

Users Manual

Users Manual: UNSM Community
Energy and Emissions Toolkit



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Glossary

Carbon Dioxide Equivalent (CO₂e): unit for measuring the Global Warming Potential (GWP) that estimates the degree to which a given mass of greenhouse gas contributes to climate change; the GWP of CO₂ is defined as one, and those of all other greenhouse gases expressed as multiples of that unit

Wood and Solid Fuels: wood or coal combusted in homes as defined by the Survey of Household Spending

Kilowatt hours (kWh): a measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour

Gigajoule (GJ): equals one billion joules, metric units used to measure energy content of a source of energy. The amount of energy represented by one GJ is equivalent to about 30 litres of gasoline, 39 litres of propane, 278 kilowatt-hours of electricity or 45.5 kilograms of coal

ICLEI: International Council for Local Environmental Initiatives, an organization of Local Governments for Sustainability, an international association of local governments and national and regional local government organizations that have made a commitment to sustainable development

Greenhouse Gases (GHG): a number of identified gases that trap the sun's energy within the earth's atmosphere. The GHGs as identified in international standards and recognized by the Intergovernmental Panel on Climate Change (IPCC) are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (NO_x), hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride (SF₆)

Base Year: the first year for which measurements are made, usually before new programs or initiatives impacting the variables measured are introduced. Changes resulting from new programs are understood in comparison to a base year specified by the program

Commuting Flows: commuting distance between home and work for standard geographic areas

Biogenic: a substance produced by life processes, either constituents or secretions of plants or animals

1.0 Introduction

The Union of Nova Scotia Municipalities (UNSM) contracted Jacques Whitford Stantec Limited (JWSL) to design an energy, air pollutant emissions, and greenhouse gas (GHG) emissions quantification tool, the UNSM Community Energy and Emissions Toolkit (Toolkit), and this user manual for its member communities.

The intent of the Toolkit is to provide each community in Nova Scotia with a tool and guidance for using it, enabling them to complete a GHG Inventory in a manner that is consistent with standards, protocols, and best practices as recognized by the Federation of Canadian Municipalities (FCM) in their Partners for Climate Protection (PCP) program. To accomplish this task, JWSL designed a Toolkit that provides users with a myriad of options to track and quantify GHG and air pollutant emissions. This design was undertaken considering the possibility that some communities may not have access to specific data sets to complete their inventory, and allows for various options that make use of the data they may have at hand.

2.0 ICLEI International GHG Protocol

The International Local Government GHG Protocol (LG Protocol) developed by ICLEI, is a set of guidelines that provides communities with a standardized approach to quantifying their GHG emissions. This approach allows for easy comparison across time and between different communities in a policy-relevant way. With the intent of helping local governments achieve tangible reductions in their GHG emissions, the LG Protocol enables the measurement of progress towards climate-related goals. Its approach is complementary to existing or foreseeable regulatory requirements and emissions certification opportunities.

The Protocol is composed of four main parts.

- Section 1 - An introduction to the LG Protocol and its suggested Framework for Greenhouse Gas Management
- Section 2 - The General Principles that ensure accurate accounting and reporting
- Section 3 - Detailed Inventory Requirements
- Section 4 - Reporting Standards

More specifically, the inventory requirements in Section 3 help communities determine what activities and GHG emissions should be counted, how they should be described, and how the emissions data should be organized.

Section 4 provides guidance on which sectors, sources and scopes of emissions should be included in a community's emissions report. It states a number of general reporting requirements, as well as specified Reporting Standards which aim to make reports comparable on a Global, National, Local Government, and Aggregate scale. In addition, Section 4 includes a sub-section describing the use of sector-specific indicators which should be implemented to ensure valid comparisons among communities. To provide additional assistance, Country/Regional Supplements are being developed by ICLEI to address issues with local context. These supplements will include appropriate data sources for the specified region.

As local governments all over the world continue to recognize the importance of monitoring and reporting their GHG emissions, a standardized approach to quantifying GHG emissions is becoming imperative. ICLEI's LG Protocol addresses this need by establishing a standard for GHG quantification and developing local GHG management programs.

UNSM member municipalities who plan to quantify and report their GHG emissions should consider this protocol, as it provides a platform from which to compare results with and learn from other local governments making progress towards their reduction targets. This is the protocol on which the UNSM Community Energy and Emissions Toolkit is based.

This protocol can be retrieved through the UNSM or by visiting the web link below:

<http://www.iclei.org/index.php?id=8154>

3.0 Toolkit Instructions

The UNSM Community Energy and Emissions Toolkit (Toolkit) is designed to assist municipalities to estimate, in a consistent manner, their Community GHG and air pollutant emissions. While completion of the Corporate inventory is relatively straightforward, and relies on data over which the municipality in most cases has full control, the Community inventory relies on alternate sources of data, surveys and estimates. The Toolkit is designed to assist municipalities to make best use of the data that they will consistently have at hand from year to year.

Throughout the process of populating the workbooks, assumptions will have to be made, averages calculated, conversions performed, and aggregations carried out. Documenting methods and data sources provides a record of the activity on the project to help future users or third party verifiers' track down the original sources of information for review purposes. Blank space is provided in each workbook for the user to any documentation necessary.

The Toolkit consists of 10 workbooks or tabs. It begins with a title page / introduction where it is important to record all basic information as to the purpose and intent of the data and analysis that follows. The rest of the tabs must be populated with data that will calculate the Community emission inventory when completed.

The data required to populate the Toolkit will be obtained from several different sectors within the community or from provincial, national or international sources. For example, you will need to locate information on energy consumption in your residential, commercial, and industrial sectors.

Establishing an effective organizational network and designing a plan for the collection of the required data can be an important first step in making the data collection task as efficient as possible. Seeking input to the plan from key staff within the municipality, the UNSM and specific provincial departments will keep them informed and allow them opportunities to advise on specific sources of data, and on other organizations or stakeholders that should be consulted.

The more information that can be collected and entered into the toolkit, the more accurate the GHG emissions calculations will be. If data are missing in one or more categories, assumptions may be required and they will need to be justified and recorded. For example, aggregated information may be all that is available to allow continuation with the calculations. Over time, the calculations can be refined by identifying and using a more complete dataset as long as the original assumptions and methodologies are accurately recorded. Otherwise, it may be impossible to make changes as previous year analyses could not be accurately revised. The base year quantification will be most difficult to establish because of the numerous 3rd party data sources. Repeating the quantification exercise in following years will be more efficient with the established network and sources.

The Toolkit contains a total of 10 workbooks (tabs) as follows:

- Workbook 1: Introduction
- Workbook 2: General Information Worksheet
- Workbook 3: Residential Sector Worksheet
- Workbook 4: Commercial Sector Worksheet
- Workbook 5: Industrial Sector Worksheet
- Workbook 6: Transportation Sector Worksheet
- Workbook 7: Waste Worksheet
- Workbook 8: Summary Worksheet
- Workbook 9: Coefficients Worksheet
- Workbook 10: Conversions Worksheet

The first 2 workbooks help set up the parameters for the quantification exercise. Workbooks 3 to 7 will require input of energy use information for various sectors. Once the workbooks have been populated with the data, the Toolkit will present a summary of the Community emissions in Workbook 8. The last two workbooks contain some further information underlying the calculations and can be considered appendices to the Toolkit. The workbooks are primarily designed to be viewed on the computer screen but can also be printed or pasted into PowerPoint presentations. By default, the entire collection of cells on each workbook that is likely to contain data has been set as “print area”. However, this can be changed to print only the relevant sections of each workbook. The Help function in Excel provides more information on “setting a print area”.

Workbooks 3 to 7 are designed to allow entry of energy use information for various sectors of the community to the greatest degree of detail possible. The Toolkit uses the data provided to calculate emissions corresponding to the energy use figures entered. The emission figures are displayed for each entry (each row) in the workbooks. In addition, air pollutant emissions for each category are presented where applicable for each entry (each row). The data required is specified in the upcoming sections. However, it should be noted that this toolkit provides options to quantify emissions using data collected directly from energy providers and energy users, or using provincial statistics to broadly estimate emissions. The accuracy of the results is largely dependent on the option chosen.

This is a generic Toolkit, and it is not expected that all categories of energy use identified in each sector will be relevant to each Community inventory.

3.1 GENERAL INFORMATION WORKSHEET

Step 1: Identify Contact Information and Community Statistics

Input the name of the municipality or local government and the contact information for the person completing the Toolkit for record keeping purposes. The inventory base year is automatically set to 2006, but other years can be selected using the drop down menu in the 'Inventory Year' cell¹.

The Toolkit also requests a variety of statistics specific to the Community including: Population, GDP (Gross Domestic Product), Average Income, Number of Residences, Number of Commercial Establishments, and Number of Industrial Establishments. If this information is not available, it may be retrieved from Statistics Canada's Community Profiles, 2006. A link to the website is provided below. Upon arrival at the website, enter the name of the municipality, select the Province of Nova Scotia from the drop down menu, and click on the Search button.

Community Profiles Website:

<http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E>

With minor exceptions, this information is not used in Toolkit calculations. Rather, it can be used to disaggregate GHG emissions levels in each sector over residential, commercial, industrial, economic, and population statistics. Number of Residences and Commercial Sector Establishments will be used in calculations if Option 3 if the Residential and Commercial Sector Worksheet is selected. The Residential and Commercial Sector Worksheet sections of this user guide provide additional information.

3.2 RESIDENTIAL SECTOR WORKSHEET

Step 1: Select Relevant Calculation Method

The Residential Sector Energy Consumption and Emissions worksheet provides three options for local governments to use to quantify Community GHG emissions.

Option 1 should be used if the municipality can retrieve Residential Sector billing records for electricity consumption from Nova Scotia Power Incorporated (NSPI), but cannot retrieve Residential Sector fuel consumption records. Option 1 uses provincial statistics to weight and estimate energy consumption from fuel sources other than electricity, with the only actual input used in the calculation being electricity consumption. The inputs and subsequent calculations

¹ The year 1990 is often suggested as a base year because 1990 is the agreed upon base year under the Kyoto Protocol. Many local governments find it difficult to retrieve information to complete defensible quantifications of GHG emissions due to lack of available data in 1990. You may wish to select a base year for which you have ample and accurate municipal records to use as inputs for the spreadsheet.

are considered High Quality (Tier 3) for electricity and Medium to Low Quality (Tier 1) for the other energy sources.

Option 2 should be used if the municipality can retrieve billing or consumption records for electricity and all other fuel types. This option is the most preferable because the inputs and subsequent calculations are considered High Quality (Tier 3). In order to obtain the information required to complete this option, a summary of residential electricity consumption in the Community may be obtained from NSPI, and a survey of residents may be carried out to identify fuel consumption amounts for each residence.

Option 3 should be used if no energy billing or consumption information can be obtained for Community residences. This is the least preferred of the three options because it is not possible to track changes from this baseline. To calculate energy inputs for this option, a provincial energy intensity value (the GJ of energy consumed for a typical household in Nova Scotia) is multiplied by the number of residences in your community. These values are then subdivided into four energy types (electricity, natural gas, wood and solid fuels, and oil) using provincial energy profile statistics for a typical residence in Nova Scotia. These inputs and subsequent calculations yield Low Quality (Tier 1) results, sufficient for broadly estimating energy consumption in your residential sector for most purposes.

Step 2: Enter Annual Energy Consumption Information

The option selected will dictate the type of information to be entered into the spreadsheet to complete the calculations.

For Option 1, electricity consumption for the residential sector must be entered into Cell E4. This information will be used in the calculations for Option 1. The Community residential electricity consumption records for a given calendar year may be obtained by contacting NSPI (1-800-428-6230). The Toolkit requires billing information that notes the number of kilowatt hours (kWh) the Community's residential sector consumed over one calendar year. Consumption records for the Community's commercial and industrial sectors, required in subsequent worksheets, may be requested at the same time.

For Option 2, electricity, natural gas, wood and solid fuels, and oil consumption must be entered into Cells E21, E22, E23, and E24 respectively. This will require billing information that notes consumption over a calendar year for these four types of fuel. Electricity information must be provided in kWh, natural gas in GJ, wood and solid fuels in GJ, and oil in litres.

If Option 3 is selected, the number of households must be entered into Cell E5. This information will be used in the calculations in the Option 3 calculator.

Step 3: View Totals and Document Comments in Worksheet

Emission totals are all calculated by the Toolkit by multiplying energy inputs by an emission coefficient (sourced from Worksheet 9), and the result is represented in appropriate units. In the

summary (Worksheet 8), visual aids summarize emission contributions from each sector. The visuals are programmed to work with the option you have selected. Where an option has not been selected, visuals in the summary worksheet will appear blank.

3.3 COMMERCIAL SECTOR WORKSHEET

Step 1: Select Relevant Calculation Method

The Commercial Sector Energy Consumption and Emissions worksheet provides three options for local governments to quantify Community GHG emissions from this sector. The commercial sector typically includes light manufacturing, retail, warehousing and institutional buildings, and related activities.

Option 1 should be used if the municipality can retrieve billing records on electricity consumption in the commercial sector from NSPI, but cannot retrieve records denoting fuel consumed in the commercial sector. Option 1 uses provincial statistics to weight and estimate energy consumption from fuel sources other than electricity, with the only actual input used in the calculation being electricity consumption. The inputs and subsequent calculations are considered High Quality (Tier 3) for electricity and Medium to Low Quality (Tier 1) for the other energy sources.

Option 2 should be used if the municipality can retrieve billing or consumption records for electricity and all other fuel types. This option is the most preferable because the inputs and subsequent calculations are considered High Quality (Tier 3). A summary of commercial electricity consumption may be requested from NSPI and a survey of commercial establishments to identify fuel consumption amounts for each may be required.

Option 3 should be used if no commercial energy billing or consumption information is available. This is the least preferred option because it is not possible to track changes from this baseline. To calculate energy inputs for this option, a provincial energy intensity value (the GJ of energy consumed for a typical commercial unit in Nova Scotia) is multiplied by the number of commercial establishments in your community. These values are then subdivided into six energy types (electricity, heating oil and other middle distillates, propane, heavy fuel oil, diesel, and other) using provincial energy profile statistics for a typical commercial unit in Nova Scotia. These inputs and subsequent calculations yield Low Quality (Tier 1) results, sufficient for broadly estimating energy consumption in the commercial sector for most purposes.

Step 2: Record Annual Energy Consumption Information

The option selected will dictate the type of information that must be entered into the Toolkit to complete the calculations.

For Option 1, electricity consumption for the commercial sector must be entered into Cell E4. The commercial sector electricity consumption records for a given calendar year can be obtained by contacting NSPI (1-800-428-6230). This spreadsheet requires billing information

that notes the number of kilowatt hours (kWh) the commercial sector consumed over one calendar year.

For Option 2, electricity, heating oil, propane, heavy fuel oil, and diesel consumption must be entered into Cells E23, E24, E25, E26, E27 and E28 respectively. This will require billing information that notes consumption over a calendar year for those five types of fuel. Electricity information must be provided in kWh, and heating oil and other middle distillates, propane, heavy fuel oil and diesel in litres.

If you select Option 3, the number of commercial establishments must be entered into Cell E5.

Step 3: View Totals and Document Comments in Worksheet

Emission totals for the commercial sector are all calculated by the Toolkit by multiplying energy inputs by an emission coefficient (sourced from Worksheet 9), and represented in appropriate units. In the summary (Worksheet 8), visual aids summarize emission contributions from each sector. The visuals are programmed to work with the option selected. In cases where no option is selected, visuals will appear blank.

3.4 INDUSTRIAL SECTOR WORKSHEET

Step 1: Select Relevant Calculation Method

The Industrial Sector Energy Consumption and Emissions worksheet provides two options for local governments to quantify Community GHG emissions from this sector.

Option 1 should be used if the municipality can retrieve billing records for electricity consumption for the industrial sector from NSPI, but cannot retrieve records denoting fuel consumed in the industrial sector. Option 1 uses provincial statistics to weight and estimate energy consumption from fuel sources other than electricity, with the only actual input used in the calculation being electricity consumption. The inputs and subsequent calculations are considered High Quality (Tier 3) for electricity and Medium to Low Quality (Tier 1) for the other energy sources.

Option 2 should be used if the municipality can retrieve billing or consumption records for electricity and all other fuel types. This option is the most preferable because the inputs and subsequent calculations are considered High Quality (Tier 3). In order to obtain the information required to complete this option, industrial electricity consumption records are available from NSPI, and a survey to identify fuel consumption amounts for this sector can be carried out.

Step 2: Record Annual Energy Consumption Information

The option selected will dictate the type of information that must be entered into the Toolkit to complete the calculations.

For Option 1, annual electricity consumption in kilowatt hours for the industrial sector, obtained from NSPI, must be entered into Cell E4.

For Option 2, electricity, natural gas, diesel fuel oil, light fuel and kerosene, heavy fuel oil, and wood waste and pulping liquor must be entered into Cells E22, E23, E24, E25 and E26 respectively. This will require billing information that notes consumption over a calendar year for those five types of fuel. Electricity information must be provided in kWh, natural gas in GJ, diesel fuel oil, light fuel oil, kerosene, and heavy fuel oil in litres, and wood waste and pulping liquor in GJ.

Step 3: View Totals and Document Comments in Worksheet

Emission totals are all calculated by the Toolkit by multiplying energy inputs by an emission coefficient (sourced from Worksheet 9), and represented in appropriate units. In the summary (Worksheet 8), visual aids summarize emission contributions from each sector. The visuals are programmed to work with the option selected. In cases where no option was selected, visuals will appear blank.

3.5 TRANSPORTATION SECTOR WORKSHEET

This worksheet calculates the emissions associated with the Community transportation sector. It is designed to calculate emissions from commuting and all other travel within your community.

Step 1: Estimate Fuel Consumption from Transportation within the Community

Enter the population of your community in cell G5.

The Toolkit takes a figure representing gasoline and diesel fuel purchases for road motor vehicles in the Province of Nova Scotia and pro-rates it by the population of the Community to broadly estimate Community fuel consumption from the transportation sector.

Step 2: Estimate Fuel Consumption from Commuter Traffic

In this worksheet, the origin and destination names and distance values for common routes travelled to work in your community for commuter travel both from and to outside the geopolitical boundary and within the geopolitical boundary must be entered.

This will require identifying what Statistics Canada refers to as common *Commuting Flows* to other communities, and estimating distances associated with commuting within the geopolitical boundary.

To identify commuting flows to other communities, visit the following Statistics Canada website. This can be copied and pasted into your web browser:

<http://www12.statcan.ca/english/census06/data/topics/ListProducts.cfm?Temporal=2006&APATH=3&THEME=76&FREE=0&GRP=1>

Upon arrival at this website, select the data subtopic called 'All place of work and commuting to work topic-based tabulations' and then click on link 6 on the next page that loads. Link 6 should have the following description:

Commuting Flow Census Subdivisions: Sex (3) for the Employed Labour Force 15 Years and Over Having a Usual Place of Work

If the web link fails, the following free data must be retrieved from Statistics Canada. The first block of text lists the name of the document and the bolded text is file name and category number. Ensure that information for the community in question is requested.

Commuting Flow Census Subdivisions: Sex (3) for the Employed Labour Force 15 Years and Over Having a Usual Place of Work **Census Subdivisions-Cat.No. 97-561-X2006011**

Follow the link and select Nova Scotia from the geographic area drop down menu. Following this, select the name of the community from the same drop down menu. Data is available for each UNSM member.

The table generated shows common commuting flows in your community by noting the place of residence, the work destination, and the number of people who travel these routes. This information must be migrated from these tables into the tables in this worksheet.

Enter the place of residence in cells D11 to D34, and the place of work into cells E11 to E34 for commuters commuting from your community to a place of work outside of your community. Enter the number of commuters making each of these commutes into cells F11 to F34. After that, estimate the remaining commuters who commute within your community. The Statistics Canada table can provide a reference point (*i.e.*, these tables show the number of commuters within your community). However, this number must be further subdivided to estimate commuting flows to major areas within the community.

The round trip distance travelled each day for each commuting flow can then be estimated using online software (www.google.ca/maps), or by measuring the straight-line distance between the centroids or central points of the two locations. A map of the Census Subdivisions, available from municipal planning offices, can also be used to estimate these distances. Once these values have been estimated, they must be entered into cells G11-G34 on the worksheet.

Step 3: View Totals and Document Comments in Worksheet

The Toolkit calculates Community GHG emissions and air pollutant emissions from vehicle travel using Step 1 and Step 2 values as inputs. Regular gasoline values are determined by subtracting commuter fuel consumption from the overall estimate of fuel consumption which occurs in Step 1.

Emission totals are all calculated by the Toolkit by multiplying energy inputs by an emission coefficient (sourced from Worksheet 9), and represented in appropriate units.

3.6 WASTE MANAGEMENT WORKSHEET

This worksheet calculates the emissions associated with the decomposition of waste in the Community in public and private landfills. It also collects information about first generation landfills. If a Corporate GHG inventory has been completed, and the Corporate waste is deposited within Community boundaries, the results of the Inventory must be calculated and communicated clearly to avoid double counting emissions. It may be a small point, but the Corporate waste generated and disposed of in the Community must be subtracted from the tonnes of waste going to the landfill from the Community as a whole.

Although input cells are provided to allow tracking of amounts of material composted in your community, emissions of CO₂ from composting are not counted in the inventory as these emissions are considered to be biogenic in origin. Composting generates methane emissions and N₂O emissions. However, these GHG emissions are difficult to quantify at local levels, and defensible emission factors that would apply on a general level to a wide variety of local governments in Nova Scotia are not currently available.

Cells are provided for tracking purposes for other categories associated with waste diversion including recycled material, composting, and other. Emissions resulting from these processes are not quantified in this worksheet. However, in most cases, the emissions from associated waste management processes and operations are mainly included in other worksheets provided as a part of this Toolkit.

Steps 1-3: Address Each Question in Steps 1, 2, and 3 in the Worksheet

Enter both qualitative and quantitative information in cells H4 through to H17.

Step 4: Record the Waste Deposited or Diverted Annually

Enter the weight in metric tonnes of material deposited in the public landfill into cells E21 through E24. If you do not have records on recycled material or composted material, leave these cells blank. Emissions associated with the disposal of these materials are not quantified in this table.

Enter the weight of residual waste diverted to private landfills from your community in cell E27.

In both cases, please record the amount of waste to landfill regardless of where the waste is being deposited (*i.e.*, – within your community or outside of your community). The average emission factor used to quantify emissions corresponds to the amount of solid waste deposited regardless of the location.

3.7 SUMMARY WORKSHEET

Workbook 8 summarizes the Community emission results as compiled and analyzed in the Toolkit, providing the overall total emissions by sector and by energy type.

3.8 COEFFICIENTS WORKSHEET

This is a list of emission coefficients, conversion factors, and sources of data and information used in this Toolkit.

3.9 CONVERSIONS WORKSHEET

This table contains many of the common conversion factors required to carry out the calculations performed by the Toolkit.

4.0 Closure

This manual has been prepared for the sole benefit of the Union of Nova Scotia Municipalities and its members. The report may not be used by any other person or entity without the express written consent of Jacques Whitford Stantec Limited and the Union of Nova Scotia Municipalities. All parties are subject to the same limit of liability and other terms as agreed to in the Jacques Whitford Stantec Limited agreement under which the work was conducted.

Any use that a third party makes of this manual, or any reliance on decisions made based on it, are the responsibility of such third parties. Jacques Whitford Stantec Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made, or actions taken, based on this manual. If this becomes a public document, members of the public and other third parties may only rely on this report, for its intended purposes, with the expressed written consent of the union of Nova Scotia Municipalities.

The conclusions presented in this report represent the best technical judgment of Jacques Whitford Stantec Limited based on the data obtained from the work.

This report was prepared by Brent MacDonald and Dr. Joe Harriman (506-634-2185). Senior review was provided by Jim Knight, P. Eng. (506-4573211). If there are any questions or comments, please contact us at your convenience.