Overview of Pollution Prevention (P2) GHG Calculator

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Purpose of Training

Review Greenhouse Gas Calculator designed to assist the P2 community in calculating green house gas reductions from P2 activities and strategies. *

Review structure/design of the calculator, hypothetical examples, data sources & justifications.

(* based on annual performance results)

Purpose of the GHG Calculator

- Calculates the GHG reductions associated with electricity conservation, green energy, fuel reduction and substitution, water conservation, and better management of hazardous materials and associated chemical processes.
- The calculator is tailored to the P2 program, its partners, and its grantees.

Purpose (continued)

- This tool was not not intended to calculate a program's GHG footprint, which is a measure of a program's entire GHG emissions for all operations, and it does not serve as a GHG inventory of past years' footprints.
- EPA's Climate Leaders, the World Resources Institute, and The Climate Registry offer recognized greenhouse gas inventories and guidance for this purpose.

P2 Performance Measurement

- In 2010 the P2 Program is responsible for reporting million metric tons of carbon dioxide equivalents (MMTC02e) reduced
- This supplements already existing performance measures of:
  - Pounds of pollutants reduced,
  - Gallons of water saved, and
  - Dollars saved through the adoption of P2 practices.

Collaboration and Resources

- Office of Air and Radiation (OAR)
  - Climate Protection Partnership Division
- Office of Resource Conservation and Recovery (ORCR)
- Office of Water (OW)
  - WaterSense Program
- Energy STAR Program
- Climate Registry
- International Panel on Climate Change (IPCC)
- U.S. EPA Inventory of GHG Emission and Sinks

GHG Design Features

- Color coded tabs for each category of GHG reductions perform conversions into carbon dioxide equivalents (C02e)
- Aggregate tab converts into million metric tons of CO2e.
- Ability to aggregate GHG reductions from both individual projects and categories for GHG reductions.
- Illustrative Examples
- Cross reference to applicable GHG tools and models. (to be updated)

Transparency- References

References & Justification				
Source #	Reference	Website	Last Updated	Justification
1	U.S. EPA, Clean Energy. "eGRID 2007 Version 1.1." February 2009. Dowloadable ZIP file: eGRID20071_1year05_aggregation.xls, tab NRL05 and US05.	http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html#download	February, 2009	The emission factors for electricity consumption by NERC electricity generating region are obtained from eGRID's most recent file of emissions factors from 2005. These data represent the generation mix, and thus the emissions, of U.S. regional electricity in 2005
2	US EPA, Downloadable Document: "Unit Conversions, Emissions Factors, and Other Reference Data, 2004." Table I, Page 1.	http://www.epa.gov/climatechange/emissions/downloads/emissionsfactorsbrochure2004.pdf	November, 2004	This is an EPA-provided list of simple conversion factors that are useful in calculating GHG emissions. Emission factors are based on molecular weights of GHGs, which will not need to be updated in the future.
3	Energy Star Program, 'Savings Calculator,' 2008.	http://www.energystar.gov/index.cfm?c=cfls.pr_cfls	January, 2008	EPA's best estimate for electricity savings from a CFL light bulb are published at the Energy Star Website, on the 'Savings Calculator.' A 15 watt, 10,000-hour CFL bulb is compared to an equivalent 60 watt, 1,000-hour conventional bulb in the calculation. Assuming the bulb is used on average 3 hours a day, this results in an annual 49 kwh savings per light bulb. This savings is converted to a savings in MTCO2e with the state's emissions factor for electricity, as listed in eGRID. While savings will differ across different power intensity light bulbs, 60 watts was deemed by EPA to be the most common for residential settings.
4	The Climate Registry, "General Reporting Protocol" 2008.	http://www.theclimateregistry.org/downloads/2009/05/2010.01.06_Emissions_Factors_Final.xls http://www.theclimateregistry.org/downloads/GRP.pdf	January, 2010 May, 2008	The Climate Registry provides the most comprehensive, user-friendly source for emission factors for a variety of GHG-emitting fossil fuels. Tables 12.1 and 12.9 provide most of the emission factors for fossil fuel energy products (explicitly for CO2, N2O, and CH4). Tables 13.1 and 13.3 provide information on GHG emission factors related to transportation. Emissions factor data from The Climate Registry is obtained primarily from U.S. EPA, Inventory of Greenhouse Gas Emissions and Sinks: 1990-2007 (noted as a source in this worksheet), which in turn was derived directly from the IPCC (also noted as a source in this worksheet).
5	EPA Climate Leaders. "Optional Emissions for Commuting, Business Travel, and Product Transport." May 2008.		May, 2008	The EPA Climate Leaders program combines multiple sources of publically available emissions factors in writing guidance to its members. Table 4 provides average emissions factors for business travel: CO2 emissions factors are modified from emissions factors given by Defra's 2007 Guidelines to GHG Emissions Factors, and N_2O and CH_4 emissions factors are calculated from the U.S. EPA Greenhouse Gas Emissions and Sinks:1990-2005 and the Bureau of Labor Transportation Statistics, National Transportation Statistics for 2007. Note that Climate Leader emissions factor categories (i.e. trip length) are not consistent with the Defra source.

Aggregate Feature:

Aggregated GHG Reductions by Project and Category								
	Electricity Conservation	Green Energy	Fuel	Greening Chemistry	Water	Materials Management	Total by project	Total by project
	Reduction in Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$)	Reduction in Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$)	Reduction in Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$)	Reduction in Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$)	Reduction in Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$)	Reduction in Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$)	Reduction in Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$)*	Reduction in Million Metric Tons of Carbon Dioxide Equivalent ($MMTCO_2e$)**
Aggregate (All Projects)	-	-	-	-	-	-	-	-
Project 1	-	-	-	-	-	-	-	-
Project 2	-	-	-	-	-	-	-	-
Project 3	-	-	-	-	-	-	-	-
Project 4	-	-	-	-	-	-	-	-
Project 5	-	-	-	-	-	-	-	-
Project 6	-	-	-	-	-	-	-	-
Project 7	-	-	-	-	-	-	-	-
Project 8	-	-	-	-	-	-	-	-
Project 9	-	-	-	-	-	-	-	-
Project 10	-	-	-	-	-	-	-	-

Category	Description
Electricity Conservation	GHG reductions from electricity conservation or reduced use of energy
Green Energy	GHG reductions from switching to greener or renewable energy sources
Fuel	GHG reductions from reduced fuel use, substitution to greener fuels
Greening Chemistry	GHG reductions from reduced use of high global-warming-potential (GWP) chemicals
Water	GHG reductions from reduced water use
Materials Management	GHG reductions from considering the lifecycle GHG impact of materials used.

Notes:

* Reporting units for Regional ACS measure (Column H) are Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$)

** Reporting units for National P2 program measure (Column I) are Million Metric Tons of Carbon Dioxide Equivalent ($MMTCO_2e$)

Electricity Category for GHG Reductions

GHG Savings from Electricity Conservation

On this tab, a user can select a state or national version of the non-baseload output emissions rate for calculating GHG emission reductions from electricity conservation. These rates are from eGRID (EPA's Emission and Generation Resource Integrated Database). "Non-baseload" refers to the output emissions rate of GHG gases (CO_2, CH_4, and N_2O) from combustion generators, weighted towards those that operate during peak demand. "Non-baseload" excludes emission rates from nuclear, hydro, geothermal, solar, and wind generators because they operate at full capacity even during baseload (low) demand. Peak demand is what is affected by energy efficiency and clean energy projects.

Type of Conservation	Electricity Conservation	CFL Bulbs	Other
How to use this tab: Instructions to obtain $MTCO_2e$	Select state (by project location) or "US National" to apply the state's NERC regional emission factor or the national emissions factor. Enter the annual amount of electricity conserved and choose unit from the drop-down menu. The next column converts all units to kWh. The final column displays the reduction in $MTCO_2e$.	Same directions as for the electicity conservation columns.	If using another calculator to provide results, please provide your methodology and source in this section and enter in your values below.
Calculation Description	MTCO2e/kWh = eGRID non-baseload output emission rate (national rate or NERC rate for state) for CO2 (lb/megawatt), CH4 (lb/gigawatt), and N2O (lb/gigawatt), then converting each into kg/kWh, and then converting each into MTCO2e/kWh, and summing them. National Conversion factor: 0.000721 MTCO2E/kwh NERC Regional Grid Conversion factor: (0.000554 to 0.000954 MTCO2E/kwh) All States belong to multi-state grids, whose operators form the North American Electric Reliability Corporation (NERC). The output emission rate for a state reflects the fuel mix of the multi-state grid, not just the state fuel mix, because in-state consumers tap the fuel mix of the entire multi-state grid.	MTCO2e = Number of bulbs * (49 kwh per year/ bulb) * [either National or Regional emissions factor] National Conversion factor: 0.000721 MTCO2E/kwh Regional Conversion factor: (0.000554 to 0.000954 MTCO2E/kwh)	

	State or U.S. (Select)	Electricity Conserved (Input value)	Unit reported (Select)	Electricity Conserved (kwh)	GHG Reduction ($MTCO_2e$)	Number of CFL bulbs replacing conventional bulbs	GHG Reduction (MTCO2e)	Input	GHG Reduction (MTCO2e)
Example:		GG Co. worked with a facility in North Carolina that has conserved 10,000 kwh of electricity through a conservation activity				GG Co. replaced a total of 1,000 conventional lightbulbs with CFL bulbs in 8 NY facilities during one year.			
	NC	10,000	kwh	10,000	7.871	1,000	38.569		
Total Input- All Projects				-	-	-	-	-	-
Input Volume-Project 1				-	-		-		
Input Volume-Project 2							-		
Input Volume-Project 3							-		
Input Volume-Project 4							-		
Input Volume-Project 5									
Input Volume-Project 6				-	-		-		
Input Volume-Project 7				-	-		-		
Input Volume-Project 8				-	-		-		
Input Volume-Project 9				-	-		-		
Input Volume-Project 10				-	-		-		

Color Key
User enters value
User selects option from drop-down menu
Do not change- calculation

Notes and Sources

	NOTES	SOURCE (refer to Reference & Justification tab)
Electricity Conservation (National and State)	The non-baseload output emissions rate simulates which generation sources are displaced due to changes in energy demand, and accounts for seasonal and daily variations in energy use. This rate does not, however, account for the 7-9% loss of energy that occurs during transmission, making this emission factor (0.000721 MTCO2e/kWh for national) that much less than it would otherwise be (0.000779 MTCO2e /kWh for national). The decision to skip the additive emissions from transmission loss was made to harmonize better with the current version of EPA's National Marginal Carbon Emissions Factor which, at 0.0019 MMTCE/BillionkWh (0.000697 MTCO2e/kWh), is lower than the eGRID non-baseload emissions factor. EPA's Climate Protection Partnership Division developed and maintains the National Marginal Carbon Emission Factor.	(a) Source 1 (b) Source 2
	NOTES	SOURCE (refer to Reference & Justification tab)

Electricity Tab (conversion factors)

More detailed National Conversion factor

	1,583.28 lbs Co2 / MwH	*	0.454 kg / 1 lb	*	1 MwH / 1,000 KwH	*	1 Co2E / 1 Co2	*	1 MTCO2E / 1,000 kg C02E	= 0.0007182
										+
0.000721 MTCO2E/kwH =	35.77 lbs CH4 / GWH	*	0.454 kg / 1 lb	*	1 GwH / 1,000,000 kwh	*	21 Co2E / 1 CH4	*	1 MTCO2E / 1,000 kg Co2E	= 0.0000003
										+
	19.97 lbs N20 / GWH	*	0.454 kg / 1 lb	*	1 GwH / 1,000,000 kwh	*	310 C02E / 1 N20	*	1 MTCO2E / 1,000 kg C02E	= 0.0000028

More detailed Regional conversion factors

	1,118.86 to 2,092.64 lbs Co2 / 1 MWH	*	0.454 kg / 1 lb	*	1 MwH / 1,000 KwH	*	1 Co2E / 1 Co2	*	1 MTCO2E / 1,000 kg Co2E	= (0.0005075 to 0.0009492)
										+
0.000554 to 0.000954 = MTCO2E/kwH	20.15 to 185.69 lbs CH4 / GWH	*	0.454 kg / 1 lb	*	1 GwH / 1,000,000 kwh	*	21 Co2E / 1 CH4	*	1 MTCO2E / 1,000 kg Co2E	= (0.0000002 to 0.0000018)
										+
	5.68 to 33.22 lbs N20 / GWH	*	0.454 kg / 1 lb	*	1 GwH / 1,000,000 kwh	*	310 C02E / 1 N20	*	1 MTCO2E / 1,000 kg C02E	= (0.0000012 to 0.0000047)

Electricity Data Source/Justification

- We use the non-baseload output emissions rate for calculating reductions from electricity conservation. This rate is from eGRID (EPA's Emission and Generation Resource Integrated Database). "Non-baseload" calculates the output emissions rate of GHG gases (CO2, CH4, and N2O) from combustion generators, weighted towards those that operate during peak demand.
- "Non-baseload" excludes emissions from nuclear, hydro, geothermal, solar, and wind generators because they operate at full capacity even during baseload (low) demand. Peak demand is what is affected by energy efficiency and clean energy projects.
- "Non-baseload" simulates which generation sources are displaced due to changes in energy demand, and accounts for seasonal and daily variations in energy use. Yet, it omits counting the 7-9% energy loss that occurs during transmission, making this emission factor (0.000721 MTCO2e/kWh for national) that much less than it would otherwise be (0.000779 MTCO2e /kWh for national).

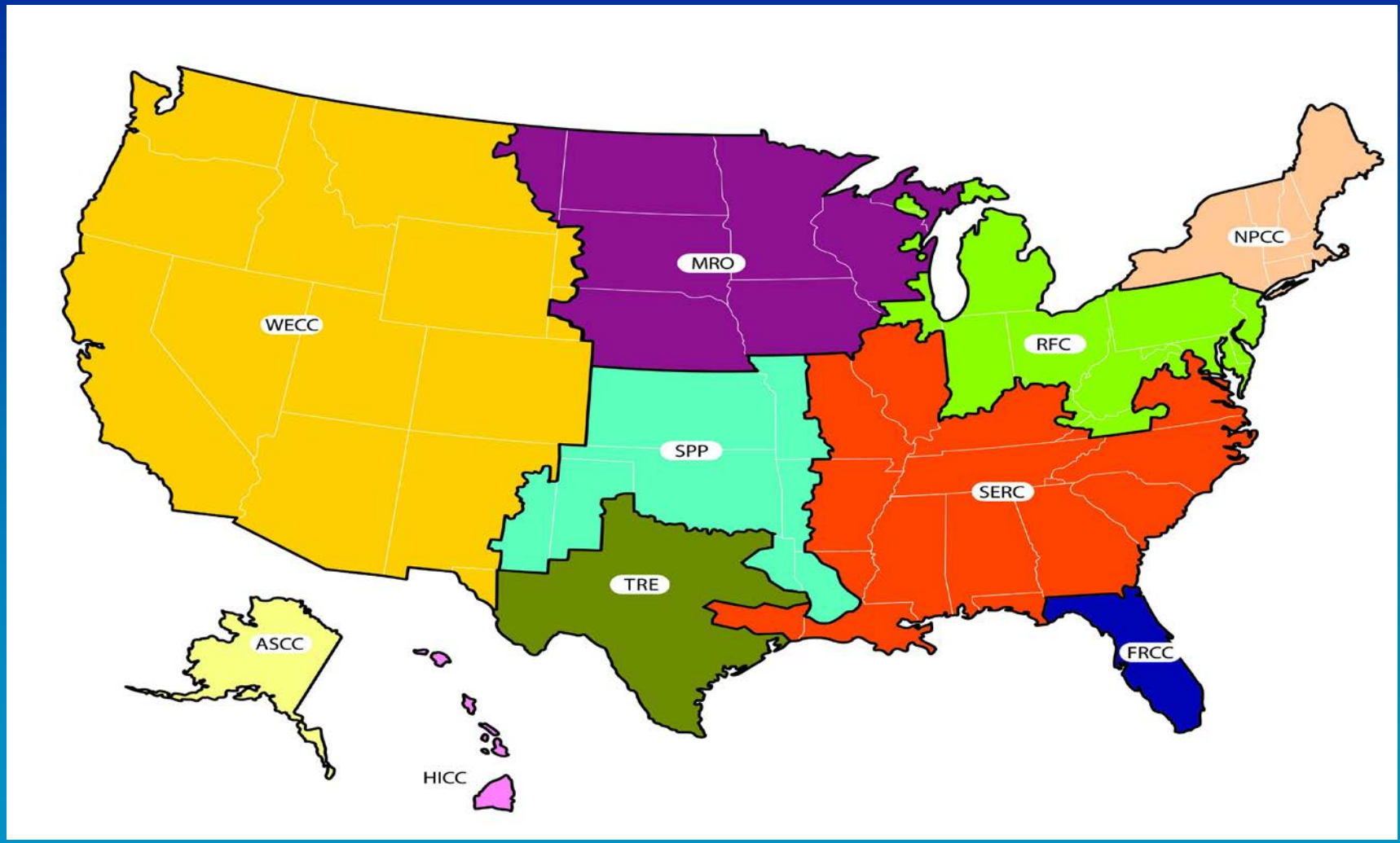
Electricity Data Source

- We accepted skipping the additive emissions from transmission loss to harmonize better with EPA's National Marginal Carbon Emissions Factor (developed by the Climate Protection Partnership Division). In its current version, NMCEM is lower than the eGRID non-baseload emissions factor (0.0019 MMTCE/Billion kWh for national, equal to 0.000697 MTCO2e/kWh for national).

- Our tool provides the national and multi-state grid versions of the non-baseload output emissions rate.

- All states belong to multi-state grids, whose operators form the North American Electric Reliability Corporation (NERC). The output emission rate for a state reflects the fuel mix of the multi-state grid to which it belongs (not just its own fuel mix), because in-state consumers tap the fuel mix of the entire multi-state grid. We concluded this was the most realistic emissions factor for the state level.

North American Electric Reliability Corporation (NERC) Region Representational Map



Electricity Examples

- GQ Co. worked with a facility in North Carolina that conserved 10,000 kwh of electricity.
- Select NC from the state drop down box, enter 10,000 in C16, select kwh in drop down box tool calculates 7.817 of MTC02e reductions.

Green Energy/Power Category for GHG Reductions

- In line with EPA's Green Power Partnership Program, this tool defines green power as:
  - **Sources producing electricity with an environmental profile superior to conventional power and producing no GHG emissions.**
  - **This includes sources built since 1997 relying on solar, wind, geothermal (earth's heat), low-impact biomass, low-impact small hydro-electric sources, biodiesel, and fuel cells. This excludes large hydro sources and those built prior to 1997.**

Green Power: Tool Assumptions

- Assumption: The tool calculates units of green power the same as it calculates units of electricity conservation. It counts them both as reductions, since both avoid GHG emissions from fossil fuel sources.

- The substitution of 1 kWh of fossil-fuel electricity for 1 kWh of renewable electricity is 1 kWh reduced, just as the conservation of 1 kwh of fossil fuel electricity is 1 kWh reduced.

Renewable Energy Certificates (RECs) (also known as green tags & green energy certificates)

- RECs represent indirect emission reductions, which facilities can use to neutralize their own indirect emissions for reporting purposes. Indirect emissions are produced off-site, and are linked to what a facility uses (like electricity).
- RECs are market-based instruments that facilitate buyer-seller transactions on renewable electricity.
- A REC conveys the right to claim the reduction in GHG emissions to the holder of the REC. A REC does not convey the right to be supplied with green energy.
- A REC provides exclusive proof that one megawatt-hour (MWh) of renewable energy has been generated.

Renewable Energy Certificates (RECs)

- Validation/Verification

  We strongly encourage but do not require the purchase of green power products that are certified by an independent third party as a matter of best practice.

Green Energy Category for GHG Reductions

GHG Savings from Shifting to Green Energy Sources

This tab calculates GHG emission reductions that result from substituting green power for conventional power. In line with EPA's Green Power Partnership Program, this tool defines green power as sources producing electricity with an environmental profile superior to conventional power and producing no GHG emissions. This includes sources built since 1997 relying on solar, wind, geothermal (earth's heat), low-impact biomass, low-impact small hydro-electric sources, biodiesel, and fuel cells. This excludes large hydro sources and those built prior to 1997. The tool calculates the switch to green power the same as electricity conservation, which is a positive value of avoided GHG emissions from fossil fuels.

This tab also calculates reductions from renewable energy certificates (RECs) purchased to offset emissions from conventional electricity. Known as green tags, green energy certificates, or tradable renewable certificates, RECs are tradable market instruments sold separately from the electricity itself, which prove 1 MWh of electricity was from a renewable source. The Program strongly encourages but do not require purchasing green power products certified by an independent third party as a matter of best practice. RECs, like electricity conservation and green energy, reduce a facility's Scope 2 indirect emissions, under international standards for reporting GHG emissions..

Green Energy		Electricity Consumed from Green Energy				Renewable Energy Offset or Renewable Energy Certificate (REC)				Renewable Energy Offset or Renewable Energy Certificate (REC)	
How to use this tab: Instructions to obtain MTCO2e		Select the state (by project location) or "U.S. National" to apply the state's NERC regional emissions factor or national U.S. emissions factor. Enter annual amount of green electricity used, and choose unit from the drop-down menu. The column "GHG Reduction" converts the unit into $MTCO_2e$.				Select the state (by project location) or "U.S. National" to apply the state's NERC regional emissions factor or national U.S. emissions factor. Enter the volume of offset or REC and choose unit from the drop-down menu. The column "GHG Reduction" converts the unit into $MTCO_2e$.				Input volume of offset or REC in metric tons CO_2 equivalent.	
Calculation Description		MTCO2e/kWh = eGRID non-baseload output emission rates (either national rates or NERC rates for state) for CO2 (lb/megawatt), CH4 (lb/gigawatt), and N2O (lb/gigawatt), then converting each into kg/kWh, and then converting each into MTCO2e/kWh. National Conversion factor: 0.000721 MTCO2E/kwh Regional Conversion factor: (0.000554 to 0.000954 MTCO2E/kwh)				MTCO2e/kWh = eGRID non-baseload output emission rates (either national rates or NERC rates for state) for CO2 (lb/megawatt), CH4 (lb/gigawatt), and N2O (lb/gigawatt), then converting each into kg/kWh, and then converting each of those into MTCO2e/kWh. National Conversion factor: 0.000721 MTCO2E/kwh Regional Conversion factor: (0.000554 to 0.000954 MTCO2E/kwh)				In this case, inputs equal outputs as the Renewable Energy Offset or Certificate woul dbe reported directly as MTCO2E.	
	State or U.S. (Select)	Electricity Consumed from Renewable Energy (Input value)	Unit reported (Select)	Electricity Consumed from Renewable Energy (kwh)	GHG Reduction ($MTCO_2e$)	Volume of Offset/Certificate Purchased (kwh)	Unit reported (Select)	Electricity Consumed from Renewable Energy (kwh)	GHG Reduction ($MTCO_2e$)	Volume of Offset/Certificate Purchased ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)
Example		GQ Co. installed 2 wind turbines in NY producing 10,000 kWh annually									
	NY	20,000	kwh	20,000	12.878						
Total Input- All Projects				-	-	-		-	-	-	-
Input Volume-Project 1				-	-			-	-		-
Input Volume-Project 2				-	-			-	-		-
Input Volume-Project 3				-	-			-	-		-
Input Volume-Project 4				-	-			-	-		-
Input Volume-Project 5				-	-			-	-		-
Input Volume-Project 6				-	-			-	-		-
Input Volume-Project 7				-	-			-	-		-
Input Volume-Project 8				-	-			-	-		-
Input Volume-Project 9				-	-			-	-		-
Input Volume-Project 10				-	-			-	-		-

Color Key
User enters value
User selects option from drop-down menu
Do not change- calculation

Sources

	SOURCE (refer to Reference & Justification tab)
Electricity conserved by renewable energy	(a) Source 1 (b) Source 2
	SOURCE (refer to Reference & Justification tab)

Green Energy Example

- GQ Co. installed 2 wind turbines in NY producing 10,000 kWh annually.

- Select NY from the drop down menu, enter 20,000 in C17, select kwh from the drop down menu. The tool calculates a 12.878 MTC02e reductions.

Fuel Category for GHG Reductions

- GHG savings from reduced fuel use and/or fuel substitutions.
- Organized by carbon emission intensity----- dirtiest to cleanest.
- Ability to calculate savings from reduced vehicle and airplane miles.

  (User should either enter fuel reduced or vehicle/air miles avoided not BOTH).
- Ability to calculate savings from multiple flights/lengths.

Fuel (continued)

- Data Source is from the General Protocol of Climate Registry.
- The P2 Calculator includes GHG savings from emissions from carbon dioxide, methane and nitrous oxide where possible.
- End result maybe higher emission factors than those tools that only express C02.

Biofuels

- No consensus emission factor ---- not all biofuels are the same.
- The P2 Program used a middle of the road approach to recognize differences in various type of biofuels and strive for consistency.
- EPA's Office of Transportation and Quality

  Lifecycle GHG emission intensities of alterative fuels in relation to gasoline.

Fuel Category for GHG Reductions

GHG Savings from Reduced Fuel Use and Substitutions of Greener Fuels	The Fuel tab calculates GHG reductions from reduced fuel use as well as fuel substitutions. The tab is organized by the carbon-emissions intensity of fuels, from highest to lowest. The too calculates savings from reduced vehicle and airplane miles traveled. (Please note that "reduced miles traveled" accounts for reduced fuel use, so choose between reduced miles traveled o reduced fuel use (not both)). Please also note biodiesel and ethanol instructions for fuel substitution, where positive value is for discontinued fuel, negative value for substitute fuel, leaving accurate net positive value for GHG emissions reduced.					
Fuel	Crude Oil		Distillate Fuel Oil (#1, 2, and 4) or Diesel		Jet Fuel	
How to use this tab: Instructions to obtain MTCO2e	Enter number of gallons of crude oil conserved. "GHG Reduction" converts the units into $MTCO_2e$.		Enter number of gallons of distillate fuel oil or diesel conserved. "GHG Reduction" converts the units into $MTCO_2e$.		Enter number of gallons of jet fuel conserved. "GHG Reduction" converts the units into $MTCO_2e$.	
Calculation Description	MTCO2e = Input Volume (gal.) * (10.35 kg CO2e / gal)a * (1 MTCO2e / 1,000 kg CO2e) See notes below for emission factor derivation		MTCO2e = Input Volume (gal.) * (10.21 kg CO2e / gal)a * (1 MTCO2e / 1,000 kg CO2e) See notes below for emission factor derivation		MTCO2e = Input Volume (gal.) * (9.67 kg CO2e / gal)a * (1 MTCO2e / 1,000 kg CO2e) See notes below for emission factor derivation	
Example			GQ Co. replaced 20,000 gallons of distillate fuel oil in a turbine with 20,000 gallons of biodiesel. STEP 1 of 2 20,000	204.157		
	Crude Oil Reduced (gal)	GHG Reduction ($MTCO_2e$)	Distillate Fuel or Diesel Reduced (gal)	GHG Reduction ($MTCO_2e$)	Jet Fuel Reduced (gal)	GHG Reduction ($MTCO_2e$)
Total Input- All Projects	-	-	-	-	-	-
Input Volume-Project 1		-		-		-
Input Volume-Project 2		-		-		-
Input Volume-Project 3		-		-		-
Input Volume-Project 4		-		-		-
Input Volume-Project 5		-		-		-
Input Volume-Project 6		-		-		-
Input Volume-Project 7		-		-		-
Input Volume-Project 8		-		-		-
Input Volume-Project 9		-		-		-
Input Volume-Project 10		-		-		-

Fuel Category (cont)

GHG Savings from Reduced Fuel Use and Substitutions of Greener Fuels

Fuel	Air Miles	Gasoline	Vehicle Miles
How to use this tab: Instructions to obtain MTCO2e	Select flight-length category from drop-down menu: short haul (<300 miles per one-way flight), medium haul (300 - 700 miles), long haul (>700 miles), multiple distances, or distance unknown. If miles are all in one flight-length category or all in distance-unknown category, enter number of air miles reduced. "GHG Reduction" converts the units into MTCQe, by appropriate formulas. **If multiple flight-lengths are involved, use** table "Calculator for Air Miles Traveled over Multiple-Distance Ranges" to enter miles per category. Copy cell value from Project Total in MTCO2e and paste into GHG Reductio column for the project row.	Enter number of gallons of gasoline reduced. "GHG Reduction" converts the units into $MTCO_2e$.	Enter the number of vehicle miles reduced. "GHG Reduction" converts the units into $MTCO_2e$.
Calculation Description	MTCO2e (short haul) = Volume (air miles traveled) * (0.28 kg CO2e / mi)a * (1 MTCO2e / 1,000 kg CO2e) MTCO2e (medium haul) = Volume (air miles traveled) * (0.23 kg CO2e / mi)a * (1 MTCO2e / 1,000 kg CO2e) MTCO2e (long haul) = Volume (air miles traveled) * (0.19 kg CO2e / mi)a * (1 MTCO2e / 1,000 kg CO2e) MTCO2e (unknown) = Volume (air miles traveled) * (0.27 kg CO2e / mi)a * (1 MTCO2e / 1,000 kg CO2e) See notesbelow for emission factor derivation	MTCO2e = Input Volume (gal.) * (8.86 kg CO2e / gal)a * (1 MTCO2e / 1,000 kg CO2e) See notes below for emission factor derivation	MTCO2e = Input Volume (miles traveled) * (0.42 kg CO2e / mi)a * (1 MTCO2e / 1,000 kg CO2e) See notes below for emission factor derivation
Example	New company policy on videoconferencing saved GQ Co. 100,000 air miles traveled on short flights over 3 years.		
	short haul: <300 miles	100,000	27.985

	Length of Flight(s) (Select)	Air Miles Reduced (miles)	GHG Reduction ($MTCO_2e$)	Gasoline Reduced (gal)	GHG Reduction ($MTCO_2e$)	Vehicle Miles Reduced (miles)	GHG Reduction ($MTCO_2e$)
Total Input- All Projects		-	-	-	-	-	-
Input Volume-Project 1			-		-		-
Input Volume-Project 2			-		-		-
Input Volume-Project 3			-		-		-
Input Volume-Project 4			-		-		-
Input Volume-Project 5			-		-		-
Input Volume-Project 6			-		-		-
Input Volume-Project 7			-		-		-
Input Volume-Project 8			-		-		-
Input Volume-Project 9			-		-		-
Input Volume-Project 10			-		-		-

Color Key	Calculator for Air Miles Reduced over Multiple Distance Ranges		
User enters value		Air Miles Reduced (miles)	GHG Reduction ($MTCO_2e$)
User selects option from drop-down menu	Project Total	-	-
Do not change- calculation	multiple distances		
	short haul: <300 miles		-
	medium haul: >300 - <700 miles		-
	long haul: >700 miles		-
	distance unknown		-

Fuel Category (cont)

GHG Savings from Reduced Fuel Use and Substitutions of Greener Fuels								
Fuel	Natural Gas or Compressed Natural Gas (CNG)				Biodiesel			
How to use this tab: Instructions to obtain MTCO2e	Enter the volume of natural gas or CNG reduced. Select from drop-down menu to indicate units. Next column converts the units into BTUs, and "GHG Reduction" converts the units into MTCQe.				Select biodiesel blend from drop-down: B5 (5% biodiesel, 95% petrol diesel), B20 (20% biodiesel, 80% petrol), or B100 (100% biodiesel). Enter gallons of biodiesel blend. "GHG Reduction" converts the units into $MTCO_2e$. **If it is all biodiesel blend being reduced,** enter a positive value for "Biodiesel Reduced. **If diesel fuel is being replaced with biodiesel,** (1) enter a positive value in "Distillate Fuel Reduced" and (2) enter a negative value in "Biodiesel Reduced." This will leave an accurate net positive number for GHG emission reductions.			
Calculation Description	MTCO2e = Input Volume (BTU) * (0.0000532 kg CO2e/ BTU)a * (1 MTCO2e / 1,000 kg CO2e) See notes below for emission factor derivation				MTCO2e (B5)= Volume (gal.) * (0.05*(3.00 kg CO2e / gal. biodiesel)+0.95*(9.67 kg CO2e / gal. diesel))a * (1 MTCO2e / 1,000 kg CO2e) MTCO2e (B20)= Volume (gal.) * (0.20*(3.00 kg CO2e / gal. biodiesel)+0.80*(9.67 kg CO2e / gal. diesel))a * (1 MTCO2e / 1,000 kg CO2e) MTCO2e (B100)= Volume (gal.) * (3.00 kg CO2e / gal. biodiesel)a * (1 MTCO2e / 1,000 kg CO2e) See below for more information on emission factor derivation			
Example	GQ Co. replaced solvent bonding of plastic parts with ultrasonic bonding, thus reducing incineration of spent solvents and saving 10,000 therms of natural gas annually.				GQ Co. replaced 20,000 gallons of distillate fuel oil in a combustion turbine generator with 20,000 gallons of biodiesel. STEP 2 of 2			
	10,000	therms	1,000,000,000	53.196	B100	-20,000	-59.995	

Total Input- All Projects	Natural Gas or CNG Reduced (Input value)	Units (Select)	Natural Gas or CNG Reduced (BTU)	GHG Reduction ($MTCO_2e$)	Blend (Select)	Biodiesel Reduced (gal)	GHG Reduction ($MTCO_2e$)
			-	-		-	-
Input Volume-Project 1			-	-			-
Input Volume-Project 2			-	-			-
Input Volume-Project 3			-	-			-
Input Volume-Project 4			-	-			-
Input Volume-Project 5			-	-			-
Input Volume-Project 6			-	-			-
Input Volume-Project 7			-	-			-
Input Volume-Project 8			-	-			-
Input Volume-Project 9			-	-			-
Input Volume-Project 10			-	-			-

Fuel Category (cont)

GHG Savings from Reduced Fuel Use and Substitutions of Greener Fuels								
Fuel	Ethanol (Corn-Derived)			Ethanol (Cellulose-Derived)			Other	
How to use this tab: Instructions to obtain MTCO2e	Select ethanol blend from drop-down menu: E10 (10% ethanol, 95% gasoline), E85 (85% ethanol, 15% gasoline), or E100 (100% ethanol). Enter gallons of ethanol blend. "GHG Reduction" converts the units into $MTCO_2e$. **If it is all corn ethanol being reduced:** enter a positive value for "Corn Ethanol Reduced" **If gasoline is being replaced with corn ethanol:** (1) enter a positive value in "Gasoline Reduced" and (2) enter a negative value in "Corn Ethanol Reduced." This will leave an accurate net positive number for GHG emission reductions			Select ethanol blend from drop-down menu: E10 (10% ethanol, 95% gasoline), E85 (85% ethanol, 15% gasoline), or E100 (100% ethanol). Enter gallons of ethanol blend . "GHG Reduction" converts the units into $MTCO_2e$. **If it is all cellulosic ethanol being reduced,** enter a positive value for "Cellulosic Ethanol Reduced. **If ethanol is replacing gasoline:** (1) enter a positive value in "Gasoline Reduced" and (2) enter a negative value in "Cellulosic Ethanol Reduced." This will leave an accurate net positive number for GHG emission reductions.			If using another tool to calculate results, please provide your methodology and source in "Calculation Description," and enter values on project lines.	
Calculation Description	MTCO2e (E10)= Volume (gal). * [0.10*(4.54 kg CO2e / gal. corn-derived ethanol)+0.90*(8.87 kg CO2e / gal. diesel)]a * (1 MTCO2e / 1,000 kg CO2e) MTCO2e (E85)= Volume (gal.) * [0.85*(4.54 kg CO2e / gal. corn-derived ethanol)+0.15*(8.87 kg CO2e / gal. diesel)]a * (1 MTCO2e / 1,000 kg CO2e) MTCO2e (E100)= Volume (gal.) *(4.54 kg CO2e / gal. corn-derived ethanol)a * (1 MTCO2e / 1,000 kg CO2e) See below for more information on emission factors derivation			MTCO2e (E10)= Volume (gal.) * [0.10*(0.53 kg CO2e / gal. cellulosic ethanol)+0.90*(8.87 kg CO2e / gal. diesel)]a * (1 MTCO2e / 1,000 kg CO2e) MTCO2e (E85)= Volume (gal.) * [0.85*(0.53kg CO2e / gal. cellulosic ethanol)+0.15*(8.87 kg CO2e / gal. diesel)]a * (1 MTCO2e / 1,000 kg CO2e) MTCO2e (E100)= Volume (gal.) *(0.53 kg CO2e / gal. cellulosic ethanol)a * (1 MTCO2e / 1,000 kg CO2e) See below for more information on emission factors derivation				
Example								
	Blend (Select)	Corn Ethanol Reduced (gal)	GHG Reduction ($MTCO_2e$)	Blend (Select)	Cellulosic Ethanol Reduced (gal)	GHG Reduction ($MTCO_2e$)	Input	GHG Reduction ($MTCO_2e$)
Total Input- All Projects		-	-		-	-	-	-
Input Volume-Project 1			-			-		-
Input Volume-Project 2			-			-		-
Input Volume-Project 3			-			-		-
Input Volume-Project 4			-			-		-
Input Volume-Project 5			-			-		-
Input Volume-Project 6			-			-		-
Input Volume-Project 7			-			-		-
Input Volume-Project 8			-			-		-
Input Volume-Project 9			-			-		-
Input Volume-Project 10			-			-		-

Biofuels

- Important Instructions to Remember:
  - Applies when switching to a less intensive fuel source.
  - For fuel substitution enter a positive value is for the discontinued fuel, and negative value for the substitute fuel, which will leave an accurate net positive value for GHG emissions reduced.

Example for Fuel

- GQ Co. replaced 20,000 gallons of distillate fuel oil in a turbine with 20,000 gallons of biodiesel.
- GQ replaced distillate fuel (discontinued fuel) a positive value of 20,000 gallons is entered in D14.
- Output is equal to 204.175 MTCO2e reduced.
- Next, proceed to biodiesel column and enter a negative value of -20,000 in T14. (replacement fuel)
- Output value is equal to -59.995 MTCO2e reduced
- Aggregate tab displays total reduction for this project as 141.161 MTCO2e reduced.

Green Chemistry

- Total of 95 chemicals
- Combination of
  - International Panel on Climate Change
  - EPA's Final GHG reporting rule
- Chemical Abstract Service (CAS) and GWP provided
- Continual Work

Green Chemistry

- Emissions of gases are translated to carbon CO2 equivalents using global warming potentials. (GWP)
- GWP describes the ability of a unit of gas emitted in the present to trap heat over 100 years (time frame selected by the International Panel on Climate Change (IPCC)
- For example, methane (CH4) has a GWP of 21= releasing 1 pound of CH4 has the GWP of 21 pounds of carbon dioxide.

Global Warming Potentials

Carbon dioxide	CO2	**1**
Nitrous oxide	N2O	**310**
HFC-23	CHF3	**11,700**
HFC-125	CHF2CF3	**2,800**
HFC-134a	CH2FCF3	**1,430**
HFC-143a	CH3CF3	**1,300**
HFC-152a	CH3CHF2	**140**
HFC-227ea	CF3CHFCF3	**2,900**
HFC-236fa	CF3CH2CF3	**6,300**
PFC-14	CF4	**6,500**
PFC-116	C2F6	**9,200**
PFC-218	C3F8	**7,000**
Perfluorocyclobutane	c-C4F8	**8,700**

Green Chemistry

GHG Savings from Reduced Emission of GHG Chemicals Directly								
The Green Chemistry tab calculates GHG reductions from reducing use of high GWP chemicals and from switching to chemicals with little to no global warming impact. The Greening Chemistry ta[b] combination of the 63 chemicals listed by the International Panel on Climate Change [Carbon Dioxide (CO2), ethane (CH4), Nitrous Oxide (N2O), Chlorofluorocarbons (CFCs), numerous Hydrof[luorocarbons] Hexafluoride (SF6)] and the 72 chemicals listed in EPA's draft GHG Reporting Rule.								
How to use this tab: Instructions to obtain $MTCO_2e$	Enter the mass of each chemical avoided for a project in the column "lbs. Chemical Avoided." Total lbs CO_2e avoided and $MTCO_2e$ reduce[d]							
Calculation Description	MTCO2e = lbs. CO2e Avoided * (0.4536 kg / lbs.) * (1 MTCO2e / 1,000 kg CO2) lbs. CO2e Avoided = lbs.Chemical Avoided * (100-year Global Warming Potential)							
Example :	GG Co. improved leak detection for their use of sulphur hexafluoride in their own electrical distribution equipment, saving 500 pounds of SF[6] of CO_2 in cell H10 and 5,504 $MTCO_2e$ in cell I8]							
Industrial Chemical Reduced	IPCC, EPA Reporting Rule, GHG Registry or both	Chemical Formula	CAS #	Global Warming Potential (100 year)	All Projects	Project 1	Project 2	Project 3
					Total GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)
ALL CHEMICALS					-	-	-	-
					Total lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided
ALL CHEMICALS					-	-	-	-
					lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided
Carbon dioxide	Both	CO2	124389	1	-			
Methane	Both	CH4	74828	21	-			
Nitrous oxide	Both	N2O	10024972	310	-			
CFC-11	IPCC	CCl3F	75694	4,750	-			
CFC-12	IPCC	CCl2F2	75718	10,900	-			
CFC-13	IPCC	CClF3	75729	14,400	-			
CFC-113	IPCC	CCl2FCClF2	76131	6,130	-			
CFC-114	IPCC	CClF2CClF2	76142	10,000	-			
CFC-115	IPCC	CClF2CF3	76153	7,370	-			
Halon-1301	IPCC	CBrF3	75638	7,140	-			
Halon-1211	IPCC	CBrClF2	353593	1,890	-			
Halon-2402	IPCC	CBrF2CBrF2	124732	1,640	-			
Carbon tetrachloride	IPCC	CCl4	56235	1,400	-			
Methyl bromide	IPCC	CH3Br	74839	5	-			
Methyl chloroform	IPCC	CH3CCl3	71556	146	-			
HCFC-22	IPCC	CHClF2	75456	1,810	-			
HCFC-123	IPCC	CHCl2CF3	306832	77	-			
HCFC-124	IPCC	CHClFCF3	2837890	609	-			
HCFC-141b	IPCC	CH3CCl2F	1717006	725	-			
HCFC-142b	IPCC	CH3CClF2	75683	2,310	-			
HCFC-225ca	IPCC	CHCl2CF2CF3	422560	122	-			
HCFC-225cb	IPCC	CHClFCF2CClF2	507551	595	-			
HFC-23: Trifluoromethane	Both	CHF3	75467	11,700	-			
HFC-32	Both	CH2F2	75105	650	-			
HFC-125	Both	CHF2CF3	354336	2,800	-			
HFC-134a	Both	CH2FCF3	811972	1,300	-			
HFC-143a	Both	CH3CF3	420462	3,800	-			
HFC-152a	Both	CH3CHF2	75376	140	-			
HFC-227ea	Both	CF3CHFCF3	431890	2,900	-			
HFC-236fa	Both	CF3CH2CF3	690391	6,300	-			
HFC-245fa	Both	CHF2CH2CF3	460731	1030	-			
HFC-365mfc	Both	CH3CF2CH2CF3	406586	794	-			
HFC-43-10mee	Both	CF3CHFCHFCF2CF3	138495428	1,300	-			
Sulphur hexafluoride	Both	SF6	2551624	23,900	-			
Nitrogen trifluoride	Both	NF3	7783542	17,200	-			
PFC–14 (Perfluoromethane)	Both	CF4	75730	6,500	-			
PFC–116 (Perfluoroethane)	Both	C2F6	76164	9,200	-			
PFC–218 (Perfluoropropane)	Both	C3F8	76197	7,000	-			
Perfluorocyclobutane	Both	c-C4F8	115253	8,700	-			
PFC–3–1–10 (Perfluorobutane)	Both	C4F10	355259	7,000	-			
PFC–4–1–12 (Perfluoropentane)	Both	C5F12	678262	7,500	-			
PFC–5–1–14 (Perfluorohexane)	Both	C6F14	355420	7,400	-			
PFC–9–1–18	Both	C10F18	306945	7,500	-			
trifluoromethyl sulphur pentafluoride	Both	SF5CF3	373808	17,700	-			
HFE-125	Both	CHF2OCF3	3822682	14,900	-			
HFE-134	Both	CHF2OCHF2	1691174	6,320	-			
HFE-143a	Both	CH3OCF3	421147	756	-			
HCFE–235da2 (Isoflurane)	Both	CHF2OCHClCF3	26675467	350	-			
HFE-245cb2	Both	CH3OCF2CHF2	22410442	708	-			
HFE-245fa2	Both	CHF2OCH2CF3	1885489	659	-			
HFE-254cb2	Both	CH3OCF2CHF2	425887	359	-			
HFE-347mcc3	Both	CH3OCF2CF2CF3	28523866	575	-			
HFE-347pcf2	Both	CHF2CF2OCH2CF3	406780	580	-			
HFE-356pcc3	IPCC	CH3OCF2CF2CHF2		110	-			
HFE–449sl (HFE–7100) Chemical ble[nd]	Both	C4F9OCH3	163702076	297	-			
HFE–569sf2 (HFE–7200) Chemical ble[nd]	Both	C4F9OC2H5	163702054	59	-			
HFE-43-10pccc124 (H-Galden 1040x)	Both	CHF2OCF2OC2F4OCHF2	E1730133	1,870	-			
HFE-236ca12 (HG-10)	Both	CHF2OCF2OCHF2	78522471	2,800	-			
HFE-338pcc13 (HG-01)	Both	CHF2OCF2CF2OCHF2	188690780	1,500	-			
PFPMIE	Both	CF3OCF(CF3)CF2OCF2OCF3		10,300	-			
Dimethylether	IPCC	CH3OCH3	115106	1	-			

Green Chemistry

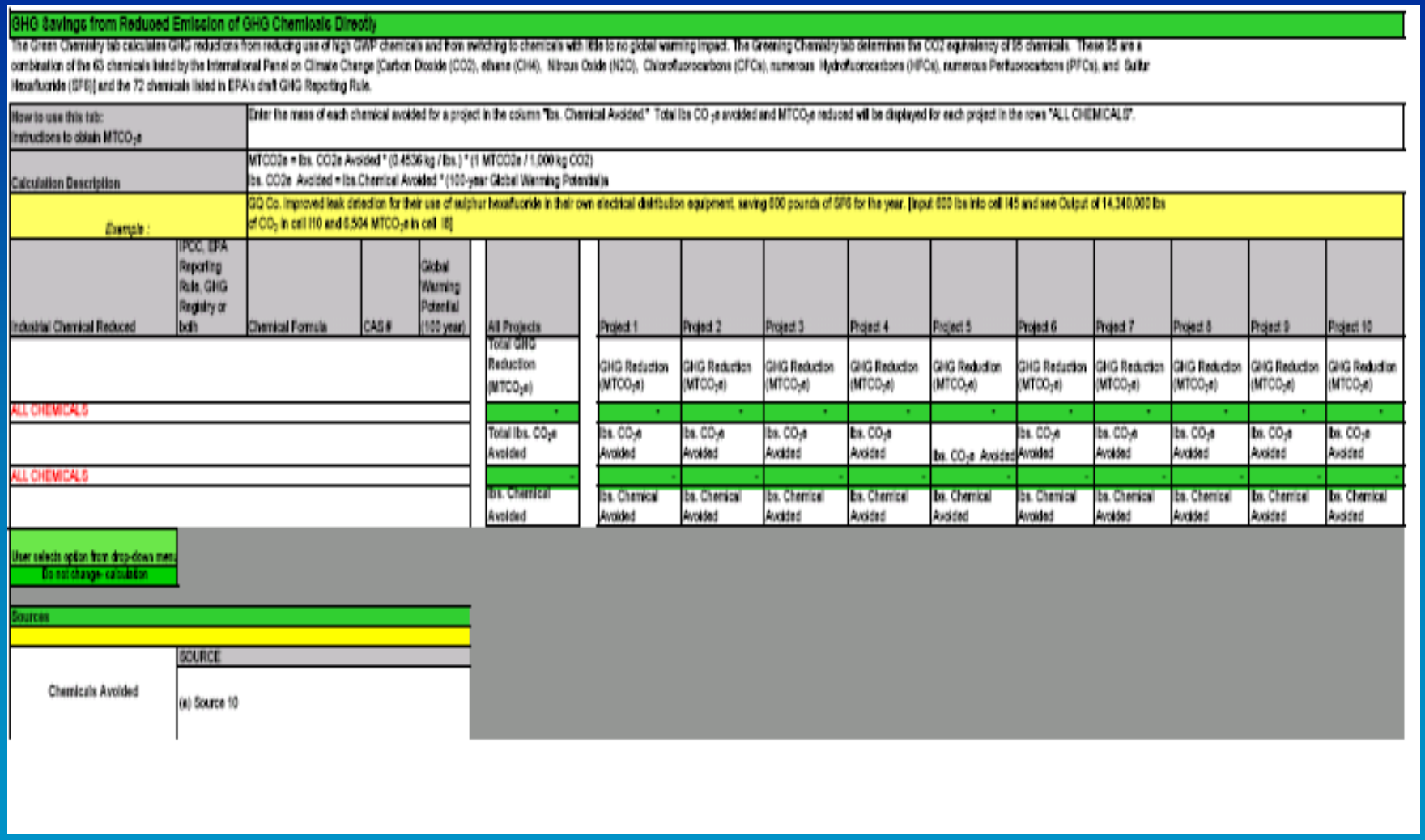
GHG Savings from Reduced Emission of GHG Chemicals Directly

The Green Chemistry tab calculates GHG reductions from reducing use of high GWP chemicals and from switching to chemicals with little to no global warming impact. The Greening Chemistry t
combination of the 63 chemicals listed by the International Panel on Climate Change [Carbon Dioxide (CO2), ethane (CH4), Nitrous Oxide (N2O), Chlorofluorocarbons (CFCs), numerous Hydro
Hexafluoride (SF6)] and the 72 chemicals listed in EPA's draft GHG Reporting Rule.

How to use this tab: Instructions to obtain MTCO$_2$e	Enter the mass of each chemical avoided for a project in the column "lbs. Chemical Avoided." Total lbs CO $_2$e avoided and MTCO$_2$e reduce
Calculation Description	MTCO2e = lbs. CO2e Avoided * (0.4536 kg / lbs.) * (1 MTCO2e / 1,000 kg CO2) lbs. CO2e Avoided = lbs.Chemical Avoided * (100-year Global Warming Potential)s
Example :	GG Co. improved leak detection for their use of sulphur hexafluoride in their own electrical distribution equipment, saving 500 pounds of SF of CO$_2$ in cell I10 and 5,504 MTCO$_2$e in cell I8]

Industrial Chemical Reduced	IPCC, EPA Reporting Rule, GHG Registry or both	Chemical Formula	CAS #	Global Warming Potential (100 year)	All Projects	Project 1	Project 2	Project 3
					Total GHG Reduction (MTCO$_2$e)	GHG Reduction (MTCO$_2$e)	GHG Reduction (MTCO$_2$e)	GHG Reduction (MTCO$_2$e)
ALL CHEMICALS					-	-	-	-
					Total lbs. CO$_2$e Avoided	lbs. CO$_2$e Avoided	lbs. CO$_2$e Avoided	lbs. CO$_2$e Avoided
ALL CHEMICALS					-	-	-	-
					lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided
HFE–236ea2 (Desflurane)	EPA Rep. Rule	CHF2OCHFCF3	57041675	989	-			
HFE 236fa	EPA Rep. Rule	CF3CH2OCF3	20193673	487	-			
HFE–245fa1	EPA Rep. Rule	CHF2CH2OCF3	84011154	286	-			
HFE 263fb2	EPA Rep. Rule	CF3CH2OCH3	460435	11	-			
HFE–329mcc2	EPA Rep. Rule	CF3CF2OCF2CHF2	67490362	919	-			
HFE 338mcf2	EPA Rep. Rule	CF3CF2OCH2CF3	156053882	552	-			
HFE–347mcf2	EPA Rep. Rule	CF3CF2OCH2CHF2	E1730135	374	-			
HFE–347mmy1	EPA Rep. Rule	CH3OCF(CF3)2	22052842	343	-			
HFE–356mec3	EPA Rep. Rule	CH3OCF2CHFCF3	382343	101	-			
HFE–356mm1	EPA Rep. Rule	(CF3)2CHOCH3	13171181	27	-			
HFE–356pcf2	EPA Rep. Rule	CHF2CH2OCF2CHF2	E1730137	265	-			
HFE–356pcf3[b]	EPA Rep. Rule	CHF2OCH2CF2CHF2	35042990	502	-			
HFE–338mmz1	EPA Rep. Rule	CHF2OCH(CF3)2	26103082	380	-			
HFE–374pc2[a,b]	EPA Rep. Rule	CH3CH2OCF2CHF2	512516	557	-			
HFE–449sl (HFE–7100) Chemical blend	EPA Rep. Rule	(CF3)2CFCF2OCH3	163702087	297	-			
HFE–569sf2 (HFE–7200) Chemical blend	EPA Rep. Rule	(CF3)2CFCF2OCH3	163702055	59	-			
HFC–161	EPA Rep. Rule	CH3CH2F	353366	12	-			
HFC–134	EPA Rep. Rule	C2H2F4	359353	1,000	-			
HFE–365mcf3	EPA Rep. Rule	CF3CF2CH2OCH3	378165	11	-			
2,2,3,3,3-pentafluoropropanol	EPA Rep. Rule	CF3CF2CH2OH	422059	42	-			
HFC–143	EPA Rep. Rule	C2H3F3	430660	300	-			
HFC–236ea	EPA Rep. Rule	CHF2CHFCF3	431630	1,370	-			
HFC–41	EPA Rep. Rule	CH3F	593533	150	-			
HFC–152	EPA Rep. Rule	CH2FCH2F	624726	53	-			
HFC–236cb	EPA Rep. Rule	CH2FCF2CF3	677565	1,340	-			
HFC–245ca	EPA Rep. Rule	C3H3F5	679867	560	-			
Bis(trifluoromethyl)methanol	EPA Rep. Rule	(CF3)2CHOH	920661	195	-			
Perfluorocyclopropane	EPA Rep. Rule	CC3F6	931919	17,340	-			
Sevoflurane	EPA Rep. Rule	CH2FOCH(CF3)2	28523866	345	-			
HFE–356pcc3	EPA Rep. Rule	CH3OCF2CF2CHF2	160620202	110	-			
(Octafluorotetramethylene)hydroxymethyl group	EPA Rep. Rule	X(CF2)4CH(OH)X	NA	73	-			

Green Chemistry



GHG Savings from Reduced Emission of GHG Chemicals Directly

The Green Chemistry tab calculates GHG reductions from reducing use of high GWP chemicals and from switching to chemicals with little to no global warming impact. The Greening Chemistry tab determines the CO2 equivalency of 95 chemicals. These 95 are a combination of the 63 chemicals listed by the International Panel on Climate Change [Carbon Dioxide (CO_2), ethane (CH_4), Nitrous Oxide (N_2O), Chlorofluorocarbons (CFCs), numerous Hydrofluorocarbons (HFCs), numerous Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF_6)] and the 72 chemicals listed in EPA's draft GHG Reporting Rule.

How to use this tab: Instructions to obtain $MTCO_2e$	Enter the mass of each chemical avoided for a project in the column "lbs. Chemical Avoided." Total lbs CO_2e avoided and $MTCO_2e$ reduced will be displayed for each project in the rows "ALL CHEMICALS".
Calculation Description	$MTCO_2e$ = lbs. CO_2e Avoided * (0.4536 kg / lbs.) * (1 $MTCO_2e$ / 1,000 kg CO_2) lbs. CO_2e Avoided = lbs.Chemical Avoided * (100-year Global Warming Potential)a
Example :	SQ Co. improved leak detection for their use of sulphur hexafluoride in their own electrical distribution equipment, saving 800 pounds of SF_6 for the year. [Input 800 lbs into cell I45 and see Output of 14,340,000 lbs of CO_2 in cell I10 and 6,504 $MTCO_2e$ in cell I8]

Industrial Chemical Reduced	IPCC, EPA Reporting Rule, GHG Registry or both	Chemical Formula	CAS #	Global Warming Potential (100 year)	All Projects	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6	Project 7	Project 8	Project 9	Project 10
					Total GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)	GHG Reduction ($MTCO_2e$)
ALL CHEMICALS					-	-	-	-	-	-	-	-	-	-	-
					Total lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided	lbs. CO_2e Avoided
ALL CHEMICALS					-	-	-	-	-	-	-	-	-	-	-
					lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided	lbs. Chemical Avoided

User selects option from drop-down men.
Do not change calculation

Sources

Chemicals Avoided	SOURCE
	(a) Source 10

Water Category for GHG reductions

- Significant energy is required to pump, treat, and transport water.
- The P2 Program relied on the survey-based water conversion factors used in the report "Water and Sustainability: U.S. Electricity Consumption for Water Supply and Treatment"
- Conserving heated water reduces GHG emissions more than conserving cold water. The tool relied on the EPA's WaterSense calculator for benefits of hot water conservation.

Water Conservation (factors)

- EPA's WaterSense Calculator accounts for the power source (natural gas or electricity) used to heat the water.
- Assigns the same factor to water heated by a renewable source that it assigns to non-heated water;
- Assigns a higher factor to water heated by natural gas and;
- Assigns the highest factor to water heated with conventional electricity.
- If users are not aware how water is heated but know that it is NOT from a renewable resource use the natural gas conversion as a default.

Contact Information

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