A Ton of Greenhouse Gas

March 2015

Overview.
The types of greenhouses gases [GHGs] of concern, and their sources, are well known. The solutions are also known, mostly. The shortage of action is due, in part, to stated disbelief in global warming. Those who believe the science and acknowledge the problem are still hamstrung when it comes to funding and political will. This checklist is intended to provide a few numbers that can serve as "walking around" information when discussing global warming.

Types of Greenhouse Gases.
The four named types of greenhouse gases are: carbon dioxide, methane, nitrous oxide and fluorinated gases. Carbon dioxide constitutes the vast majority of the problem.

Sources of Greenhouse Gases.
Producing electricity accounts for a third of all gas emissions in the United States. Other sources of GHG emissions are: transportation, industry, commercial/residential activities and agriculture.

www.wundeground.com

In **"Shrinking the Carbon Footprint of Metropolitan America",** the Brookings Institution Metropolitan Policy Program [May 2008] reported sources from another perspective using the Energy Information Administration data. They categorized "U.S. CO2 Emissions by Sector in 2005" as 39% buildings, 33% transportation and 28% industry. Building construction, operation and maintenance are incredibly high producers of carbon dioxide gases. Improvement in building practices have a positive effect.

Size of the Greenhouse Gas Problem as Reported by the U.S. EPA.
"*The Inventory of U.S. Greenhouse Gas Emissions and Sinks* tracks the national trend in greenhouse gas emissions and removals back to 1990. The key findings of the 1990-2012 U.S. Inventory include:

- In 2012, U.S. greenhouse gas emissions totaled 6,526 million metric tons CO2.
- U.S. emissions decreased by 3.4 percent from 2011 to 2012. Recent trends can be attributed to multiple factors including reduced emissions from electricity generation, improvements in fuel efficiency in vehicles with reductions in miles traveled, and year-to-year changes in the prevailing weather.
- Greenhouse gas emissions in 2012 were 10 percent below 2005 levels."

Read or download the entire Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012 (PDF, 529 pp., 12.6 MB). Over 6 billion metric tons of CO2 annually is an enormous number. The following page presents illustrations of the size of one ton of CO2 gas.

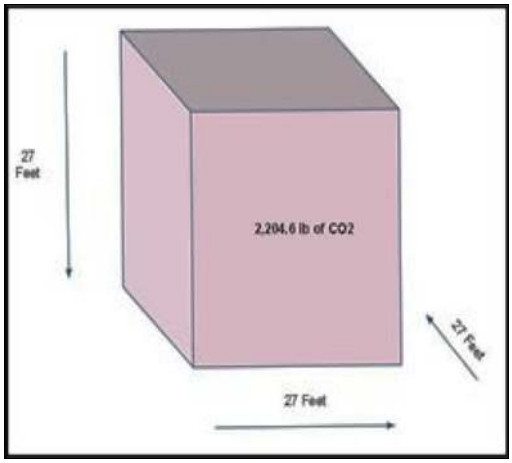
A Ton of Greenhouse Gas

March 2015

One Ton of Carbon Dioxide.

The press and others talk about tons of carbon dioxide entering the atmosphere every day. Brainiac reports, "According to the Intergovernmental Panel on Climate Change, the average citizen of an industrialized country causes 10 tons of carbon dioxide to be released into the atmosphere every year, through driving and other fuel-consuming habits. The average figure is even higher for Americans: 23 tons."

State of the USA produced the adjacent illustration that shows the volume of space taken by one ton of carbon dioxide; almost 30 feet on each side.



www.stateoftheusa.org

The Boston Globe's Brainiac reports, "Recognizing how abstract such figures [like a ton of carbon dioxide gas] can seem, and to coincide with the Copenhagen Climate Talks, a group called Millennium Art has installed a cube that represents how much space one ton of CO2 takes up. The cube floats on a barge in St. Jorgens Lake, in Copenhagen."

What does one ton of carbon dioxide look like?
Posted by Christopher Shea December 11, 2009 10:43 AM
Source: The Boston Globe

A Ton of Greenhouse Gas

March 2015

Size of the Global Greenhouse Gas Problem as Reported by the U.S. Department of Energy.

The U.S. Department of Energy produced the numbers on the table below. Global emission increased from 23 million tons in 2000 to 31 in 2010. The industrial nations are the biggest emitters with the U.S. leading the pack. Remember the size of a ton of CO2 – approximately a volume of 30'x30'x30'.

The figures show the decline in CO2 from 2000 to 2010 produced by the United States, Japan, Germany, Canada, the United Kingdom and Italy.

- The UK emission shave been declining since 1980,
- Italy's emission in 2010 rose from 2000 and generally equal the emission levels of 1990.

China, India and Russia have large and growing CO2 emissions.

- China had a humongous increase from 2000 to 23010 and is by far the largest emitter.
- Russia's emissions have an up and down history:
- They grew somewhat from 2000 to 2010,
- The 2010 levels are just more than half of the 1980 levels, and
- Emission declined dramatically from 1990 to 2000; seems the fall in emissions coincided with the fall of the Soviet Union.

Top 15 Nations Producing Carbon Dioxide Emissions, 1980 – 2010.
Source – USDOE
[in millions of metric tons of CO2 emitted from the consumption of energy]

Country	1980	1990	2000	2010
China	1,448	2,269	2,849	8,320
United States	4,776	5,040	5,861	5,610
India	291	578	1,002	1,695
Russia	3,081	3,820	1,498	1,633
Japan	947	1,046	1,201	1,164
Germany	759	698	854	793
Korea, South	131	242	438	578
Iran	116	202	321	560
Canada	457	470	573	548
United Kingdom	613	601	560	532
Saudi Arabia	176	208	290	478
South Africa	235	297	386	465
Brazil	185	237	344	453
Mexico	240	302	383	445
Italy	371	415	447	416
World Total	18,343	21,615	23,738	31,780

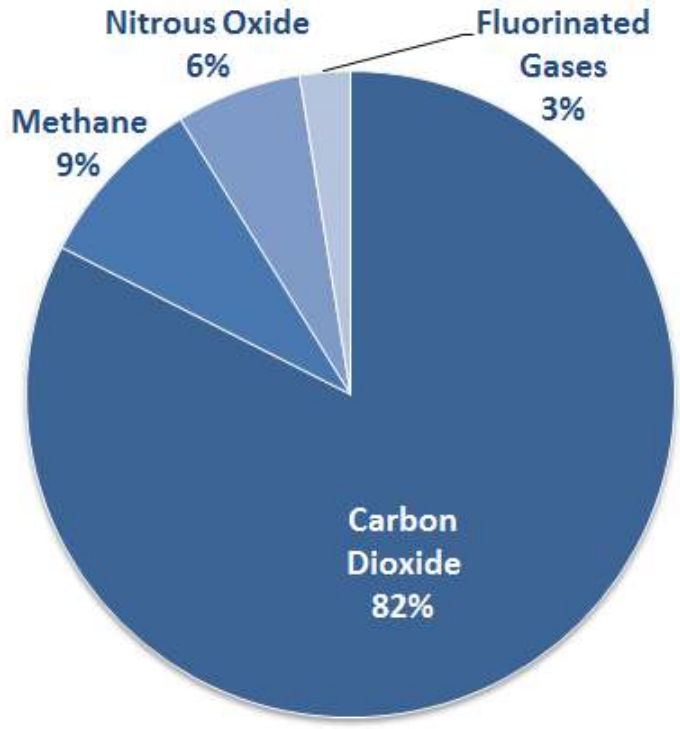
A Ton of Greenhouse Gas

March 2015

The EPA, *Overview of Greenhouse Gases* reports:

- "**Carbon dioxide (CO_2)** : Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions (e.g., manufacture of cement). Carbon dioxide is removed from the atmosphere (or 'sequestered') when it is absorbed by plants as part of the biological carbon cycle.
- "**Methane (CH_4)** : Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.
- "**Nitrous oxide (N_2O)** : Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- "**Fluorinated gases** : Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for stratospheric ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases('High GWP gases')."

U.S. Greenhouse Gas Emissions in 2012

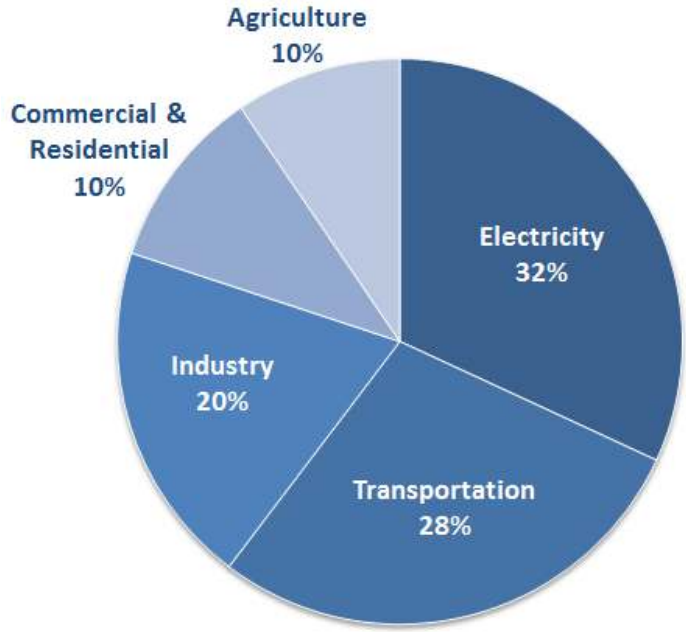


Total U.S. Emissions in 2012 = 6,526 Million Metric Tons of CO_2 equivalent
http://www.epa.gov/climatechange/ghgemissions/gases.html

A Ton of Greenhouse Gas

March 2015

Total U.S. Greenhouse Gas Emissions by Economic Sector in 2012



Total Emissions in 2012 = 6,526 Million Metric Tons of CO_2 equivalent

* Land Use, Land-Use Change, and Forestry in the United States is a net sink and offsets approximately 15% of these greenhouse gas emissions. All emission estimates from the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012.*

The EPA in *Overview of Greenhouse Gases* also reports that the primary sources of greenhouse gas emissions in the United States are:

- "Electricity production (32% of 2012 greenhouse gas emissions) - Electricity production generates the largest share of greenhouse gas emissions. Over 70% of our electricity comes from burning fossil fuels, mostly coal and natural gas.
- "Transportation (28% of 2012 greenhouse gas emissions) - Greenhouse gas emissions from transportation primarily come from burning fossil fuel for our cars, trucks, ships, trains, and planes. Over 90% of the fuel used for transportation is petroleum based, which includes gasoline and diesel.
- "Industry (20% of 2012 greenhouse gas emissions) - Greenhouse gas emissions from industry primarily come from burning fossil fuels for energy as well as greenhouse gas emissions from certain chemical reactions necessary to produce goods from raw materials.
- "Commercial and Residential (10% of 2012 greenhouse gas emissions) - Greenhouse gas emissions from businesses and homes arise primarily from fossil fuels burned for heat, the use of certain products that contain greenhouse gases, and the handling of waste.
- "Agriculture (9% of 2012 greenhouse gas emissions) - Greenhouse gas emissions from agriculture come from livestock such as cows, agricultural soils, and rice production."

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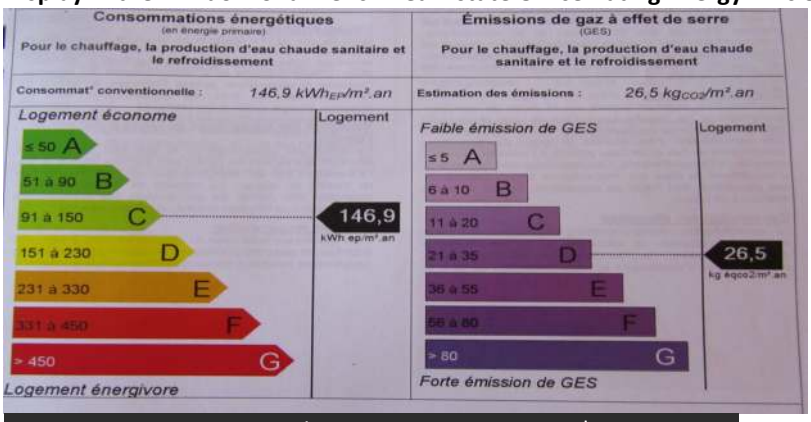
Strategies to Reduce Greenhouse Gas Emissions.

Cities have limited means to affect global warming, but there are meaningful things cities can do to reduce greenhouse gas emissions. The mantra – reduce, reuse, recycle – has resonance and many cities are enacting operating practices to address the issue by increasing fleet fuel efficiency, promoting recycling to reduce deposits in landfills, water conservation measures and others.

Conclusions based on the Brookings Institution Report.

1. Carbon dioxide is the overwhelming problem.
2. Buildings [39%] and transportation [33%] produce over 70% of the carbon emissions. Development patterns play a major role in emissions from the transportation system and the built environment.
3. Controllable factors to reduce GHG emissions are:
   a. Reductions in Vehicle Miles Travelled [VMT] through better land use decisions and multi-modal transportation systems.
   b. More efficient freight operations using rail freight and improved fuel efficiency in the nations trucking fleet.
   c. Better integrate transportation, energy, buildings, workforce and land use policies.
   d. Adapt national standards to measure performance with community-based standards published in a Pattern Book prepared uniquely for every community to assess performance in: 1) carbon emissions, 2) energy consumption, 3) water consumption, and 4) waste reduction, reuse and recycling.
   e. "Locationally Efficient Neighborhood" methods for home loans.
   f. Post home energy disclosure when selling and financing residential housing to influence buying habits[example below]. The French and the UK have mandatory information systems.

Display in the Window of a French Real Estate Office Rating Energy Efficiency in Each Home for Sale



New measures to improve the EPA process in France | Energy 3.0 ...
www.electrical-efficiency.com
Conducting an Energy Performance Assessment (EPA), called diagnostic de performance énergétique or DPE in French, has been compulsory in France since 2006 ...