

# Biomass

Ken Clifton, CISSP, MCSE, MCSD, MCDBA, Network+, A+, CTT+, CXE



*Database Administrator  
Systems Engineer + Internet  
Solution Developer  
Trainer*

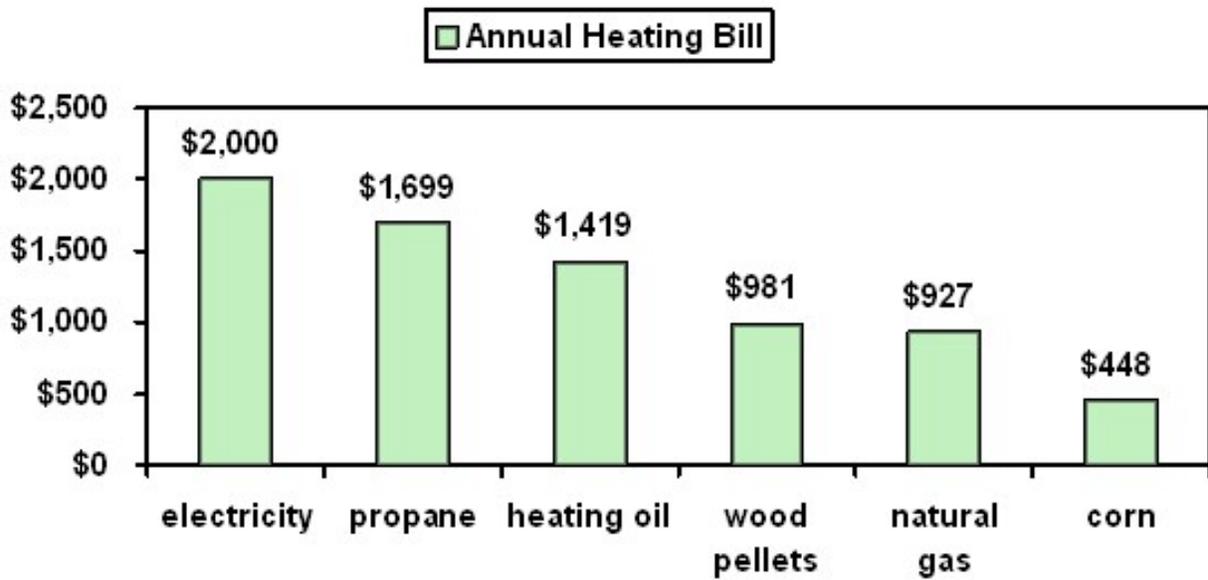


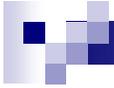
# Why?

- Concern for the environment
- Renewable Energy
- Have you seen the [fightglobalwarming](http://fightglobalwarming.com) 30 second public service (Ad Council) videos?



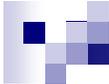
# Another Reason....





# Another Comparison

Home Heating Cost Analysis						
Heat Source	BTU Value/Unit	Units to =1 million BTUs	Cost/Unit	Cost X # of Units	Efficiency %	Annual Heating Cost based on 100mm BTU/Yr
<b>Dry, Shelled Corn</b>	<b>500,000 bushels</b>	<b>2 bushels</b>	<b>\$2.5/bushel</b>	<b>\$5.00</b>	<b>85%</b>	<b>\$588</b>
Electricity (baseboard)	3,412/KWH	293 KWHs	\$.08/KWH	\$23.44	100%	\$2,344
Natural Gas	1,000/cu.ft	1,000 cu.ft.	\$1.29/ccf	\$1,290.00	85%	\$1,518
Fuel Oil	139,000/gallon	7.2 gallons	\$1.25/gallon	\$9.00	85%	\$1,059
LP Gas	91,000/gallon	11 gallons	\$1.25/gallon	\$13.75	85%	\$1,618
Wood (red oak)	21.3 million/cord	.047 cord	\$115/cord	\$5.41	75%	\$721
Coal	13,000/lb	.0385 tons	\$140/ton	\$5.39	75%	\$719
<i>Assumes 100 million BTU's are required to heat the average home of 1,800-2,000 sq. ft. for one year</i>						



## Correcting An Inaccurate Quote

- View the [email reply](#) to my first phone call from the Salisbury Post
- Note the use of **CO2 Neutral** – *Not Zero CO2*

From: U. S. Department of Energy, Energy Efficiency and Renewable Energy, *Biomass Program: Environmental Benefits* ( 2007, Jan 25, Para 11 )

Link: <http://www1.eere.energy.gov/biomass/environmental.html>

Biomass Program: Environmental Benefits: Reduced Carbon Emissions

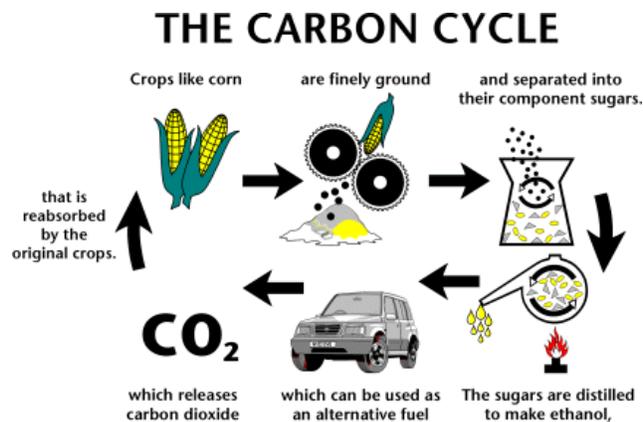
Plants absorb CO<sub>2</sub> during their growth cycle when managed in a sustainable cycle, like raising energy crops or replanting harvested areas.

Biomass Power generation can be viewed as a way to recycle carbon. Thus, Biomass Power generation can be considered a **carbon-neutral** power generation option. (Para 11)

- **What Percentage of corn plants are actually burned?**
- **What about the CO<sub>2</sub> sequestered by the stalk and other 60 percent?**

# The Carbon Cycle

The Carbon Cycle for Biomass, however, direct burining of biomass does not require the energy input noted below "to distill sugars," the result is a much more efficient energy cycle with even less CO2 emission.



From: U. S. Department of Energy, Energy Efficiency and Renewable Energy, *Ethanol A Renewable Fuel* ( 2006, October )

Link: <http://www.eia.doe.gov/kids/energyfacts/sources/renewable/ethanol.html>

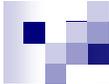


# Does Biomass Compete with the Food Supply?

From: Penn State University, College of Agricultural Sciences,  
*Factsheet, Burning Shelled Corn, a Renewable Heat Source* ( 2004,  
January) by Dennis E. Buffington, Professor of Agricultural and  
Biological Engineering

Link: <http://www.age.psu.edu/extension/factsheets/h/H78.pdf>

**Utilizing corn as a fuel does not compete with the food supply needed for nourishment throughout the world.** While it is recognized that malnutrition is a serious global problem, the world is not experiencing a food production problem. Instead, the world faces political challenges associated with providing the infrastructure systems for food distribution and storage. (Para 1)



## Food Supply (cont.)

From: U. S. Department of Energy, Energy Efficiency and Renewable Energy, *Biomass Basics FAQs* ( 2007, Jan 25, Para 26-28 )

Link: [http://www1.eere.energy.gov/biomass/biomass\\_basics\\_faqs.html](http://www1.eere.energy.gov/biomass/biomass_basics_faqs.html)

### **Does the U.S. have enough biomass resources to displace petroleum with biofuels without negative impacts to the food supply?**

A joint study conducted by the Departments of Energy and Agriculture, the [Billion Ton Study \(PDF 5.5 MB\)](#), estimates that 1.3 billion tons of biomass feedstock is potentially available in the U.S. for the production of biofuels. This is enough biomass feedstock to displace approximately 30 percent of current gasoline consumption on a sustainable basis.

Both the [U.S. Department of Agriculture's \(USDA\) Chief Economist \(PDF 53 KB\)](#), as well as the [National Corn Growers Association](#), have recently testified to Congress that they do not foresee proposed increases in ethanol production having a negative impact on the availability of corn and other grains for food purposes.

The development of technologies to convert cellulosic feedstocks (or non-grain based resources that are not used for food purposes, such as switchgrass, agricultural residues, and wood resources) will make it possible to produce biofuels at levels that will meet the various goals described above from feedstocks that are not competing with other uses. (Para 26-28)



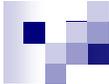
## About Energy Inputs and Outputs...

*Cornell ecologist's study finds that producing ethanol and biodiesel from corn and other crops is not worth the energy, Cornell University News Service (Lang, 2005, July 5)*

Link:

<http://www.news.cornell.edu/stories/july05/ethanol.toocostly.ssl.html>

***Professor Pimentel of Cornell University is one of the most vocal opponents of ethanol, yet he is still in favor of biomass: According to Pimentel, "producing ethanol or biodiesel from plant biomass is going down the wrong road, because you use more energy to produce these fuels than you get out from the combustion of these products. Although Pimentel advocates the use of burning biomass to produce thermal energy (to heat homes, for example), he deplores the use of biomass for liquid fuel." (Para 7-8)***



## How Does It Work?



# The Furnace



100,000 BTU Forced-Air with 14 day fuel supply in hopper



## Primary Fuel Storage





## Fuel Usage . . .

- Acceptable fuels: shelled corn (deer corn), rye grass seed, cherry pits, grass pellets, wheat pellets, wood pellets, sugar beet pellets and cardboard pellets – so far.
- Normal usage 30 pounds of shelled corn per day.
- This year we burned 4,000 pounds of corn, of which 70 percent was molded and not usable by animals (3,200 pounds from a children's 'sandbox' at Patterson's Farm.
- This amount of corn could be produced on 2 acres of farmland.
- **Our fuel supply can be renewed (grown) every 120 days,** as opposed to 40 years for a tree (if burning wood) or 40 million years for coal or other fossil fuels



# Safety of the Furnace

- Corn will not burn without *extra air*, so a fuel leak will not usually burn the house down.
- The system injects air into the combustion chamber where it swirls around the flame yielding very efficient combustion.
- By products are CO<sub>2</sub>, water and a very small amount of CO -- so I am told, my tests with a digital Carbon Monoxide meter in the exhaust read zero. **No heavy metals exist in the exhaust or ashes.** **The same can't be said about most fossil fuels.**
- Exhaust is clear – no visible smoke.

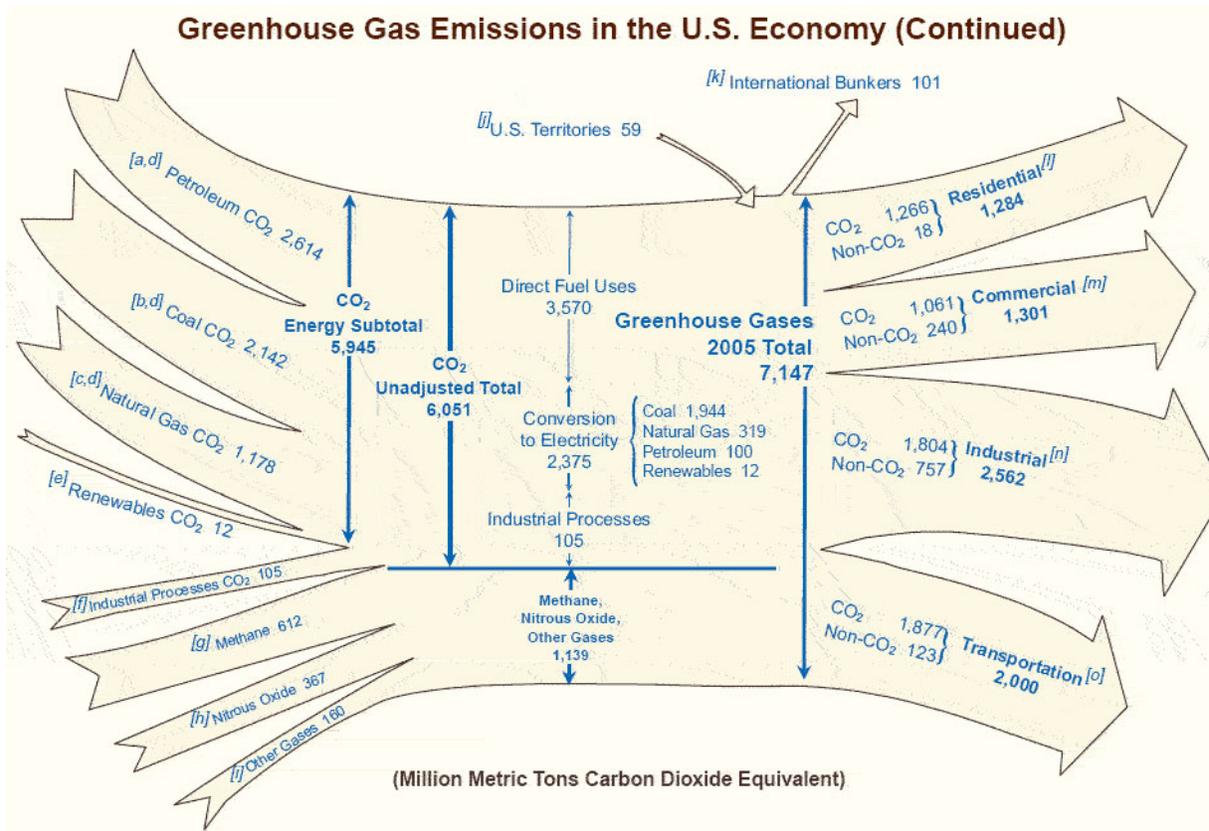
# Fuel Handling and Storage

- One month of fuel looks like:



# Where do Greenhouse Gases Originate?

From: U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2005*, (2006, November, p. XV) Link: <http://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057305.pdf>



# How Clean is that Electricity?

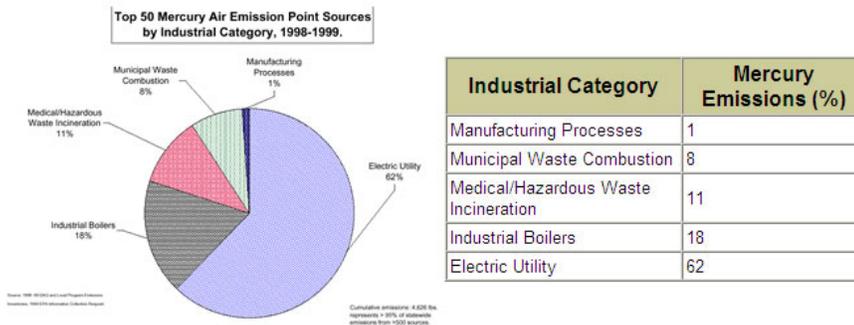
From: North Carolina Department of Environment and Natural Resources, Division of Air Quality, Mercury Emission Sources and Atmospheric Behavior, (2002, March 15) Link: <http://daq.state.nc.us/quick/mercury/top50pie.shtml>

North Carolina Department of Environment and Natural Resources

## Division of Air Quality

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**Mercury: Emission Sources and Atmospheric Behavior**



Cumulative Emissions: 4,626 lbs.; represents 95% of statewide emissions from >500 sources.

Source: 1998-99 DAQ and Local Program Emissions Inventories, 1999 EPA Information Collection Request.



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North Carolina Department of Environment and Natural Resources (NCDENR)

Last Modified: Fri March 15 20:38:26 2002

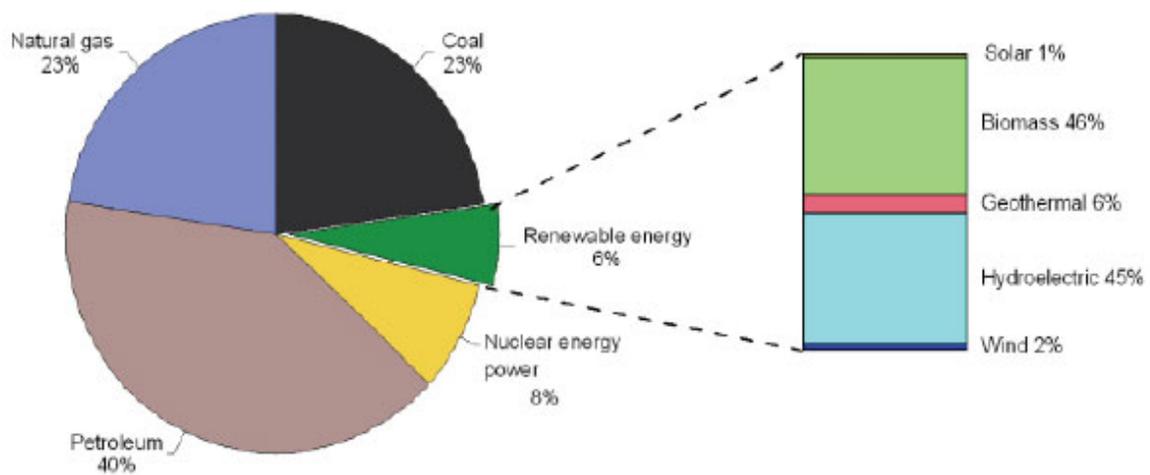
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# How Much Biomass is Being Used?

Figure 1.1  
Summary of Biomass Energy Consumption, 2005

Total = 99.877 Quadrillion Btu

Total = 6.061 Quadrillion Btu



**Source:**

Energy Information Administration, Monthly Energy Review, August 2006.  
<http://www.eia.doe.gov/emeu/mer/contents.html>



## Interesting Readings...

- Visit: The Oil Depletion Analysis Centre,  
Web site: <http://www.odac-info.org/>
- Interesting papers on "Peak Oil," pay particular attention to the information on oil fields in Kuwait, Mexico, Nigeria and the North Sea oil fields.



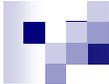
## More Interesting Readings...

**Another reading**, with several highly questionable viewpoints, but interesting commentary on peak oil and natural gas.

To summarize one section regarding peak oil:

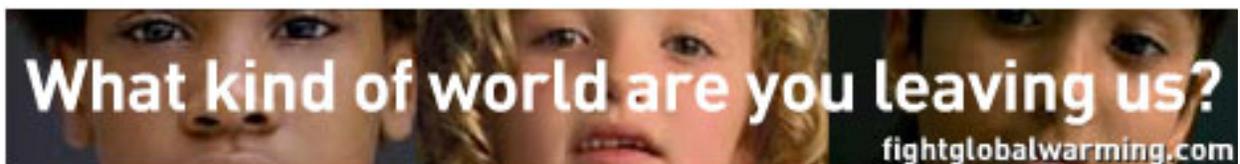
American natural-gas production is also declining, at five percent a year, despite frenetic new drilling, and with the potential of much steeper declines ahead. Because of the oil crises of the 1970s, the nuclear-plant disasters at Three Mile Island and Chernobyl and the acid-rain problem, the U.S. chose to make gas its first choice for electric-power generation. The result was that just about every power plant built after 1980 has to run on natural gas. **Half the homes in America are heated with natural gas.** To further complicate matters, gas isn't easy to import. Here in North America, it is distributed through a vast pipeline network. Gas imported from overseas would have to be compressed at minus-260 degrees Fahrenheit in pressurized tanker ships and unloaded (re-gasified) at special terminals, of which few exist in America. Moreover, the first attempts to site new terminals have met furious opposition because they are such ripe targets for terrorism.

Adapted from *The Long Emergency*, 2005, by James Howard Kunstler



# Thank You!

- More information on Biomass is published on my blog server at: [www.kenclifton.com](http://www.kenclifton.com)
- Visit [www.fightglobalwarming.com](http://www.fightglobalwarming.com) to learn more about Global Warming



Go to [fightglobalwarming.com](http://fightglobalwarming.com)  
while there's still time.



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