

THE BULLFROG POWER 2016 GREEN ELECTRICITY EMISSIONS CALCULATION METHODOLOGY

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INTRODUCTION

WHAT IS BULLFROG POWER?

Bullfrog Power, Canada's 100% green energy provider, offers homes and businesses clean, renewable energy solutions. Bullfrog Power offers a 100% clean, renewable electricity choice to everyone in Canada. All of Bullfrog Power's electricity comes from renewable facilities certified as low-impact under Environment Canada's EcoLogo^M certification program, and do not emit any CO₂, NO_x, SO_x or produce nuclear waste in their generation of electricity.

Bullfrog Power's renewable generators injects as much renewable electricity into the electricity grid as its customers use. Bullfrog purchases all the environmental attributes¹ associated with each megawatt hour (MWh) of renewable electricity that is injected, and retires those environmental attributes on behalf of its customers.

Bullfrog Power also offers a green natural gas product as a clean and renewable alternative to conventional fossil fuel-based natural gas. Unlike conventional natural gas, Bullfrog's green natural gas does not increase the amount of carbon dioxide in the environment. It is considered a net-zero carbon dioxide emissions energy source that enables you to use appliances and heat your home without contributing to climate change. For a more detailed description of the product and its environmental benefits refer to The 2012 Green Natural Gas Operating Criteria and Quantification Methodology and Green Natural Gas Emissions Calculator which can be found at: <https://www.bullfrogpower.com/business/calculators.cfm>.

¹Environmental Attributes represent the general environmental benefits resulting from the generation of renewable low-impact electricity and injection into the electricity grid including, among other things, the displacement of non-renewable fuels, the reduction of air emissions, and the reduction of impacts on aquatic, riparian and terrestrial ecosystems. These benefits are transacted in the form of Green Electricity Certificates, sometimes referred to as Renewable Energy Certificates.

WHY HAS BULLFROG POWER DEVELOPED THESE CALCULATORS?

Conventional electricity production in Canada is among the largest industrial sources of CO₂, a primary greenhouse gas and major contributor to climate change. Electricity production is also a major source of pollutants such as NO and SO₂ that contribute to poor air quality and are precursors of smog conditions. In jurisdictions that rely on nuclear power, electricity generation results in radioactive waste, a highly toxic, long-lasting material that must be safeguarded for thousands of years.

Many of Bullfrog Power's customers are curious to understand how their becoming bullfrogpowered affects their environmental footprint. Companies seeking to calculate their emission footprint (also known as their emissions inventory) should follow the Greenhouse Gas Protocol (Corporate Standard)². Individuals can apply the same methodology in order to calculate their personal emissions inventory.

The GHG Protocol identifies three categories of emissions. Direct emissions from facilities that are owned or controlled by the company are known as Scope 1 emissions. Indirect emissions resulting from a company's use of electricity, which are generally emitted at the facilities of third party generators, are known as Scope 2 emissions. All other indirect emissions (e.g. airplane and rental car emissions) related to a company's operations are known as Scope 3 emissions.

The GHG Protocol identifies how companies should calculate their emissions in each Scope. For the purposes of calculating Scope 2 (electricity) emissions, the GHG Protocol adopts an emissions factor-based methodology. This methodology estimates "GHG emissions by multiplying a level of activity (e.g., kwh of electricity consumed by a facility) by an emission factor (e.g. grams of CO₂ per kwh)."³ For the purposes of calculating Scope 2 emissions, renewable power generating facilities are treated as having a zero emissions factor.⁴

²The Greenhouse Gas (GHG) Protocol Corporate Standard provides standards and guidance for companies and other organizations preparing a GHG emissions inventory, <http://www.ghgprotocol.org/standards/corporate-standard>

³ "Indirect CO₂ emissions from the Consumption of Purchased Electricity, Heat, and/or Steam", p. 3 (registration required to access calculation tools), http://www.ghgprotocol.org/calculation-tools/downloads/downloads-registration?referred_from=/downloads/calcs/ElectricityHeatSteamPurchase_guidance1.2.pdf/

⁴ See "National Inventory Report 1990-2013" Part I, p44 Environment Canada http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php

In 2015 the World Resources Institute (WRI) published an amendment to the Corporate Standard: GHG Protocol Scope 2 Guidance⁵ which outlines a new dual reporting methodology that includes both a location-based and market-based method. A Bullfrog Purchase will be recorded under the market-based methodology. The guidance document also includes some product Quality Criteria. Bullfrog meets or exceeds all of the Quality Criteria measurements and this is now included as a positive assertion in our annual Green Power Audit completed by Deloitte.

Many individuals and companies, though, do not calculate their emissions inventory, and are simply looking for an estimation of the emissions reduction imputable to their purchase from Bullfrog Power. The Bullfrog Power calculators are designed for this purpose.

Bullfrog Power maintains calculators to estimate emission reductions that can be imputed to each MWh of renewable electricity and the associated environmental attributes that are retired on behalf of Bullfrog Power customers.

Bullfrog Power publishes the calculators on its website to help educate consumers about the emissions produced when generating conventional electricity in their region. Bullfrog also uses the calculator when preparing customers' electricity bills to estimate avoided emissions/waste that result from the generation of renewable electricity.

Bullfrog Power is committed to providing customers purchasing our standard product emissions reductions that meet—and in many cases exceed—the national average as disclosed in the National Inventory Report.

⁵ World Resource Institute published the GHG Protocol Scope 2 Guidance document to help assist corporations in calculating their GHG emissions inventory from purchased electricity., http://www.ghgprotocol.org/scope_2_guidance

METHODOLOGY GOALS

Design goals for the calculators include:

1. **TRUSTED SOURCES:** Data used in the calculator must be publicly available from trusted sources.
2. **UP TO DATE:** On an annual basis, Bullfrog Power will update the calculator to use the latest data available at the time of the update.
3. **TRANSPARENT AND REPEATABLE:** The calculations and formulae must be transparent and repeatable by anyone who wishes to verify the calculation.
4. **REASONABLE ASSUMPTIONS:** The assumptions used must be clear and reasonable.
5. **UNDERSTANDABLE:** The calculator should not be overly complex or difficult to understand.

EMISSION REDUCTION METHODOLOGIES

There are several ways to estimate the emissions reductions imputable to one MWh of clean, renewable power. This section explains several of the methodologies that are most commonly used in Canada, and then discusses in more detail the two calculation methodologies Bullfrog Power uses.

FOOTPRINT (AVERAGE) CALCULATION

The footprint calculation is an estimate of the emissions produced by an average MWh of electricity consumed. The assumption in this calculation methodology is that, if the consumer had not purchased a MWh of renewable electricity, they would have purchased a MWh of electricity with the average pollution intensity of the electricity consumed

The percentage contribution by generation type (e.g. coal, gas, hydro, etc.) is then multiplied by the emissions intensity for that generation type.

SYSTEM (OPERATING MARGIN) CALCULATION

System reduction is an estimate of the emissions/waste produced by a MWh of the type of generation that is “on the margin” at any point in time. Electricity generation facilities are called upon by the market operator to provide electricity at any point in time based primarily upon their marginal cost to produce an additional unit of electricity. The grid operator selects the generator with the lowest marginal cost, and that type of generator (e.g. nuclear, gas, hydro) is referred to being “on the margin”. The assumption is that, if a MWh of renewable electricity had not been generated for the consumer, the consumer’s electricity demand would have been met by whichever type of generation was on the margin at that time.

Currently, margin data is only publicly available for the Ontario electricity market.

BUILD MARGIN CALCULATION

The Build Margin reduction is an estimate of the emissions/waste that would be produced by a MWh of generation from the type of generation that would be built if the renewable electricity facility serving the consumer did not exist. In many markets, the build margin is a natural-gas fired generation facility. The assumption is that, if the renewable generation facility supported by the consumer did not exist, a new and more polluting type of generation facility would have to be built to meet that demand.

A calculation of the build margin would use the emission intensities of recent or planned capacity additions as the basis for the calculation.

HYBRID INTENSITY CALCULATION

There are also hybrid approaches that combine several different calculations to determine emission reductions. Recently, as part of its intensity-based cap and trade system, the Alberta Government published the Electricity Displacement Factor in an Offset Credit Project Guidance Document⁶. The Document is used by large regulated emitters in Alberta (e.g. refineries) to calculate the emissions reductions associated with purchasing, among other things, wind in order to achieve the regulatory emissions targets. The Document combines the footprint (average), system (operating margin), and build margin calculations to arrive at a reduction of 0.65 tonnes of carbon for each MWh of wind purchased. Unfortunately, the majority of the data used in this analysis is not publicly available.

⁶ Source: <http://environment.gov.ab.ca/info/library/7915.pdf>

FOOTPRINT

Bullfrog Power provides regional emission intensity figures based on the National Inventory Report.

The figures presented in the National Inventory Report are based on the average generation mix or footprint throughout Canada and then adjusted to reduce items such as line losses (both transmission and distribution system) and other inefficiencies to determine an estimated consumption average,

However, the National Inventory Report does not take into account any interprovincial or US imports and exports. Throughout Canada and North America the electricity grids are interconnected and import and export electricity on a daily basis with neighboring jurisdictions. As a result, the impacts that imports and exports can have on emission intensity rates can be significant depending on the mix of the neighboring jurisdiction, but are excluded from the calculation

Since individuals and companies generally calculate their emissions footprint using the average emissions intensity of electricity grid in their region, the Footprint Reduction is generally also the appropriate estimate of emissions reductions for an individual or company.

WHAT PUBLIC INFORMATION IS AVAILABLE?

Aside from using the emission intensity rates provided in the National Inventory Report, companies and individuals could create their own calculator.

Ideally there would be a single trusted public source of information which clearly and transparently reported intensity of emissions per MWh of electricity consumed in each region, taking into account both electricity imports and exports. Unfortunately, to our knowledge, this information is not available today. As a result, the best public sources available at the time include:

1. **STATISTICS CANADA.** Statistics Canada Manufacturing and Energy Division makes available upon request an annual report indicating the total electricity generation by source and by Province including import and export data. We use the Statistics Canada data to determine the total electricity consumption in the Province.
2. **NATIONAL ENERGY BOARD (NEB).** NEB reports monthly statistics on Electricity Exports and Imports. We use the NEB report to determine the sources of US imports into the Maritimes by State.
3. **PROVINCIAL UTILITIES AND POWER GENERATORS.** Many provincial utilities provide overall electricity generation information, CO_{2e} emission intensity from its fossil fuel generation facilities on an annual basis.
4. **PROVINCIAL REGULATORS.** Many provincial regulators or utility commissions provide information about how much electricity is produced by each production type (coal, nuclear etc.) and how often each resource type of production is “on the margin”.
5. **GOVERNMENTAL AGENCIES.** Several government agencies publish reports on the levels of emissions produced in the Province and also breakdowns by facility type, including those from power plants or electricity generation.
6. **UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA).** We are unable to find specific NO and SO₂ emissions intensity data for certain fossil fuel generators, so the calculators rely on the EPA’s estimate of average emissions intensity for Natural Gas and Oil generation.
7. **EPA EMISSIONS & GENERATION RESOURCE INTEGRATED DATABASE (EGRID).** The EPA also publishes a comprehensive inventory of environmental attributes of all the US electric power systems by State. We use this data to determine the emissions intensity of the electricity being imported from the US.

WHY ARE THE CALCULATIONS ONLY ESTIMATES?

While electricity consumption and production is metered very accurately, many assumptions are necessary in order to develop the calculator. Assumptions include:

- Generalization about the timing of renewable power generation;
- Assumptions about how the grid operates or is managed, including which fuels are displaced when renewable electricity is generated;
- Assumptions about changes from year to year. The current year calculator is derived from historical data, some of which may be many months or even years old;
- Assumptions about how emissions intensity varies by resource type. For example, the emission intensity for the electricity produced by Industry owned facilities in the Maritimes is assumed to be identical to the utility owned facility emission intensities.

Ultimately, the exercise of calculating avoided emissions reductions is an exercise in quantifying something (pollution) that did not happen. As with any effort to quantify something that did not happen, the pollution that was avoided cannot be physically measured because it did not happen, and can only be estimated based upon educated assumptions about what would have happened if the renewable electricity had not been generated or consumed. As a result, the emissions reductions attributable to one MWh of clean renewable power should be treated as estimates.

CONCLUSION AND FURTHER INFORMATION

Bullfrog Power is interested in your feedback on the methodology and the calculator. Please email your comments to info@bullfrogpower.com