

# DELTA OFFSETS

## “Some Clicks” Calculator

### ASSUMPTIONS AND REFERENCES

#### INTRODUCTION

The Delta Institute Carbon Offsets “Some Clicks” Calculator is structured according to the two major sources of individual carbon dioxide emissions: lifestyle and transportation. The following describes assumptions and references used to calculate your greenhouse gas emissions from each source. All assumptions and references are based on the most current publicly available information.

#### ABBREVIATIONS USED IN THIS DOCUMENT

kWh = kilowatt-hour,  
unit of energy equivalent to one kilowatt of power expended for one hour of time

#### LIFESTYLE

##### ELECTRICITY

*Annual household emissions from electricity*

$$= (\text{average monthly household electric bill} / \text{average U.S. price per kWh}) * \text{electricity emission factor} * \text{months in a year}$$

Assumption	Reference
1. Average U.S. price per kWh = <b>\$0.11</b> in July 2007	U.S. Energy Information Administration. “Average Retail Price of Electricity to Ultimate Customers by End-Use Sector” <a href="http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html">http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html</a> . 2007.
2. Electricity emission factor (pounds CO <sub>2</sub> /kWh) = <b>1.34</b>	U.S. Energy Information Administration. “Average Electricity Emission Factors by State and Region” <a href="http://www.eia.doe.gov/oiaf/1605/e-factor.html">http://www.eia.doe.gov/oiaf/1605/e-factor.html</a> . 2002.
3. Average U.S. monthly electric bill = <b>U.S. average monthly consumption (938 kWh, 2005) * U.S. average price per kWh (\$0.11, July 2007) = \$103.18</b>	U.S. Energy Information Administration. “Electric Sales, Revenue, and Price” <a href="http://www.eia.doe.gov/cneaf/electricity/esr/esr_sum.html">http://www.eia.doe.gov/cneaf/electricity/esr/esr_sum.html</a> . Table 5: U.S. Average Monthly Bill By Sector, Census Division and State. 2006.

## NATURAL GAS

*Annual household emissions from natural gas*

= (average monthly household natural gas bill / average U.S. price per thousand cubic feet)

\* natural gas emission factor \* months in a year

Assumption	Reference
1. Average U.S. price per thousand cubic feet = <b>\$16.65</b> in July 2007	U.S. Energy Information Administration. "Natural Gas Prices" <a href="http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm">http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm</a> . 2007.
2. Natural gas emission factor (pounds CO <sub>2</sub> /thousand cubic feet) = <b>116.376</b>	U.S. Energy Information Administration, Voluntary Reporting of Greenhouse Gases Program. "Fuel and Energy Source Codes and Emission Coefficients" <a href="http://www.eia.doe.gov/oiaf/1605/factors.html">http://www.eia.doe.gov/oiaf/1605/factors.html</a> . Accessed October 18, 2007.
3. Average U.S. monthly natural gas bill = <b>U.S. average monthly consumption (7.68 thousand cubic feet, 2005) * U.S. average price per thousand cubic feet (\$16.65, July 2007) = \$127.87</b>	U.S. Energy Information Administration. "A Look at Residential Energy Consumption in 2001." 2004.

## HEATING OIL (FUEL OIL)

*Annual household emissions from heating oil (No. 2 Fuel Oil)*

= (average monthly household heating oil bill / average U.S. price gallon) \* heating oil emission factor \* months in a year

Assumption	Reference
1. Average U.S. price per gallon = <b>\$2.495</b> in March 2007	U.S. Energy Information Administration. "Weekly Heating Oil and Propane Prices" <a href="http://tonto.eia.doe.gov/dnav/pet/pet_pri_wfr_dcus_nus_m.htm">http://tonto.eia.doe.gov/dnav/pet/pet_pri_wfr_dcus_nus_m.htm</a> . 2007.
2. Heating oil emission factor (pounds CO <sub>2</sub> /gallon) = <b>22.384</b>	U.S. Energy Information Administration. "Fuel and Energy Source Codes and Emission Coefficients" <a href="http://www.eia.doe.gov/oiaf/1605/factors.html">http://www.eia.doe.gov/oiaf/1605/factors.html</a> . Accessed October 18, 2007.
3. Average U.S. monthly fuel oil bill = <b>U.S. average monthly consumption (55 gallons, 2001) * U.S. average price per gallon (\$2.495, March 2007) = \$137.25</b>	U.S. Energy Information Administration. "A Look at Residential Energy Consumption in 2001." 2004.

## WASTE AND RECYCLING

*Annual household emissions from waste and recycling*

= (average pounds CO<sub>2</sub> equivalent generated from waste – paper recycling emissions reduction – glass recycling emissions reduction – plastic recycling emissions reduction – metals recycling emissions reduction) (per person per year) \* number of people in household

Assumption	References
1. Average pounds CO <sub>2</sub> equivalent generated from waste per person per year = <b>1,018</b>	(a) U.S. Environmental Protection Agency. "Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2004." 2006. (b) U.S. Environmental Protection Agency. "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2003." 2005.
2. Paper recycling emissions reduction per person per year = <b>184.3 pounds</b>	Note that these emission factors take into account the full material life cycle; i.e. not only emissions at the landfill, but also emissions and sequestration associated with production, manufacturing, remanufacturing, forest carbon storage due to reduced harvests, etc.  U.S. Environmental Protection Agency. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks" EPA530-R-06-004. 2006.
3. Glass recycling emissions reduction per person per year = <b>25.6 pounds</b>	
4. Plastic recycling emissions reduction per person per year = <b>46.6 pounds</b>	
5. Metals recycling emissions reduction per person per year = <b>165.8 pounds</b>	
6. Indicating "yes" to recycling a certain material means recycling 100% of all recyclable materials generated as waste.	

## FOOD AND DIET

*Annual household emissions from food and diet*

= (average pounds CO<sub>2</sub> equivalent generated from the average U.S. diet – vegetarian diet emissions difference – organic diet emissions difference) (per person per year) \* number of people in household

Assumption	References
1. Average pounds CO <sub>2</sub> equivalent generated from the average U.S. diet (that includes red meat and fish almost every day) = <b>4,100</b>	U.S. Environmental Protection Agency. "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004." Table 6-1, Table A-104. 2006.

<p>2. Vegetarian diet emissions difference per person per year =  <b>+3,600 pounds</b> for eating red meat or fish every day at most meals;  <b>0 pounds</b> (average) for eating meat on most but not all days, and not avoiding red meat or fish;  <b>-5200 pounds</b> for eating meat rarely, eating meat that is primarily poultry, or eating a vegetarian diet that includes dairy and eggs;  <b>-6400 pounds</b> for eating a strict vegetarian or vegan diet</p>	<p>Gidon Eshel and Pamela A. Martin. "Diet, Energy, and Global Warming" <i>Earth Interactions</i> 2006. Paper 10-1009.</p>
<p>3. Organic diet emissions difference per person per year =  <b>0 pounds</b> (average) for eating organic foods never or rarely;  <b>-200 pounds</b> for eating organic foods sometimes;  <b>-600 pounds</b> for eating organic foods most of the time</p>	<p>David Pimentel, et. al. "Environmental, Energetic, and Economic Comparisons of Organic and Conventional Farming Systems" <i>BioScience</i> 2005. 55(7): 573-582.</p>

## TRANSPORTATION

### DRIVING

*Annual household emissions from driving*

$$= \{[(\text{average miles driven per week} * 52 \text{ weeks}) \text{ OR } (\text{average miles driven per year})] / (\text{average fuel economy in miles per gallon})\} * \text{pounds of CO}_2 \text{ emitted per gallon} * \text{emissions of greenhouse gases other than CO}_2$$

Assumption	Reference
<p>1. National average fuel economy for light-duty vehicles (cars, minivans, sport utility vehicles, pickup trucks) = <b>20.2 miles per gallon</b> in 2007</p>	<p>U.S. Environmental Protection Agency. "Light Duty Automatic Technology and Fuel Economy Trends: 1975 Through 2007" <a href="http://www.epa.gov/otaq/fetrends.htm">http://www.epa.gov/otaq/fetrends.htm</a>. 2007.</p>
<p>2. National average miles driven per 2-person household per year = <b>21,200</b> in 2001 (<b>408</b> per week)</p>	<p>U.S. Department of Energy, Transportation Energy Data Book. "Chapter 8 Household Vehicles and Characteristics" <a href="http://cta.ornl.gov/data/chapter8.shtml">http://cta.ornl.gov/data/chapter8.shtml</a>. Table 8.7. Edition 26, 2007.</p>
<p>3. Pounds of CO<sub>2</sub> emitted per gallon = <b>19.564</b></p>	<p>U.S. Energy Information Administration, Voluntary Reporting of Greenhouse Gases Program. "Fuel and Energy Source Codes and Emission Coefficients" <a href="http://www.eia.doe.gov/oiaf/1605/factors.html">http://www.eia.doe.gov/oiaf/1605/factors.html</a>. Accessed October 18, 2007.</p>
<p>4. Emissions of greenhouse gases other than CO<sub>2</sub> = 100/95</p>	<p>U.S. Environmental Protection Agency. "Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle." 2005.</p>

## FLYING

### *Annual household emissions from flying*

= [(number of roundtrip flights up to 311 miles away \* 622 miles \* pounds CO<sub>2</sub> emitted per mile on flights under 311 miles) + (number of roundtrip flights 311-982 miles away \* 1964 miles \* pounds CO<sub>2</sub> emitted per mile on flights between 311-982 miles) + (number of roundtrip flights over 982 miles away \* 4000 miles \* pounds CO<sub>2</sub> emitted per mile on flights over 982 miles)] \* radiative forcing index

Assumption	Reference
1. pounds CO <sub>2</sub> emitted per mile on flights under 311 miles = <b>0.532</b>	Greenhouse Gas Protocol. CO <sub>2</sub> Emissions from Business Travel, Version 1.2. "Distance-Based Emission Factors for Air, Rail, Bus and Car Travel" <a href="http://www.ghgprotocol.org/calculation-tools/all-tools">http://www.ghgprotocol.org/calculation-tools/all-tools</a> . 2005.
2. pounds CO <sub>2</sub> emitted per mile on flights between 311-982 miles = <b>0.426</b>	
3. pounds CO <sub>2</sub> emitted per mile on flights over 982 miles = <b>0.390</b>	
4. radiative forcing index = <b>2.7</b>	Intergovernmental Panel on Climate Change (IPCC). Special Report on Aviation in the Global Atmosphere. 1999.