

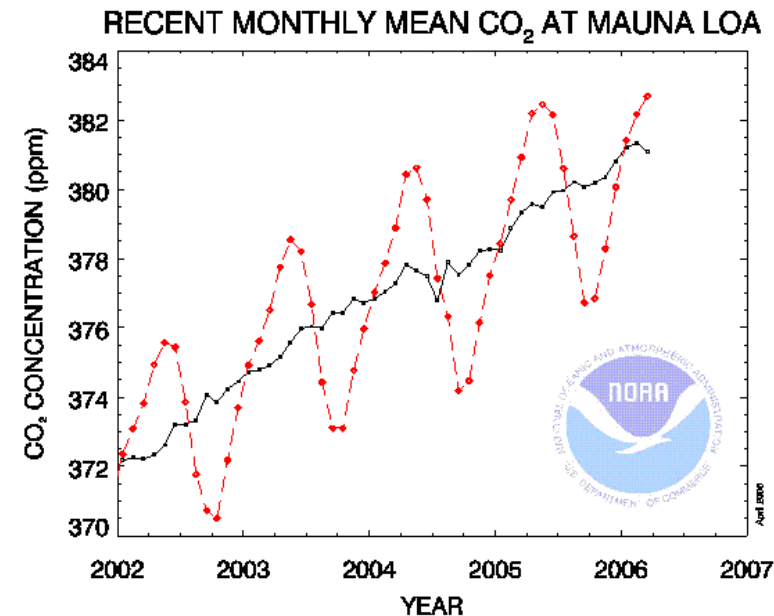
How many **forests** does
it take to make a
HARBEC?

Global Warming: Solutions That Work

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Greenhouse Gas Review

- 2 types: Natural occurring +++ and human induced ---
- Carbon dioxide
- Methane
- Ozone
- CO₂ is worst because it does the most cumulative damage
- Takes 10 to 15 years to be neutralized by photosynthesis
- Ocean takes about 60%
- Land plants take 40%
- Excess beyond what nature can consume creates backed up system and too much CO₂



When factories make things they give off CO₂

- Greenhouse gases are sent into the air:
 - Directly
 - Process emissions
 - Solvent, fuels, cleaners, etc.
 - Transportation- vehicle exhaust
 - Indirectly
 - Utility power required to electrify the factory
 - Utility energy required to heat and cool the factory



Trees are one way to remove CO₂



- One acre of trees will consume 3 tons of CO₂ each year.
- Source: "Our Ecological Footprint" (by Wackemagel and Reese, 1996)



CO₂ from utility power plants

- Based on U.S. average utility fuel mix of coal, oil, natural gas, nuclear, and others:
 - 1.5 lb. of CO₂ is emitted for every kilowatt hour (kWh) of electricity generated.
 - Ten 100w light bulbs for one hour or 1 kWh = 1.5 lb. CO₂



Harbec makes Eco-economic decisions which reduce the amount of CO₂ and save money in the long run.

- One way to equate the results of these decisions is to compare it to the amount of forest acres it would require to get the same benefit for the environment.
- One acre of trees will consume 3 tons of CO₂ each year.
 - Source: "Our Ecological Footprint" (by Wackemagel and Reese, 1996)

CO2 Savings #1

- Harbec's 250 kW wind turbine produces about 300,000 kWh of electricity per year
 - $300,000 \times 1.5 \text{ lb.} = 450,000 \text{ lb.} = \underline{\underline{225 \text{ tons}}}$ of CO2



CO2 Savings #2

- Harbec purchases 1,800,000 kWh of renewable electricity per year
 - $1,800,000 \times 1.5 \text{ lb.} = 2,700,000 \text{ lb.} =$
1350 tons of CO2
 - This measure does not save Harbec any money directly but indirectly frees up capital



CO₂ Savings #3

- Harbec produces 1,030,000 kWh of Combined Heat and Power (CHP) electricity per year
 - $1,030,000 \times 1.5 \text{ lb.} = 1,545,000 \text{ lb.} = \underline{\underline{772.5 \text{ tons}}}$ of CO₂
 - Capstone CNG microturbines = 90% less CO₂ than best coal or oil fired generating plant
 - Adjusted total reduced = **695 tons** of CO₂



CO2 Savings #4

- Harbec's CHP provides heat and A/C without producing any CO2 because no fuels are burned
 - 9000 sq.ft. molding plant + 17,000 sq.ft. warehouse normally require 1,610,000 BtuH of thermal energy (based on Energy Concepts, LLC. 2004)
 - Normal methods (gas, coal, oil, electric) would require 242,000 kWh per year
 - 242,000 kWh x 1.5 lb. = 362,000 lb. = **181 tons** of CO2



CO2 Savings #5

- Every gallon of gasoline = 20 lb. of CO2
- Average American vehicle gets 23 mpg
- Harbec has 100% Green Fleet
 - 2 Prius Hybrids = 40,000 miles per year (twice average mileage) so, 1740 gallons is reduced to $870 \times 20 \text{ lb.} = 17,400 \text{ lb}$
 - 1 Ford EV Ranger = 3,000 miles per year = 130 gallons $\times 20 \text{ lb.} = 2600 \text{ lb.}$
 - $17,400 + 2600 = 20,000 \text{ lb.}$
= **10 Tons** of CO2
 - CNG delivery van *TBD*
 - Biodiesel delivery truck *TBD*



CO2 Savings #6

- Harbec's equipment purchases are eco-economic based decisions
 - 30 All-electric molding machines vs. hydraulic save 50-70% on energy consumption
 - 30 machines consume 290 kWh per hour and 50% savings = $145\text{kWh/hr} \times 24 \times 5 \text{ days per week} = 17,400 \text{ kWh}$
 - At 60% utilization = $10,400 \text{ kWh/wk} = 540,000\text{kWh}$ per year $\times 1.5 \text{ lb.} = 810,000\text{kWh}$
= 405 tons of CO2
 - Variable speed inverter driven air compressor
TBD
 - Dryer numbers reduction due to A/C *TBD*
 - Soft starts on >10hp.motors, daylight gathering, etc. *TBD*

CO2 Savings #7

Lighting Systems – High efficiency: fixtures, ballasts, and sensors

- Complete lighting upgrade was installed the end of 2007
- Replaced every fixture and ballast plus high bay sodium with new T-8 type fluorescent bulbs and reflectors
- Quality of light was improved by using fuller spectrum bulbs
- Bulbs have longer life & reduce replacement cost
- Lighting energy consumed was reduced by **48%** on average company wide

280,000 kWh per year saved:
 $1.5 \times 280,000 = 420,000$ lb. of CO2
 $=$ **210 tons of CO2**

CO2 Savings #8

Manufacturing Equipment Modification

Molding Machine Barrel Heater Insulation Project:

- Replace heater bands and install insulation covers
- Install metal cover to contain and protect insulation



324,000 kWh per year saved:
 $1.5 \times 324,000 = 486,000 \text{ lb. of CO}_2$
 $= \underline{\text{243 tons of CO}_2}$

CO2 Savings Total

- #1 Wind energy = 225 tons
- #2 Green Power = 1350 tons
- #3 CHP Electric = 695 tons
- #4 CHP Thermal = 181 tons
- #5 Vehicles = 10 tons
- #6 Equipment = 405 tons
- #7 Lighting Upgrade = 210 tons
- #8 Equipment Mods = 243 tons
- TOTAL CO2 = 3319 tons

3319/3 tons per acres = 1100+ acres

Total difference one small **company** can make...

Conscientious efforts and decisions of one company that cares impacts the **CO2** global warming dilemma as much as **1100+ acres** of **forest** would to reduce environmental effects of excessive **CO2** build up which causes global warming.



HARBEC is striving to be a **carbon neutral** company