Carbon Footprinting

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Riyaz Shipchandler
riyaz@istc.illinois.edu
(630) 472-5336
Overview

- Greenhouse Gases & Climate Change
- Carbon Footprinting
Greenhouse Gases
The Greenhouse Effect

Some energy is reflected back out to space

Earth's surface is heated by the sun and radiates the heat back out towards space

Solar energy from the sun passes through the atmosphere

Greenhouse gases in the atmosphere trap some of the heat

Source: http://triusenergy.com
Greenhouse Gases

- CO$_2$: Carbon dioxide (Fossil Fuels)
- CH$_4$: Methane (Agricultural, waste, fuels)
- N$_2$O: Nitrous oxide (Agricultural, waste, fuels)
- HFCs: Hydrofluorocarbons (Refrigerants)
- PFCs: Perfluorocarbons (Semiconductor, aluminum)
- SF$_6$: Sulfur hexafluoride (Electrical distribution)
Global Average Temperature and Carbon Dioxide Concentrations, 1880 - 2004

Data Source CO2 (Siple Ice Cores): http://cdiac.esd.ornl.gov/ftp/trends/co2/siple2.013
Data Source CO2 (Mauna Loa): http://cdiac.esd.ornl.gov/ftp/trends/co2/maunaloa.co2

Graphic Design: Michael Ernst, The Woods Hole Research Center
Civilization

- Energy: 86%
- Industrial: 5%
- Agriculture: 6%
- Land Use: 1%
- Waste: 2%
- Solvent / Product Use: 0%

Total = Tg CO₂ Eq

Aggregate Contributions of Major GHG Emitting Countries

Percent of Global GHG Emissions

Number of Countries

WORLD RESOURCES INSTITUTE
Climate Change
Impacts of Climate Change

- Economic loss from extreme weather
- Depletion of natural resources
- Flooding
- Disease
- Water shortages
- Heat waves

What should we do?

1. Continue on same energy path. Learn to adapt to climate change.
   - Flooding, disease, lower food production, water shortages, etc.

2. Curb emissions
   - Carbon tax
   - Cap and Trade
   - Regulations
Bottom Line

1. Currently, you can emit greenhouse gases for “free” in the U.S.

2. It is likely that there will be restrictions or a cost on greenhouse gas emissions

3. It may become costly to emit carbon
   - Prices for fossil fuels, steel, cement & water could go up
Bottom Line

4. Sell more products / services by lowering your customer’s carbon footprint.

5. Carbon Footprints can help reduce operating and transportation costs
Carbon Foot Printing
Carbon Footprint Steps

1. Determined sources to include
2. Gather activity data
3. Find emission factors
4. Complete calculations
5. Reduced and reported emissions
Sources that Must be Included

- **All Direct Sources**
  - Emissions from company owned sources
  - Ex: natural gas usage in boilers
  - Ex: fuel usage in fleet vehicles

- **Indirect Sources**
  - Emissions from sources owned by others, but as a consequence of company activities
  - Ex: electricity usage
Optional Indirect Sources

- Business travel by air, rail, or taxi
- Employee commuting
- Consumables (i.e. paper, raw materials)
- Leased Facilities
# General Formula

<table>
<thead>
<tr>
<th>Activity Data</th>
<th>$\times$</th>
<th>Emission Factor</th>
<th>$=$</th>
<th>Carbon Emissions</th>
</tr>
</thead>
</table>

## Activity Data for a Printer in 2007

<table>
<thead>
<tr>
<th>Activity</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas</td>
<td>5,600 therms</td>
</tr>
<tr>
<td>Delivery Trucks</td>
<td>4,000 gals / yr of gasoline</td>
</tr>
<tr>
<td>Electricity</td>
<td>4.6 million kWh / yr</td>
</tr>
<tr>
<td>Employee commuting</td>
<td>1.5 million miles / yr</td>
</tr>
</tbody>
</table>
Emission Factors

- Convert activity data to carbon emissions
- World Resources Institute
  - [http://www.ghgprotocol.org/calculation-tools](http://www.ghgprotocol.org/calculation-tools)
- Department of Energy
  - [http://www.eia.doe.gov/oiaf/1605/coefficients.html](http://www.eia.doe.gov/oiaf/1605/coefficients.html)
- Power company
From the power company

<table>
<thead>
<tr>
<th>Emissions</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide</td>
<td>1,770 lbs</td>
</tr>
<tr>
<td>Nitrogen Oxides</td>
<td>2.96 lbs</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>7.43 lbs</td>
</tr>
<tr>
<td>High-Level Nuclear Waste</td>
<td>&lt;.0001 lbs</td>
</tr>
<tr>
<td>Low-Level Nuclear Waste</td>
<td>&lt;.0001 ft³</td>
</tr>
</tbody>
</table>

1. KNOWN: Known sources for the 12 months ending September 30, 2007.
<table>
<thead>
<tr>
<th>Activity Data</th>
<th>Activity Data Details</th>
<th>x</th>
<th>Emission Factor</th>
<th>=</th>
<th>Carbon Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas</td>
<td>5,600 therms</td>
<td>x</td>
<td>11.7 lbs CO₂ / therm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery trucks</td>
<td>4,000 gals / yr of gasoline</td>
<td>x</td>
<td>19.6 lbs CO₂ / gal of gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>4.6 million kWh / yr</td>
<td>x</td>
<td>1.77 lbs CO₂ / kWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee commuting</td>
<td>1.5 million miles / yr</td>
<td>x</td>
<td>19.6 lbs CO₂ / gal of gas 22 mpg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Carbon Footprint

- Employee Commuting: 643 tons
- Sales Force: 113 tons
- Leased Warehouses (utilities): 109 tons
- Chicago Office (Utilities): 35 tons
- Natural Gas (Bloomington): 33 tons
- Business Travel: 11 tons
- Electricity (Bloomington): 0.4 tons
- Backup Generator: 3029 tons
Recommendations for Small Companies

- Keep it simple
  - It is OK to not include small sources
  - Focus on fossil fuels and CO$_2$ emissions
- Establish a baseline and reduction targets
  - Use footprinting to help achieve other organizational goals
- ISTC can assist with carbon footprinting
Questions