Lasqueti GHG Baseline Report

Oct. 20, 2011
Joseph Fall

Terms of Reference

In March 2011, the Lasqueti Island Local Trust Committee requested proposals to:

> *"... develop a household greenhouse gas baseline report. Also, the Local Trust Committee is requesting an analysis of the data from the Lasqueti Advisory Planning Commission greenhouse gas emissions survey conducted in 2010, and would like a report outlining possible next steps that could be taken in regards to the this survey information."*

In May 2011, Linda asked me to also include an evaluation of the GHGproof software from Sustainability Solutions Group.

Executive Summary

As part of B.C.'s commitment to reduce greenhouse gas (GHG) emissions, local communities are required to incorporate policies, actions, and targets for reducing GHG emissions in their official community plans or regional growth strategies. The Community Energy and Emissions Inventory (CEEI) is a B.C.-wide effort to aid in this task by estimating emissions on a per-community basis. However, there is concern that CEEI methodology may not be adequate to address the special situation of Lasqueti and similar island communities.

This report reviews the relevance of CEEI methodology for the Lasqueti context and explores potential alternatives for establishing a GHG emissions baseline for Lasqueti. CEEI methodology appears suitable for estimating Lasqueti's emissions from solid waste management and agriculture. However, CEEI methodology is inadequate for estimating emissions from on-road transportation, residential and commercial buildings, and land-use change. Issues in these sectors arise largely because CEEI methodology make assumptions and use factors derived from regional or province-wide averages, which are not appropriate for Lasqueti.
A survey of local Lasqueti households conducted by the Lasqueti APC could potentially serve as an alternative GHG emissions baseline. This dataset is very specific to the Lasqueti context and captures relevant quantities such as fuel consumption more directly than the CEEI assessment. However, the survey was limited in scope and does not cover some of the sectors considered in the CEEI assessment. Furthermore, since the data came from a voluntary survey it may not be representative of the total island population, and accuracy hinges on the ability of households to estimate their consumption patterns.

The software package GHGproof was evaluated as a potential alternative route for establishing a GHG emissions baseline. GHGproof uses the same basic "emissions sectors" as CEEI for the emissions inventory, but while many of the methods used resemble CEEI's, there are significant differences in how the data and calculations are done and what specific emission sources are included. While CEEI only accounts for those emissions generated within the jurisdiction, GHGproof provides a more comprehensive measure of total GHG emissions attributable to the population. Such a more comprehensive view is essential, for example, to capture the effects of policies that aim to reduce emissions from transport by encouraging the use of local goods and services. GHGproof uses metrics that are directly relevant to GHG reduction policy initiatives. With some customization, GHGproof could be adapted to work well on Lasqueti, and perhaps the other Gulf Islands.

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In evaluating CEEI methodology and potential alternatives, I identified several gaps in methodology and data that should be addressed to produce a baseline that is relevant and comprehensive. The first concerns transportation. CEEI treatment of vehicles and vehicle use on the Vancouver Island side of the ferry terminal needs to be clarified, and marine transportation, a potentially significant source of emissions for an island community, is not considered in the CEEI methodology at all. Another source of emissions not considered in CEEI is liquid waste.

The key observation from these analyses is that there is no "generic" ideal methodology for creating a GHG inventory. Many choices must be made about what to measure and how to obtain an estimate for each metric, and these choices will impact, often substantially, both the results of the inventory and its usefulness for various purposes. Thus, the design of a GHG inventory should begin with a clear statement of purpose and a clear understanding of how it will be used over time.
That said, some principles did emerge that can guide the design of a more generally useful and robust inventory. While the CEEI assessment does not provide an adequate baseline for Lasqueti, the basic structure of CEEI sectors is appropriate for the Lasqueti and Gulf Islands context. The GHG inventory for Lasqueti should, at a minimum, be based on those same sectors. Deviations from the CEEI methodology should be justified, and accuracy, completeness, consistency, and relevance of the alternative method should be documented, with respect to the inventory's overall objective. Furthermore, sectors not considered in the CEEI, such as marine transportation, and emissions arising from import of goods and liquid waste could be included as "add-ons" in such a way that the baseline inventory remains compatible with the CEEI. These principles ensure that the GHG Inventory for Lasqueti maintains legitimacy and is comparable with the CEEI for Lasqueti and other municipalities, while still providing a more comprehensive inventory useful for public education and policy evaluation.

Objectives

> *"The Province of B.C. has committed to reducing greenhouse gas (GHG) emissions by 33 per cent from 2007 levels by 2020. ...*
> *The Community Energy and Emissions Inventory (CEEI) represents energy consumption and greenhouse gas emissions from community activities in on-road transportation, buildings and solid waste. ....*
> *Community Energy and Emissions Inventory Reports ... help local governments to meet the Green Communities legislative requirement to establish greenhouse gas reduction targets, policies and actions in official community plans or regional growth strategies."*
>
> http://www.env.gov.bc.ca/cas/mitigation/ceei/

The purpose of this project is to identify an appropriate methodology for establishing a GHG emissions baseline on Lasqueti. This report:

1. reviews the CEEI methodology and document the relevance of the principles and methodologies in the Lasqueti context;
2. analyzes and summarizes the data collected by the Lasqueti APC GHG survey with a goal of producing an initial baseline report;
3. analyses and evaluates the GHGproof software for use on Lasqueti
4. identifies and documents data quality and data gap issues;
5. recommends a set of methods for establishing a more accurate GHG emissions inventory on Lasqueti and tracking that inventory over time.

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Report

1. Critical Analysis of CEEI methodology in Lasqueti context

The *Technical Methods And Guidance Document For 2007 CEEI Reports* provides much valuable background, methodological analysis, and conversion factors for tallying GHG inventories at the municipal level. However, for a variety of reasons, the recommended CEEI methodologies are unlikely to produce a meaningful measure of Lasqueti Island's GHG emissions, nor provide helpful guidance for establishing GHG reduction policies. This brief analysis attempts to highlight some of the reasons these methodologies do not work well on Lasqueti Island.

In the following, I consider the major methodologies covered in the CEEI report. Chapter numbers from the report for each sector analyzed are included for cross-reference.

On-Road Transportation Sector (CEEI ch. 5)

The CEEI methodology recommended for this sector, called "Resident-based", utilizes "the number and type of vehicles registered in a geopolitical boundary, the fuel consumption rate of individual vehicles and an estimate of the annual vehicle kilometres traveled (VKT) by various vehicle classes – to calculate GHG emissions"

This methodology does not work well for vehicles on Lasqueti for the following reasons:

i) many vehicles are not properly registered, so do not show up in the data;
ii) it is difficult to estimate VKT by vehicle class in such a small, diverse population;
iii) gravel roads and generally poor vehicle maintenance practices result in fuel consumption rates are likely significantly higher than average;
iv) the methodology explicitly excludes "golf carts, snowmobiles, farm vehicles, road construction vehicles, and other industrial machinery", which may represent a significant proportion of transportation fuel used on Lasqueti.

The methodology is also unlikely to produce satisfactory results for Lasqueti vehicles stored in French Creek – due to their sporadic use, the VKT is unlikely to be accurate.

In fact, the methodology description is ambiguous about whether on-island, off-island, or both sets of vehicles are included in the CEEI 2007 report for Lasqueti. The report documents over 300 ICBC registered vehicles in various classes. This number appears high for registered on-island vehicles, but low for a total of on-island plus off-island vehicles.

Residential Commercial and Industrial Buildings Sector (CEEI ch. 6)

This sector deals with the energy consumed in supplying heat and electricity to buildings. It assumes that buildings are connected to the electrical grid and uses total electricity and natural gas supplied by the various utilities. This is of no use on Lasqueti, where no such utilities exist.

The methodology for heating oil, propane, and wood (sec. 6.2.2) basically estimates the average household energy consumption (by housing type and region), and then subtracts grid electricity and natural gas, assuming the remainder is made up from heating oil, propane, and wood. Since there is no electrical or natural gas grid on Lasqueti, this method devolves to

estimating household energy use from averages for the region. Obviously this is not helpful in measuring Lasqueti's actual use or in setting policy or measuring progress on Lasqueti. Lasqueti residents use considerable amounts of fossil fuel for residential uses, including cooking, heating, and running generators. Yet, in the 2007 CEEI report for Lasqueti, the on-road transportation sector is estimated to account for 97% of all local emissions on Lasqueti, leaving only 3% for all other sectors. This low number illustrates that CEEI methodology does not capture the bulk of emissions from the residential building sector on Lasqueti.

Municipal Solid Waste Sector (CEEI ch. 7)

The primary culprit here is methane production from decomposing organic matter in the landfill. The methodology outlined in this section for Dry Landfills would be well suited to Lasqueti's landfill.

Land-Use Change - Deforestation Sector (CEEI ch. 8)

"For the purposes of greenhouse gas accounting, deforestation is defined as the direct human-induced conversion of forested land to non-forested land." On Lasqueti, this would primarily result from clearing land for residential construction and agriculture.
The data used in the CEEI methodology is regional, and so would not represent Lasqueti's deforestation rate, but rather the average rate of deforestation in the region.
Interestingly, the "CEEI inventories include deforestation, but the reports do not include afforestation or the conversion of non-forested land to forest." There is no rationale given for this – it may rely on an assumption that in most regions, afforestation is a relatively uncommon. This assumption would have to be examined closely on Lasqueti, since anecdotally, there are many old clearings and homesteads that are growing over.

Agriculture – Enteric Fermentation Sector (CEEI ch. 9)

Emissions from this sector primarily arise from enteric fermentation (methane produced in ruminants), manure management, and N2O emissions from soils.

- *Enteric fermentation*: the CEEI methodology would be suitable for Lasqueti, although a decision would need to be made about how to account for, or not, the feral sheep population, which make up the vast majority of ruminants on Lasqueti.
- *Manure Management*: given that there are no large feedlots or other livestock operations on Lasqueti, this category could probably be excluded.
- *Agricultural Soils*: the CEEI methodology excludes these emissions – "Emissions from agricultural soils are not included because we have insufficient information about them at a local level."

2. Analysis and Summary of Lasqueti APC GHG survey data

The APC GHG survey represents a first attempt to gather baseline information about energy use patterns on Lasqueti. This survey focuses on sources of GHG emissions from household energy and local transportation for island residents. The following is a summary of responses on fossil fuel use and estimates of resulting CO2 emissions:

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LTC APC 2009 GHG SURVEY SUMMARY
Estimate on-island Fossil Fuel use and equivalent CO2 emissions

Total Fuel Use & Emissions	for **205** resident households	
Estimated Total Household Fuel Use	79,175	litres per year
Total Household CO2e emissions	197,938	kg CO2e per year
Estimated Total Transportation Fuel Use	73,300	litres per year
Total Transportation CO2e emissions	183,250	kg CO2e per year
Per-person Fuel Use & Emissions	for **359** residents	
Total On-Island Fuel Use	152,475	litres per year
Total CO2e emissions (from on-island fossil fuel sources)	381,188	kg CO2e per year
per-resident fuel use	425	litres per year per resident
per-resident CO2e	1,062	kg C02e per year per resident

Table 1. The complete spreadsheet, with the survey data and all of the analysis is provided as an electronic attachment to this report (APC-GHG-Analysis.xls).

The final per-person CO2e of 1,062 kg/year is two orders of magnitude less than the Canadian average of 16.4 t/year, and about a quarter of the CEEI estimate for Lasqueti.

Strengths:

The methodology used here is "bottom-up" – it uses data collected from individual households and thus reflects true usage patterns. It also focuses on the portion of GHG emissions under the most direct control of residents – their own personal use of fossil fuels. For these reasons, it provides a good baseline for measuring progress toward GHG reductions, and it provides residents with direct feedback about how their usage patterns compare to their neighbours and tightly integrates with specific actions that could be taken to reduce dependence on fossil fuels.

Weaknesses:

The weaknesses are primarily in the data's incompleteness. The survey focused on fuel use only. As such, it does not form a complete assessment of total GHG emissions for Lasqueti Island. It does not capture the large population of visitors and summer vacationers; nor does it include all emission sources for its residents (e.g., emissions from local businesses, such as saw mills, barge services, and restaurants; and those arising from the ferry, agriculture, and land clearing are excluded).

In addition, the information is derived from a voluntary survey and thus may not be representative (it seems likely that people with an awareness about GHG emissions and low-emission lifestyles were more likely to respond). Moreover, estimates rely on the ability of individuals and households to accurately remember and tally up their fuel consumption.

3. GHGproof – sample analysis

A brief analysis of the GHGproof software was conducted using "best-guess" data for Lasqueti Island. This work was reported to the Lasqueti LTC at their August 2011 meeting. We had 2 objectives for this analysis:

i) assess whether GHGproof is a suitable tool for GHG analysis in the Gulf Islands and Lasqueti in particular; and
ii) assess the difficulty of customizing the model to account for regional variation.

An overview of the methods and results are presented here for illustrative / comparative purposes.

General Assessment

GHGproof uses the same basic "emissions sectors" as CEEI for the emissions inventory: Transportation, Buildings, Waste, Forest and Agriculture. But while many of the methods used in the model are similar to those recommended in the CEEI, there are significant differences in the underlying data and calculations, and in which specific emission sources are included. GHGproof provides a more comprehensive measure of total GHG emissions attributable to the population, whereas CEEI only accounts for those emissions generated within the jurisdiction. For example, in the Agriculture sector, CEEI only accounts for emissions sources from agricultural operations within the jurisdiction. Whereas, GHGproof attempts to estimate the total GHG emissions produced to feed the population of that jurisdiction – including emissions from the transportation of food from outside.

Thus, the emissions estimates from GHGproof may not be directly comparable to CEEI estimates in many cases because they actually measure somewhat different quantities.

That said, GHGproof tends to measure things that may be important to policy makers on the Gulf Islands. For example, policies that encourage more local agriculture may theoretically raise emissions levels as measured by the CEEI, because an increase in agricultural activity likely results in more emissions from that sector. However, this does not account for any potential reduction in the amount of food imported to the region, and the commensurate reduction in GHG emissions associated with its production and transport. Since GHGproof does include both of these factors, it is more likely to provide sensible feedback on the effect of agricultural policy on GHG emissions.

One additional strength of GHGproof lies in its "scenario forecasting" model. Policy makers can estimate the impact of some policy options on the metrics used as inputs to the model, and then see a side-by-side comparison of the impact of those policy options on GHG emissions.

Sample GHGproof Analysis for Lasqueti Island

Using "best-guess" data, obtained from the APC GHG survey, the CEEI report, and anecdotal estimates, we used GHGproof to make a baseline emissions estimate (no scenario planning was done for this exercise). The basic results are presented here:

Summary of GHGproof analysis showing Baseline Annual GHG Emissions (t CO2e)	
Transportation	720
Roads	0
Buildings	281
Waste	112
Agriculture and forestry	614
Total	***1,727***

Table 2. The complete spreadsheet is provided as an electronic attachment to this report (GHGproof-Lasquei-example-scenario.xls).

For the population of 359 residents, this yields about a per-capita annual emission of 3,000 kg CO2e. This is approximately three times that from the APC GHG survey (with is much more limited scope) but about 25% less than the CEEI estimate (which employs methods inappropriate for Lasqueti).

This analysis should serve as proof-of-concept only – not every aspect of the model was explored nor utilized. For example, the calculations from residential energy use were not completed, and a constant was used in place. Additional work is required to produce a full GHGproof analysis for Lasqueti.

Customizing the GHGproof Model

To assess the ease with which the model can be customized, I added a new "Liquid Waste" sub-category for "*Composting Toilets*". This is the most common type of liquid waste management system on Lasqueti, and there is no comparable category in the stock GHGproof model, so it seemed like a good candidate. Here is a summary of the steps taken to add this customization:

- Sheet 1- add row to Inputs table: *25.1 Liquid waste, dry latrine / composting toilet*
- Sheet 2- add row to Assumptions table: *14.4.1 Emissions factor: dry latrine / composting toilet*; with emissions factor estimated from IPCC Guidelines.
- Sheet 3- add new set of calculations for the new category: *Liquid waste, composting toilet / dry latrine*
- Sheet 4- add new category into Liquid waste sub-total calculations for Baseline, BAU, and other scenarios.

This customization was relatively straightforward, requiring only about 1 hour for planning, implementation, and testing. However, the calculations on Sheets 3 and 4 are not conducive to easy modification, and so some care must be taken here to avoid introducing errors. I think it would be possible to restructure these calculations to make them more amenable to customization in future releases of GHGproof.

Recommendation

In the course of using and customizing GHGproof, I encountered several bugs, which were documented and sent to the model's authors at Sustainability Solutions. Additional work validating and verifying the model, and perhaps re-structuring the spreadsheet to reduce data coupling issues and the complexity of some formulae would be required for me to unconditionally recommend its use.

Nonetheless, with some customization GHGproof could be adapted to work well on Lasqueti, and perhaps the other Gulf Islands. It appears to be flexible enough to utilize data from a variety of sources, easily customizable, and uses metrics that are directly relevant to GHG reduction policy initiatives. Some careful consideration of the trade-offs between compatibility / comparability with the CEEI vs. relevance and usefulness for public education and policy analysis would be required to tailor the model to the Island Trust's specific needs.

4. Data Quality / Gaps

Marine Transportation

Marine transportation tends to be fuel-intensive and is likely a significant source of emissions for island communities. In addition to the regular foot passenger ferry service , Lasqueti residents and businesses also make use of barge services and private power boats to commute and transport goods. Although the CEEI methodology does not consider marine transportation, it should be included in a GHG emissions baseline for Lasqueti and other islands.

On-Road Transportation

i) Clarification is required about which vehicles are included in the CEEI 2007 report –on-island vehicles, off-island vehicles, or both. This clarification would allow for a more meaningful comparison of the CEEI results with those produced via a different methodology.
ii) Anecdotally, the estimates for vehicular fuel use gathered in the APC survey appear to be grossly under-estimated.. Additional data from on-island fuel sales could help to quantify bias inherent in the survey data and provide alternative direct estimates of on-island fuel consumption.

Land Use

There is very little local data on agricultural uses and deforestation.
It is instructive to note that the CEEI report for Lasqueti did not attempt to estimate values for these sectors.
As noted, the exclusion of agricultural imports from the CEEI analysis could easily distort the measured impact of local agricultural policies on emissions.

Liquid Waste / Sewage

I was surprised to find that the CEEI does not include a methodology for municipal liquid waste. This represents a significant source of both CO2 and Methane in many municipalities. On Lasqueti, sewage is typically handled by septic system, pit toilet, or composting toilet. Each of these treatment / disposal methods is associated with a different emissions profile, and it would be useful to include this as a category in the Lasqueti inventory, as is done in the GHGproof model. Currently, there is no data source I am aware of on the distribution of sewage disposal methods employed on Lasqueti. This would likely have to be estimated by survey.

5. Recommendation

Different types of GHG emissions inventories serve different purposes, and there is no inventory or inventory method that meets all needs equally well. What emmissions should be included and what methods and metrics used depends to a large degree on the purpose of the inventory. For establishing the largest contributors to emissions in order to target policies effectively, the GHG emissions inventory must be broad and cover all sectors, though data need only be of high enough quality to rank sectors by order of magnitude. For the purpose of establishing a baseline and measuring progress against this baseline, it may not be necessary or even useful to consider all sectors, but methods must be designed so that measurements and assessments are easily repeatable and results accurate enough to detect and quantify progress. For setting and measuring

the effectiveness of policy alternatives, a suite of metrics that are directly relevant to policy makers and the public would be most suitable. And for comparison across communities and jurisdictions, a shared methodology and standardized set of sectors and sub-sectors are important. The CEEI methodology serves this last purpose well in a province-wide context, but it is:

i) too coarse to work as an effective baseline for Lasqueti;
ii) not broad enough to cover all emission sources that may be affected or targeted by Island Trust policies;
iii) and does not provide many metrics that would be relevant for setting and measuring the effectiveness of emission reduction policies on Lasqueti.

Although the CEEI methodology will not yield useful results for Lasqueit in all emissions sectors, any GHG Inventory for Lasqueti should, nonetheless, use the same sectors as the CEEI and aim to produce comparable results, even though it may be by other methods. Any methodology that deviates from the CEEI methodology should be justified, and a comparison of the relative accuracy, completeness, consistency, and relevance of the two methods should be documented. These general principles ensure that the GHG Inventory for Lasqueti remains comparable with the CEEI for Lasqueti and other municipalities.

The CEEI fails to consider some emission sources that would be useful to include for public education campaigns or policy analysis. Estimates for these emissions could be included as "add-ons" in such a way that the baseline emissions inventory was compatible with the CEEI, but that a more comprehensive inventory could be used for Island's Trust purposes.

Measuring emissions from On-Road Transportation

The "Fuel Sales" methodology would be most suitable Lasqueti because of its unique geography (i.e., fuel purchased here is burned here). Obtaining accurate fuel sales figures relies on cooperation of pump and barge owners. If that could be obtained, it would greatly improve the reliability, accuracy, and repeatability of the GHG inventory.

In the absence of data from the fuel vendors / transporters, a survey-based methodology, like the one employed by the APC, would likely yield the best results. These efforts may be greatly aided by distributing booklets to encourage people to record their mileage and fuel consumption so that a more accurate estimate of fuel use in this sector can be obtained.

Either, or both, of these methods would be suitable for producing an inventory, tracking reductions over time, and for guiding policy and measuring its effect.

Measuring emissions from Gas / Diesel Generators, Propane, and Wood

Again, a Fuel Sales methodology would provide a simple, accurate measure of propane use, but requires the cooperation of the Lasqueti Propane and barge operators.

In the absence of these data, a survey seems like the next best approach, and, again, booklets for tracking propane and generator fuel may help improve accuracy.

The CEEI methodology treats wood fuel as basically carbon-neutral[1], presumably because new growth re-captures carbon emitted from burning. However, burning wood does emit other GHG components (CH_4 and N_2O). The total CO2e emissions from these sources is minor, but should be included because it is the only real measure of household heating efficiency in the inventory.

[1] Table 9, p. 26 Technical Methods and Guidance Document for 2007 CEEI Reports.

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The GHGproof methodology for handling solid-wood fuel seems more complicated than required – this should be replaced by the simpler CEEI approach.

Measuring emissions from Marine Transportation

If possible, data on ferry fuel consumption should be obtained from Western Pacific Marine, as well as commercial barge service operators. Since gas and diesel are generally more expensive on Lasqueti than in French Creek or the Sunshine Coast, gas or diesel for private boats is usually not bought on island and would therefore typically not be captured by a tally of on-island fuel sales. To estimate this figure, a survey could be used to establish the number and type of boats and use patterns. Survey estimates could be cross-checked by tallying the number and type of boats moored in Lasqueti's protected anchorages.

Measuring emissions from the Lasqueti Landfill

From personal observation, very little organic matter makes its way into this landfill, as most Lasqueti residents are ardent composters. The landfill generally has no unpleasant odour associated with methane production, and I would guess that even a detailed analysis of the Lasqueti landfill would reveal that very little GHG emissions are produced on this site. However, it should be included in the analysis for completeness, and as a general measure of waste production.

Composts can produce methane if they are not properly managed, and certainly produce CO2, however, I'm not clear on the value of including this in the emissions inventory.

Measuring emissions from Deforestation

As an educational tool for illustrating how land-use practices can impact GHG emissions, it would be useful to include this sector. Based on a back-of-the-envolope calculation, a local forester has estimated that emissions from land clearing may be significant on Lasqueti. Deforestation or afforestation rates could be estimated by an air photo or satellite image analysis of Lasqueti. Given the CEEI criteria used to define deforestation (1 ha minimum area with 25% min. crown closure), is would not be a difficult interpretation exercise.

Measuring emissions from Agriculture

Given the small-scale nature of agriculture on Lasqueti, the predominance of organic farming and gardening methods, and the lack of large-scale livestock operations, very few emissions likely arise from this sector. This sector was also not included in the CEEI report for Lasqueti. However, Lasqueti does import a lot of food, and the GHGproof model indicates that this represents a significant source of emissions attributable to its population. Representing these emissions in a GHG baseline would be valuable to credit benefits of local food production and avoid having new agricultural operations appear only as an incremental source of emissions.

Measuring emissions from Liquid Waste / Sewage

I would recommend that an additional sector be added to the analysis for liquid waste disposal, as done in the GHGproof model. This is an area where Lasqueti has some advantages in terms of application of alternative systems, and could demonstrate how these systems contribute to reduced emissions. This metric, though, would have to be excluded from any emissions calculations intended to be comparable to the CEEI.

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Documentation & Analysis Spreadsheets (attachments & sources)

- ***APC-GHG-Analysis.xls***: Excel spreadsheet with APC survey data and related analyses;
- ***GHGproof-Lasqueti-example-scenario.xls***: Excel spreadsheet with sample GHGproof model using "best-guess" data for Lasqueti.
- **Lasqueti Island Trust Area 2007 CEEI report** (http://www.env.gov.bc.ca/cas/mitigation/ceei/RegionalDistricts/Islands_Trust/ceei_2007_lasqueti_island_trust_area.pdf)
- **Technical Methods and Guidance Document for 2007 CEEI Reports** (http://www.env.gov.bc.ca/cas/mitigation/ceei/CEEI_TechMethods_Guidance_final.pdf)
- **Residential Heating Oil, Propane, and Wood Heat Estimates for BC Communities** (http://www.env.gov.bc.ca/cas/mitigation/ceei/pdf/Residential_Heat_Estimates.pdf)