CHE 670 Sustainability Seminar

GHG Calculators

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``I think you should be more explicit here in step two..."
EPA Greenhouse Gas Equivalencies Calculator

• Uses the Emissions & Generation Resource Integrated Database (eGRID) U.S. annual non-baseload CO₂ output emission rate
• Puts carbon dioxide (CO₂) emissions reductions in everyday terms
• May be useful in communicating your greenhouse gas reduction strategy, reduction targets, or other initiatives aimed at reducing greenhouse gas emissions
• Useful for emissions reductions from energy efficiency or renewable energy programs
• Only for CO₂, no other GHG
• http://www.epa.gov/RDEE/energy-resources/calculator.html
EPA’s Pollution Prevention GHG Calculator

• Quantifies reductions based on conversion factors
  – Electricity conservation
  – Green energy
  – Fuel substitution
  – Greening chemistry
  – Water conservation
  – Materials management

• GHG Conversion Tool May 2009.xls
EPA’s Mandatory Reporting Rule

• Tier 1: $\text{CO}_2 = 1 \times 10^{-3} \times \text{Fuel} \times \text{HHV} \times \text{EF}$
  
  – Fuel = mass or volume of fuel combusted/year (mass in short tons, volume in scf [gas] or gallons [liquid])
  
  – HHV = default high heat value (Table C-1) (mmBTU/mass or volume)
  
  – EF = fuel-specific default CO2 emission factor
  
  – $1 \times 10^{-3} = \text{conversion factor for kg to metric tons}$
EPA’s Mandatory Reporting Rule

- Tier 2: \( CO_2 = 1 \times 10^{-3} \times \text{Fuel} \times \text{HHV} \times \text{EF} \)
  - \( \text{HHV} \) = annual average high heat value of fuel from all valid samples for the year
    - If fuel samples > monthly, \( \text{HHV} \) (annual) = \( \frac{\sum (\text{HHV})_i \times (\text{Fuel})_i}{\sum (\text{Fuel})_i} \)

- Tier 3: depends on solid, liquid, gas
- Tier 4: CEMS
EPA Applicability Tool

• Assess whether your facility would be required to report GHG
• Applicability depends on the source categories and, for some source categories, the emission level or production capacity
• Not intended for Suppliers of fossil fuels or industrial GHGs and Engine Manufacturers
• Applicability Tool
The Climate Registry

- General Reporting Protocol, May 2008
- Electric Power Sector Protocol
- Oil and Gas Production Protocol

Data Quality Tiers
- A1 Direct Monitoring
- A2 Calculation based on fuel use (measured carbon content and measured heat content)
- B Calculation based on fuel use (measured heat content and default carbon content, or vice versa)
- C Calculation based on fuel use (default CO$_2$ emission factors by fuel type)
The Climate Registry

• Estimating emissions from stationary combustion using fuel use data involves six steps
  1. Determine annual consumption of each fuel combusted at your facility
  2. Determine the appropriate CO₂ emissions factors for each fuel
  3. Determine the appropriate CH₄ and N₂O emissions factors for each fuel
  4. Calculate each fuel’s CO₂ emissions
  5. Calculate each fuel’s CH₄ and N₂O emissions, and
  6. Convert CH₄ and N₂O emissions to CO₂ equivalent and determine total emissions
EPA Climate Leaders Simplified GHG Emissions Calculator (SGEC)

• Based on Climate Leaders GHG protocol guidance
• Determines direct and indirect emissions at all sources in the company
• [http://www.epa.gov/climateleaders/documents/sgec_tool_v2%208.xls](http://www.epa.gov/climateleaders/documents/sgec_tool_v2%208.xls)
GHG Protocol

• Default emission factors are averages based on the most extensive data sets available
• Largely identical to those used by the Intergovernmental Panel on Climate Change (IPCC)
• Businesses should use custom values whenever possible
• Cross-sector tools
  – Stationary combustion
  – Purchased electricity, heat, and steam
  – Transport or mobile sources
  – Employee commuting
  – Refrigeration and air-conditioning
• [link](http://www.ghgprotocol.org/calculation-tools/all-tools)
  – Stationary combustion tool
American College & University Presidents Climate Commitment (ACUPCC)

- Clean Air-Cool Planet Campus Carbon Calculator: [http://www.cleanair-coolplanet.org/toolkit/content/view/43/124/](http://www.cleanair-coolplanet.org/toolkit/content/view/43/124/)
Comparison of Calculators

57,200,000 scf natural gas

- GHG Equivalencies – 2,860 metric tons CO$_2$e (therms)
- P2 GHG Calculator – 3,128 (scf); 3,043 (therms)
- Climate Leaders – 3,131 (scf)
- EPA Applicability Tool – 3,118 (scf)
- GHG Protocol – 3,053 (scf); 3,386 (therms)
- ACUPCC – 3,017,628 (MMBTU)