

THE BULLFROG POWER 2009 ALBERTA EMISSIONS CALCULATION METHODOLOGY

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INTRODUCTION

WHAT IS BULLFROG POWER?

Bullfrog Power supplies Alberta-based customers with clean power from Alberta-based renewable energy producers. All of Bullfrog Power's producers are EcoLogo certified by the federal government, and do not emit any CO₂, NO or SO₂ in their generation of electricity.

Bullfrog Power purchases all the environmental attributes¹ for each MWh it purchases from its suppliers. Bullfrog Power retires the environmental attributes, on behalf of its customers, of each MWh it sells. Bullfrog Power is audited on an annual basis to ensure that it purchases and retires at least as much as it sells. The audits are available to the public on Bullfrog Power's website.

WHY HAS BULLFROG POWER DEVELOPED THIS CALCULATOR?

The negative environmental consequences of conventional electricity generation are well known: CO₂ is a greenhouse gas and the major contributor to global warming and NO and SO₂ are major precursors of reduced air quality.

Many of Bullfrog Power's customers are curious to understand how their purchase of green electricity affects their environmental footprint. Bullfrog Power maintains this calculator to illustrate emission reductions that can be imputed to the environmental attributes being retired (per MWh) on behalf of Bullfrog Power customers.

Bullfrog Power publishes the calculator on its website to help educate about the emissions produced when generating electricity in the province. Bullfrog also uses the calculator when preparing customers' electricity bills to illustrate avoided emissions.

¹ Environmental Attributes represent the general environmental benefits resulting from the generation of renewable low-impact electricity 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.

METHODOLOGY GOALS

Design goals for this calculator include:

1. **TRUSTED SOURCES:** Data used in the calculator must be publicly available from trusted sources.
2. **UP TO DATE:** At the beginning of each calendar year, Bullfrog Power will update the calculator to use the latest data.
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.

FOOTPRINT VERSUS SYSTEM

There are several ways to look at the emissions reductions imputable to the retiring of a MWh of environmental attributes from clean, renewable power.

Bullfrog Power calculates and reports what we call the “Footprint Reduction”. Footprint reduction is an estimate of the emission produced by an average MWh of production in Alberta.

For Ontario customers, Bullfrog Power also reports what we call the “System Reduction”. System reduction is an estimate of the emissions that *would have been produced* by the overall electricity system, if the MWh of clean renewable power *had not been produced*. We calculate the System Reduction by estimating the emissions produced by a MWh of generation at the margin of the Ontario electricity system. Unfortunately, generation at the margin data is not publicly available for Alberta and so we are unable to provide a System reduction calculation for Alberta customers.

WHAT PUBLIC INFORMATION IS AVAILABLE?

Ideally there would be a trusted public source of information which clearly and transparently reported intensity of emission per MWh of production in Alberta. Unfortunately, to our knowledge, this information is not available directly today. Instead we draw data as best we can from public sources, and transparently show the calculations on this data to arrive at our calculator. The public sources used by the calculator include:

1. **ALBERTA ENVIRONMENT.** Alberta Environment periodically publishes reports the levels of emissions produced in the Province and also breakdowns by facility type, including those from power plants or electricity generation.
2. **ALBERTA ENERGY AND UTILITIES BOARD (EUB).** EUB reports how much electricity is generated in the Province on an annual basis up to and including 2005. Subsequently, they have not published annual generation information.
3. **STATISTICS CANADA.** Statistics Canada publishes an annual report indicating the total electricity generation, by source, by Province.

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. As a result, the emission reductions attributable to retiring Environmental Attributes from a MWh of clean renewable power should be treated as estimates.

Inaccuracies with the calculator include:

- 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 the grid operates or is managed. We don't know exactly how the rest of the grid reacts to the production of renewable power.

FOOTPRINT CALCULATION

The footprint calculation is simply an estimate of the emission produced by an average MWh of production in Alberta.

The three steps to building the calculator are:

1. Determine the amount of emissions (CO₂, NO_x and SO₂) from all electricity generation in Alberta for the most recently available time period.
2. Determine how much electricity was generated during the time period that emissions data is available.
3. By dividing the result of step 2 into the results of step 1, calculate the average emissions generated per MWh of electricity production in Alberta.

STEP 1 – HOW MANY EMISSIONS ARE CREATED BY ELECTRICITY GENERATION IN ALBERTA?

Reporting CO₂

Alberta Environment (a ministry of the provincial government) reports greenhouse gas emissions. The most recently available source is the “Summary Report on 2006 Greenhouse Gas Emissions”. It reports that in 2006 CO₂ emissions from power plants in Alberta totaled 51,300,000 tonnes², representing 47% of all emissions reported in Alberta. .

Reporting NO_x and SO₂

The Government of Alberta and Government of Canada report NO_x and SO₂ emissions through the National Pollutant Release Inventory (NPRI).³

The most recent time period available is the year 2002. Reported NO_x emissions during 2002 from “Electrical Power Generation (Utilities)” was 86,732 tonnes. Reported SO₂ emissions was 131,925 tonnes.

STEP 2 – HOW MUCH ELECTRICITY WAS GENERATED IN ALBERTA?

Historically the Alberta Energy and Utilities Board reports the total electricity generation in Alberta. In 2006, this data was available through a Statistics Canada Report on electricity generation in Canada.

Total electricity generation is summarized in the following table

Year	Total MWh
2002	65,200,000 ⁴
2003	63,700,000 ⁵
2004	66,300,000 ⁶
2005	63,100,000 ⁷
2006	64,100,000 ⁸

² Alberta Environment *Summary Report on 2006 Greenhouse Gas Emissions* (Page 13) Available at http://environment.alberta.ca/documents/2006_GHG_Report.pdf

³ Alberta Environment *Summary Report on 2004 NPRI Air Emissions* (Page 73) Available at <http://environment.gov.ab.ca/info/library/7758.pdf>

⁴ Alberta Energy and Utilities Board *2002 Year-End Review* (Page 44). Available at: <http://www.eub.ca/docs/products/STs/st41-2003.pdf>

⁵ Alberta Energy and Utilities Board *2003 Year In Review* (Page 57). Available at: <http://www.eub.ca/docs/products/STs/st41-2004.pdf>

⁶ Alberta Energy and Utilities Board *2004 Year In Review* (Page 44). Available at: <http://www.eub.ca/docs/products/STs/st41-2005.pdf>

⁷ Alberta Energy and Utilities Board *2005 Year In Review* (Page 50). Available at: <http://www.eub.ca/docs/products/STs/st41-2006.pdf>

⁸ Statistics Canada *Electric Power Generation 2006* (Table 2) . Available at: <http://www.statcan.gc.ca/pub/57-202-x/2006000/5208610-eng.htm>

STEP 3 – CALCULATE TOTAL EMISSIONS PER MWH

By dividing the total MWh produced into the emissions produced in the same year, we now can calculate the average tonnes of emission per MWh.

CO₂ tonnes of emissions in 2006 / total MWh produced in 2006
= 51,300,000 tonnes CO₂ / 64,100,000 MWh
= 0.800 tonnes CO₂/MWh

NO_x tonnes of emissions in 2002 / total MWh produced in 2002
= 86,732 tonnes NO_x / 65,200,000 MWh
= 0.00133 tonnes NO_x/MWh
= 1.33 kg NO_x/MWh

SO₂ tonnes of emissions in 2002 / total MWh produced in 2002
= 131,925 tonnes SO₂ / 65,200,000 MWh
= 0.00202 tonnes SO₂/MWh
= 2.02 kg SO₂/MWh

In conclusion, for each MWh of green electricity purchased, Bullfrog Power customers are reducing their emissions footprint by:

0.800 tonnes of CO₂
1.33 kg of NO_x
2.02 kg of SO₂

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