing Strategy. The housing strategy was developed to meet five key goals:

1. **Use existing assets and resources:** The Nuxalk Nation are working towards self-sufficiency. For new housing, the Nation used their own gravel for site preparation, and lumber that was milled with their own saws. Their future plans include a concrete plant, a cabinet maker, a door builder, and eventually, a trades school.
2. **Build capacity:** The Nation identified the need for skills training in the community. It was less costly, and kept members in the community with family while they were training. Local contractors build homes for approximately $110 per square foot.
3. **Build to meet economic, social, and cultural needs:** Design choices were driven by the needs of members, such as open-concept homes for get-togethers. Exterior and interior finishing choices were driven by the desire to use local resources and the community members' aesthetics.
4. **Build structures that stand up to the coastal climate:** Previous homes were built to CMHC standards that, while appropriate for other parts of Canada, did not stand up to the wet and windy coastal climate. The Nation developed their own set of building standards and specifications.
5. **Educate and empower residents and homeowners:** The Nation created guides for maintenance, repair, and financing. Tenants and homeowners were connected to the home-building crew to draw on their expertise.

Designing Homes for the Coast

Embedding energy efficiency into new homes starts when a community begins designing a home, or selects a pre-existing design. This section provides an overview of high-level considerations for energy, culture, climate, and costs during this design stage. The design stage is the most cost-effective time to incorporate these considerations.

Energy Efficiency

To ensure that a home is as energy efficient as possible, it is critical to involve an individual who has knowledge of building science, as well as heating and ventilation systems. They must also be able to understand how design has an impact on heating and ventilation when selecting or developing a new housing project.

One useful profession that is becoming more commonplace in the building industry is the Certified Energy Advisor (CEA). This low-cost professional can be engaged early in the design stage to improve energy performance of a home before it is built.

CERTIFIED ENERGY ADVISORS HAVE THE ABILITY TO:

- Make comments on house drawings to explain how design decisions will have an impact on energy use and efficiency.
- Offer suggestions to "tweak" designs to improve efficiency.
- Model the energy performance of a home before it is built.
- Inspect a home during construction to make sure the building is being assembled as designed, for optimum energy efficiency.
- Offer a pre-occupancy blower-door test to make sure air does not leak where it should not.
- Offer advice throughout the building process.
- Help measure home energy performance post occupancy.

A list of Certified Energy Advisors is provided in Appendix A. Costs for energy modelling are on average less than $800 per home.

The types of recommendations an energy-focused professional would make include:

- If possible, orient the building on the site to take advantage of passive solar gain.
- Identify opportunities for windows to provide enough daylight to reduce the amount of electric lighting required.
- Ensure the floors, walls, foundation, and ceilings are designed to accommodate high insulation values.
- Identify ways to minimize breaks in the building envelope.
- Ensure the home design matches the selected heating system. (See more about selecting the right heating system on page 11.)
- Eliminate traditional wood burning appliances and use pellet or chip burning appliances instead.
- Install appropriately sized, energy-efficient heat pumps rather than more traditional fossil fuel-based heating systems.

SEABIRD ISLAND SOLAR ORIENTATION OF NEW HOMES

Seabird Island homes were carefully planned to take advantage of the sun to maximize solar gain for heating. In addition to passive solar features, these houses also use renewable energy technologies, such as solar hot water preheat, wind turbines, and a geothermal system, called Earth Tubes, to preheat fresh air. A well-insulated envelope and energy-efficient appliances ensure the overall low energy use of the building. Other sustainable features include the use of recycled and durable materials to limit maintenance requirements, rainwater collection, non-toxic materials and water-efficient fixtures. More details here: http://www.broadwayarchitects.com/downloads/Integration-Innovation-SeabirdIslandProject.pdf

Reflecting Local Culture

When selecting or designing a home for your community, it is important to consider how a new home could better accommodate the way your community members live in homes. A few examples from other communities include:

- Providing space for preparing traditional foods.
- Managing moisture for different numbers of people at different times of the month or year.
- Ensuring a diversity of housing types to house singles, seniors, youth, small families, large families, etc.
- Representing how homes were made in the past in the new home design (e.g., the carved wooden doors on the Nuxalk Big House).
- Building with resources that are available in your community to have homes more closely reflect your culture and geography.
- Address homelessness with single-room occupancy homes (e.g., mini homes).
- Using timber-frame concepts that utilize resources from within your community.
- Building homes that allow appropriate space and systems for specific needs (e.g., open spaces for community gathering and large meal preparation).

Built for the Coastal Climate

While a community is selecting a design, there is a significant opportunity to consider how the local climate has an impact on current housing, and what can be done to improve a building's performance on the Coast. Two Coastal First Nation communities (the Nuxalk Nation and the Skidegate on Haida Gwaii) have made their own building specifications, which detail how homes should be built to withstand the coastal climate, including:

- Three-foot overhangs and appropriately fastened metal roofs to accommodate the high winds and driving rain experienced on the Coast.
- Proper rainscreen on all exterior surfaces, to ensure any moisture that hits the home does not seep through the building into the walls.
- Natural indoor cross-ventilation within rooms and homes by using techniques such as undercut interior and closet doors, and louvered interior and closet doors (slats for moisture to move and dry).
- Interior venting in closets to ensure moisture is not trapped on wet clothes.
- Clear span or structural grade trusses to ensure loads are transferred to the outside walls, so that there is flexibility in placing walls wherever it is desired and the home can be adapted over its lifespan.
- Mould-resistant drywall, compound, and fibre tape, or other non-moulding interior surfaces.
- Mud rooms to keep wet clothes and shoes outside of the main building envelope.

Costs Considerations

During the design stage, it is also important to understand that costs are related to choices made during the design and construction process. When designing a cost-effective home, it is important to consider the following:

- Is there an opportunity to build with higher-quality materials (no asbestos or melamine, limited plastics) to prolong the lifespan of the building?
- Can you build with only natural materials?
- Is there an opportunity to spend the time to develop local materials that are suitable for the coastal climate?
  - **Short Term:** Where is the best place to procure high-quality, appropriate materials in the region?
  - **Long Term:** Are you able to make any high-quality materials locally in the future? What would need to happen to achieve this?
- Are there opportunities to standardize design and building so there are fewer wasted materials? For example, all walls/doors are designed to use standard plywood sheet units, or all windows are the same standard size to reduce costs and ease replacement.

Maintenance and Monitoring Performance

New homes should be designed to ensure they can be maintained and perform well over the lifetime of the building. Making maintenance simple where possible, and providing resources to support maintenance where necessary, will enhance the useful life of the building.

It is also useful to put a performance-monitoring process in place to ensure new homes are working as expected over time. Comparing the performance of a home to the original modelled performance can help identify improvement in future projects. This level of performance monitoring will require the Certified Energy Advisor to revisit the home at certain times to conduct airtightness testing and other inspections.

Technical Building Performance Decisions

In addition to these high-level questions for the design stage of a new project, there are many questions regarding building performance that must be considered throughout the building process to ensure that you are making choices that are consistent with your housing objectives and community capacity. Choices need to be made about:

- Foundation type.
- Framing method (typical stick build, advanced framing, or modular/prefab).
- Insulation type and value.
- Windows and doors (double- or triple-pane, ENERGY STAR® rated).
- Heating systems (oil or propane furnaces, air-source heat pumps, hot water systems).
- Ventilation (system design, heat recovery ventilators).
- Interior finishings.
- Appliances (ENERGY STAR® rated).
- Lighting (LED) and water fixtures (low flow).
- Controls (programmable thermostats, fan timers).

The Technical Bulletin for Housing "Providers" as a sister document is a starting point for considering some of these decisions when designing a new home for coastal communities, and for how these decisions may impact the performance of the home.

Decisions made about how to build a home have short- and long-term cost and performance implications. Often times, a higher initial investment can enhance the performance, and long-term cost effectiveness of a project. The payback period is the time it takes to save as much money (from reduced energy costs) to break even on the up-front cost to purchase and install a piece of equipment. An example of a positive payback is found in lighting, where LED light bulbs cost 3–5 times more to purchase, but use roughly 90% less energy, saving money in the long run. The table below illustrates payback periods calculated for some standard energy-related features of a home.

Technical Aspect	Payback Period
Increased Insulation	2–5 years
ENERGY STAR® Windows	Under 10 years
Heat Pump	6–10 years[1]
ENERGY STAR® Appliances	Over 20 years
LED Lighting	3 years

[1] Depends on the current heating requirements of the home and its existing system. E.g., for homes using baseboard heating with Zone II electricity rates, it is likely that the payback period would be less than a home with an oil furnace. On a per-kWh basis, oil and propane is often cheaper than electricity, even in remote communities. However, heat pumps are more efficient.

POSITIVES OF PREFABRICATED HOMES

- Fast on-site construction.
- Affordability — generally less expensive than traditional construction.
- Built in a dry environment.
- May be more energy efficient.
- Less construction waste.

NEGATIVES OF PREFABRICATED HOMES

- Cannot make changes on site.
- May have limited floor plan choices.
- Damage to panels may occur during shipping.
- Some types of panels must be kept dry on site while waiting for assembly.

Choosing an Efficient Heating and Ventilation System

There are a variety of ways to heat a home and each way has its advantages and disadvantages. A heating system should be able to maintain a stable temperature of 21°C throughout the home. When choosing any heating system, it should meet EnerGuide, ENERGY STAR®, or higher standards. Selecting the most efficient heating system will depend on a variety of factors, including location, available fuel sources and costs, climate, occupants, and the home itself. To minimize cost, it is important to calculate the heating needs to ensure the heating system is properly sized for these factors.

In Coastal First Nation communities, small hydro projects, solar photovoltaic installations, and diesel generators are used to make electricity. Heat is provided by using electricity in electric space heaters, furnaces, or heat pumps, by burning fossil fuels in furnaces or boilers, with wood or pellet stoves, or in some cases, by preheating water with solar energy (Skidegate). In order to achieve the goal of reducing dependency on fossil fuels, each community will have to consider which energy sources are used to produce energy locally, and align heating system decisions to take advantage of renewable sources as much as possible.

The table below provides a comparison of heating systems, their advantages and disadvantages, as well as their appropriateness for Coastal First Nation communities.

Fuel Source	Capital Cost	Operating Cost	Advantages	Disadvantages
Electricity				
Air-source heat pumps	$$$	$	• Airflow • Energy efficient	• "Black box" — difficult to fix locally
Baseboard heaters	$	$$$	• Easy to install • Low-maintenance	• Poor heat distribution/ mould
Space heaters	$	$$$	• Portable • Easy to install • Low-maintenance	• Fire hazard • Poor heat distribution/ mould
Wood				
Woodstoves	$$	$	• Local fuels (if available)	• Maintenance • Daily labour
Pellet stoves	$$	$$	• GHG neutral • Energy efficient	• Maintenance • Daily labour
Fossil Fuels				
Forced-air furnaces	$$	$	• Airflow	• Maintenace • GHGs
In-floor radiant heaters	$$$	$$	• Even, comfortable heat • Low-maintenance	• Requires a boiler

AIR-SOURCE HEAT PUMPS

An air-source heat pump is a highly energy-efficient heating appliance compared to electric baseboards or furnaces. A properly sized air-source heat pump can be 40–70% more efficient than an oil-fired furnace. Skidegate has invested in air-source heat pumps as part of a major retrofit project, and is experiencing significant savings in electricity costs, from $80 to $250 per home per month. It is important to note that while this technology can provide heating in mild conditions, an air-source heat pump requires a back-up heat supply during very cold months.

The following questions offer helpful guidance when making decisions on what heating system should be used in a new home:

- **What fuels/resources are available?** Heating systems can use a variety of clean, renewable energy resources, and the most efficient option depends on what resources are available locally.
- **Is there a culture of wood burning?** In places where wood is in abundant supply, and community members have a culture of wood burning, this GHG-neutral option can be quite efficient and affordable, and contribute to a local economy.
- **How many homes are being built?** If many homes are planned, there could be an opportunity to create a district heating system. The Old Massett are planning a wood-puck biomass district heating system.
- **Is investing in climate adaptation a priority for you?** As the climate continues to change, summer temperatures will increase and cooling may become a priority during the warmer months. If appropriate, heat pumps can provide heating as well as cooling.

Energy Efficient Water Heating

Water heating for bathing and washing can account for an average of 25% of a home's energy use. Choosing an efficient appliance to heat water depends on available fuel sources, the number of occupants in the home, and how the occupants use the home (are they home all day, or are they out of the home during the day). A tankless water heater uses 30% less energy on average, but is more expensive to install. This appliance may make sense in cases where grid-connected (Zone I) hydro electricity[2] is available, or when heating loads are high at certain times of the day, rather than constant throughout the day.

If this is not the case, a tank water heater, with a rooftop solar photovoltaic (PV) system, is likely the best option for heating water on the Coast.

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[2] Tankless water heaters use less total energy but have higher peak loads, meaning they use more energy at one time. In off-grid communities where the electrical system capacity is constrained, tankless hot water heaters are not recommended due to the increased peak load, especially if most homes would have this system.

COMPARING SOLAR HOT WATER AND SOLAR PHOTOVOLTAIC

Solar hot water (HW) uses the sun's energy to heat water for a building's hot water system. In many BC communities, there is not enough energy from the sun during the year to fully heat water to 60°C, so an additional method of heating is required. This also reduces the energy demands of a hot water system.

Solar photovoltaic (PV) systems use solar panels to convert the sunlight to electricity. The electricity generated from the panel can be stored in batteries or fed back into the local electricity grid. Solar PV systems can offset the total amount of electricity that a building uses.

Currently, solar PV systems are more cost effective than solar HW system. This may be different in different locations (e.g., a coastal community compared to an Okanagan community, as there may be more heat gained from a system in the Okanagan). Cost comparisons should be completed for each potential project. Future costs of each system are expected to decline as manufacturing production increases.

Heat Recovery Ventilation

A heat recovery ventilator (HRV) is a fan system that is connected to the vents in a home that captures the heat from the outgoing warm, stale, moist air to preheat fresh air before it goes through the furnace. An HRV can easily be included in a new home with a ducted heating system. For homes that don't have ducted heating systems, there are wall-insert HRVs that can be installed. The HRV can recover 60–90% of the heat leaving the house and reduce heating requirements while maintaining air quality in a tightly sealed home. It can reduce the energy requirements associated with ventilation by 50–70%.

Managing Construction

A well-designed home must be properly built to achieve its projected energy performance. While not all communities have the skills to properly manage contractors to ensure homes are being built to the standards specified in the design, a clear building management process with the appropriate checks and opportunities for remediating deficiencies can keep most new building projects on track. This section talks about how to ensure new homes are being built as designed, in order to realize the projected energy performance.

Being able to ensure homes are being built to perform as designed requires the following:

- Stating the level of energy performance required during the contracting phase.
- Having the skills to check for performance during the construction midpoint inspection, when improvements can still be made before the wall coverings are installed.
- Having the skills to check energy performance during the pre-occupancy inspection, before final invoices are paid.

Stating the Energy Performance Level

Builders produce what they are contractually obligated to deliver. By stating the required energy performance during the contracting phase, a community makes clear what is required for successful completion of a project and payment. Including clear energy performance requirements in the building contract is an appropriate way to communicate performance requirements to builders. Examples of possible requirements include:

- The EnerGuide rating must [meet/exceed] a typical new home built to Building Code 30% or better.
- The blower-door test must demonstrate Air Changes per Hour (ACH) of 3.5 or lower.
- The building must be ENERGY STAR®certified (note: this requires an ENERGY STAR® certified builder).

These requirements mean that a building envelope must keep air in the building, and not leak air through cracks in the wall system (air barrier). This can be tested using a blower-door test operated by a Certified Energy Advisor. Final payment of invoices should only be issued once this requirement is met.

Checking for Performance During the Building Process

The most straightforward way to check for energy performance is to conduct a blower-door test during the construction midpoint inspection (once the air barrier is complete, but the interior walls are not yet up). This test pressurizes the building and tests for leaks. If the home is not performing as required per the contract, the Certified Energy Advisor can identify where the leaks are coming from, and recommend remedies to improve the air barrier before the interior walls are hung. Improvements that are possible during this stage include:

- Providing more insulation.
- Additional air sealing.
- Adding drain-water heat recovery.

Performing this test during the construction midpoint inspection is the most productive and least expensive way to test for and improve any deficiencies. Once the walls are up, improving the air barrier becomes time-consuming and more costly.

Checking for Performance Before Occupancy

Before the contract is completed, it is in the best interest of the band to repeat the blower-door testing to ensure the home has been built to the energy performance level required. Repeating the blower-door test before final invoices are paid ensures the responsibility of addressing any deficiencies falls on the contractor, and that the band is left with a high-performing home before the contract ends.

How to Select Contractors

There are many builders, contractors, and companies that are interested in building homes for First Nations communities in the Great Bear Region. Some have valuable experience to apply, so to ensure you are using the best contractor for your community consider the following:

- What internal skills (carpenters, trades, and other related skills) do you have in your community that can be used in the project?
- Are there any regional builders that have demonstrated experience with high-performance buildings in a similar climate?
- Do the contractors you are considering have experience with remote communities or building on reserve?
- Does the contractor have a track record of delivering quality projects on budget?
- Is the contractor open to mentoring local workers to enhance local capacity?

In addition to this, having a contract that requires specific energy performance is essential to holding your contractor accountable to delivering a quality, high-performance home on time and on budget.

Preparing Your Community

As each band considers their unique short-term and long-term approach to developing new homes, it will be important to engage with the community and prepare leadership, band staff, and community members for their role in the future of housing.

For example, if your long-term approach is to build a local economy using the resources in your territory, it will take time to research, plan, and train individuals to participate in this new economy, and resources to make initial investments. Leadership will play a critical role in supporting this activity, and local champions will be necessary to lead and see this project through.

As each community begins this journey, unique opportunities to prepare the community will emerge. That said, there are clear steps that can help prepare your community to participate in the success of achieving high-performance homes. Some examples are outlined below.

Preparing the Band

- Decide what your new housing priorities are, and align resources to support them.
- Develop contract language for new homes appropriate for your community.
- Gain the skills and acquire the equipment to conduct a construction midpoint and final energy inspection (blower-door tests).
- Have housing maintenance staff trained to service the equipment that will be required in your new homes (HRVs, heat pumps, boilers, wood or pellet stoves, Wood Energy Technician Training (WETT), etc.).
- Engage in asset management to ensure the longevity and performance of your new homes over time.

Preparing New Occupants

- Tell the story of the new housing approach to occupants so they can share in the pride of the project.
- Share information about the special features of the home (e.g., cleaning filters annually, setting programmable thermostats) and how it is expected to perform.
- Develop an owner's manual that includes clear, visual instructions on how to operate and maintain the home.

Conclusion

This work has been completed by the Great Bear Initiative in partnership with the communities of the Great Bear Region. As each community moves forward with their own approach to achieve the goal of reducing dependency on fossil fuels, the considerations put forward in this document can help to align thinking, and share the Great Bear experience with other communities aiming to achieve high-performance and culturally appropriate housing and energy independence.

Special thanks goes out to Richard Hall of the Nuxalk Nation for his time and guidance during the development and review of this work.

Appendix A: List of Certified Energy Advisors Working in the Great Bear Region

A Certified Energy Advisor (CEA) is an individual that conducts EnerGuide home evaluation and can provide expert advice to homeowners who wish to make their homes more energy efficient. Certified Energy Advisors are licensed through NRCan.

Table 1: Northern BC Certified Energy Advisors

Name	Company	Contact Details
Rod Croome	Hometech Energy Solutions	250-596-4545 rod@hometechenergy.com
Alison Conroy	Pelican Consulting	604-240-2106 alison@pelicanconsulting.ca

Note: A full list of Certified Energy Advisors can be found here: http://www.chbabc.org/media/docs/CHBABC_CEAs_2017.pdf. This list is updated and maintained by the Canadian Home Builders' Association of BC.

Appendix B: How to Ensure New Homes are Energy Efficient

Key Steps for Building Energy Efficient Homes

1. **Ensure a Certified Energy Advisor is involved in the design.** Either require your builder to engage a Certified Energy Advisor, or engage one directly, to give advice to the designers on how to design for energy efficiency in a cost-effective way. This is the best and least expensive time to do this in the building process.
2. **Have the Certified Energy Advisor model the home as designed and recommend improvements.** The Certified Energy Advisor will prepare two reports for you (this typically costs $800 for a house):
   - o EnerGuide Homeowner Information Sheet (see Appendix D).
3. **Decide which upgrades to include in your contract.** Review the Certified Energy Advisor's reports and select the recommended upgrades you want to include.
   - o At a minimum, make sure the overall EnerGuide rating is less than a typical home
   - o If you choose upgrades, get an updated EnerGuide Model Homeowner Information Sheet from the Energy Advisor that includes the upgrades so that it is ready to attach to the contract or RFP documents (see Appendix D).
4. **Prepare a request for proposal (RFP) or contract for builder that states the energy standards that must be met prior to final payment.** These should include:
   - o Building inspection that confirms the home is built to the same or better specifications for each element in the EnerGuide Homeowner Information Sheet (see Appendix D).
   - o Maximum air leakage of #.5 ACH50 (Air Changes per Hour when the house is pressurized to 50 Pascals) or lower, to be verified by a blower-door test.
5. **Conduct construction midpoint blower-door test.** This airtightness test should be done after the airtightness layer has been installed, but before all the interior drywall is installed, and should be at or below 3.5 ACH50. This is the best and most cost-effective time to fix any air leaks found. The Certified Energy Advisor can help identify the changes needed.
6. **Conduct post-construction/final blower-door test.** This airtightness test is to confirm that the air barrier is still intact at the end of construction, and should be at or below 3.5 ACH50 (or as stated in the contract documents). Final payment to the builder should be contingent on meeting this standard. The Certified Energy Advisor can help identify changes needed. This may involve caulking, removing drywall to repair the airtightness layer, replacing pot lights with airtight pot lights, and others.
7. **File the EnerGuide Label for the home.** Obtain an EnerGuide Label for the home from the Certified Energy Advisor, place the label on the home's electrical panel, and file the report with the construction documents for the home.
8. **Prepare home occupants.** Teach home occupants how to use the heating controls (e.g., programmable thermostats), how to maintain the heating system (e.g., change out filters once per year), and other key items related to the energy systems installed in the home.

Appendix C: Current Resources Available in GBI Communities

Many resources currently exist within the Great Bear Initiative communities that can support energy-efficient, culturally appropriate home building in the region. These resources include:

- Nuxalk and Skidegate building specifications.
- Examples of well-performing heat pumps (Skidegate, Kitasoo, and Nuxalk).
- Local building materials, including a concrete plant and timber supply.
- Mills and kilns (Heiltsuk and Nuxalk).
- Completed home designs (1- to 4-bedroom homes for Coastal First Nation communities).
- Energy baselines.
- Expertise in alterative mechanical systems for the Coast.
- Energy efficiency policies.
- A pool of local trades.
- Rooftop solar installations (Kitasoo, Haida Gwaii).
- Upgrades of existing homes (Nuxalk, Kitasoo).
- Guides for building (under development in 2017).
- Guides for occupants (under development in 2017).
- Cabinet makers.
- Electricians in various communities.
- Post occupancy guidance for occupants.
- Metal roof making machine (Haida Gwaii).
- Heavy equipment in various communities.

Appendix D: Results of Energy Modelling for a Specific Building

This section offers housing providers a draft report template to ask a Certified Energy Advisor to provide after a building design has been energy modelled.

Energy Model Results

The table below details the performance of the building as it relates to a typical building that achieves the BC Building Code.

Table 2: Building Results

	EnerGuide Rating Report	BC Building Code Performance
Energy Performance (kwh/year)	Convert GJ to kWh and insert number here	Convert GJ to kWh and insert number here
Airtightness (ACH50)	Insert ACH from report here	3.5
% Better than BC Building Code		

Note to CEA: insert screen shots of EnerGuide label and "How Your Rated Energy is Used" for reference and include copies of the EnerGuide Evaluation and Renovation Upgrade Report as an attachment to this file.

Key Messages

Note to CEA: Summarize results of modeling using the list below as a guide. More details can be added to the list if relevant. Modify the highlighted words and words within the < > to represent the results of this building.

- Performs <well/poorly>, <better/worse> than a residential building constructed to minimum code requirements.
- Improving airtightness by <10%> will achieve an air change per hour rate of <3.21> at 50 Pascals, requiring attention to detail during construction, but adding minimal cost.
- Insert notes about insulation levels.
- Insert note about any other renovations / improvements that would meaningfully increase the efficiency of the building.

NEW HOUSING **GUIDE**

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