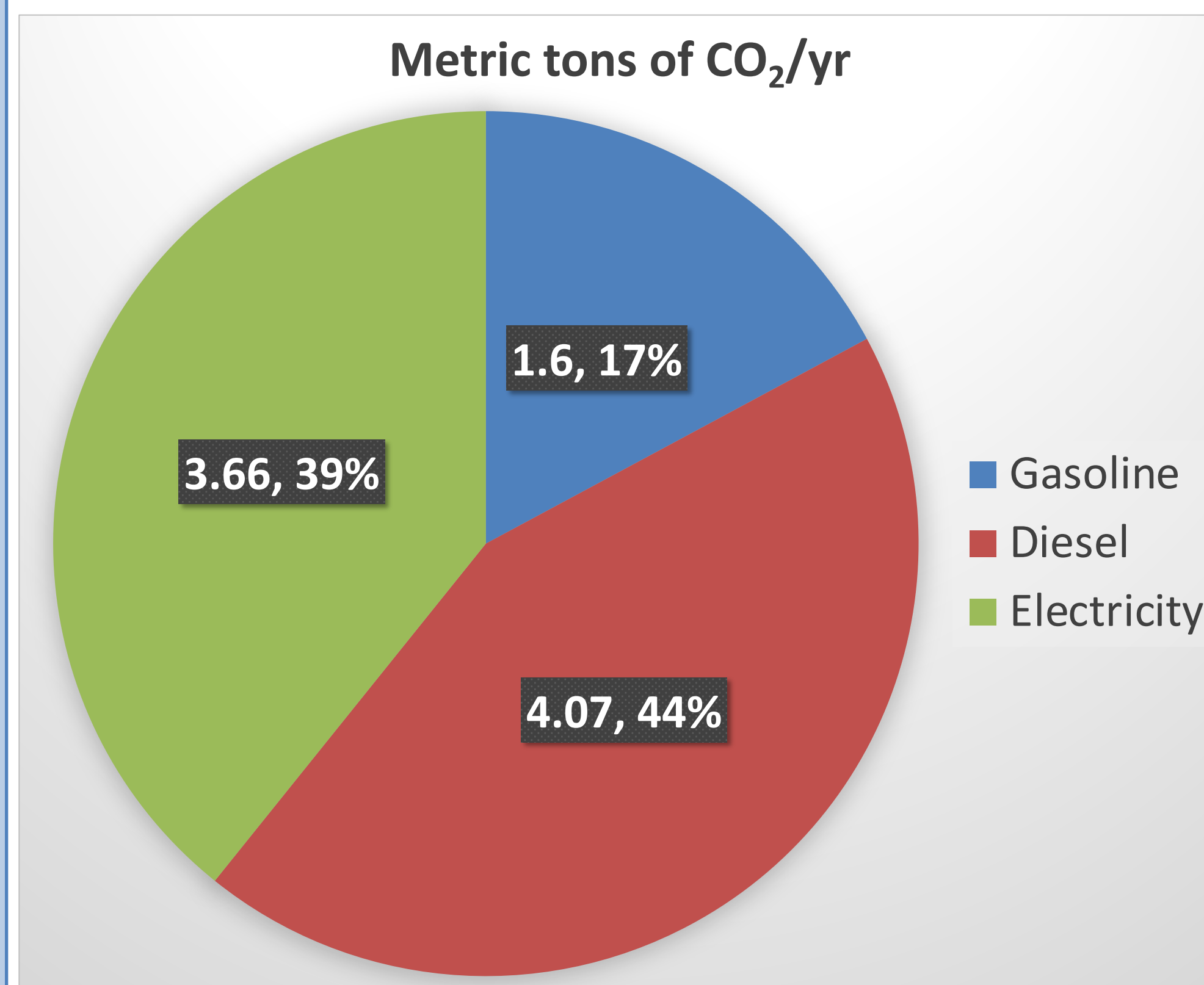


Introduction

Anthropogenic climate change is a long-term pattern of increasing global temperatures caused by the emission of greenhouse gases. To mitigate negative effects, humanity must become carbon neutral by either reducing fossil fuel use or offsetting the carbon that is emitted into the atmosphere. We examined options to achieve carbon neutrality at The Nature Conservancy's Bridgestone Nature Reserve at Chestnut Mountain. We conducted a basic energy audit for the primary structure (office), as well as secondary structures, vehicles and power equipment, to determine needed energy efficiency improvement. Several companies were also contacted to install renewable energy systems onsite.

Carbon Footprint

We first calculated a rudimentary carbon footprint for the site, based on utility and fuel use data. Emissions from vehicles are responsible for the majority of the footprint.



- In total, this facility is responsible for producing 9.33 metric tons of CO₂ per year
- This would require 12.11 acres of forest or 156 individual trees to offset
- Switching to renewable energy and electric vehicles/equipment could bring carbon emissions almost to zero

Energy Efficiency

We performed an energy audit for the office building. The audit included insulation, air leakage and appliance efficiency. We also compared prices of replacing substandard materials and equipment to ensure cost effectiveness.

Insulation:

R-values measure thermal resistance, and a higher R-value indicates better insulation. The two most effective insulation types are cellulose and spray foam.

	FIBERGLASS	CELLULOSE	SPRAY FOAM
HOME COMFORT	✓✓	✓✓✓	✓✓✓✓✓
ENERGY SAVINGS	✓✓	✓✓✓	✓✓✓✓✓
R-VALUE / INCH	2.9 TO 3.8	3.1 TO 3.8	3.6 TO 7.1
AIR SEAL	NO	NO	YES
PERMANENT SOLUTION	NO	NO	YES
INSTALL METHOD	DIY	DIY/PROFESSIONAL	PROFESSIONAL
FIRE RATING	CLASS 1	CLASS 1	CLASS 1
COST	\$\$	\$\$\$	\$\$\$\$\$
MAINTENANCE	ANNUALLY	BI-ANNUALLY	NONE

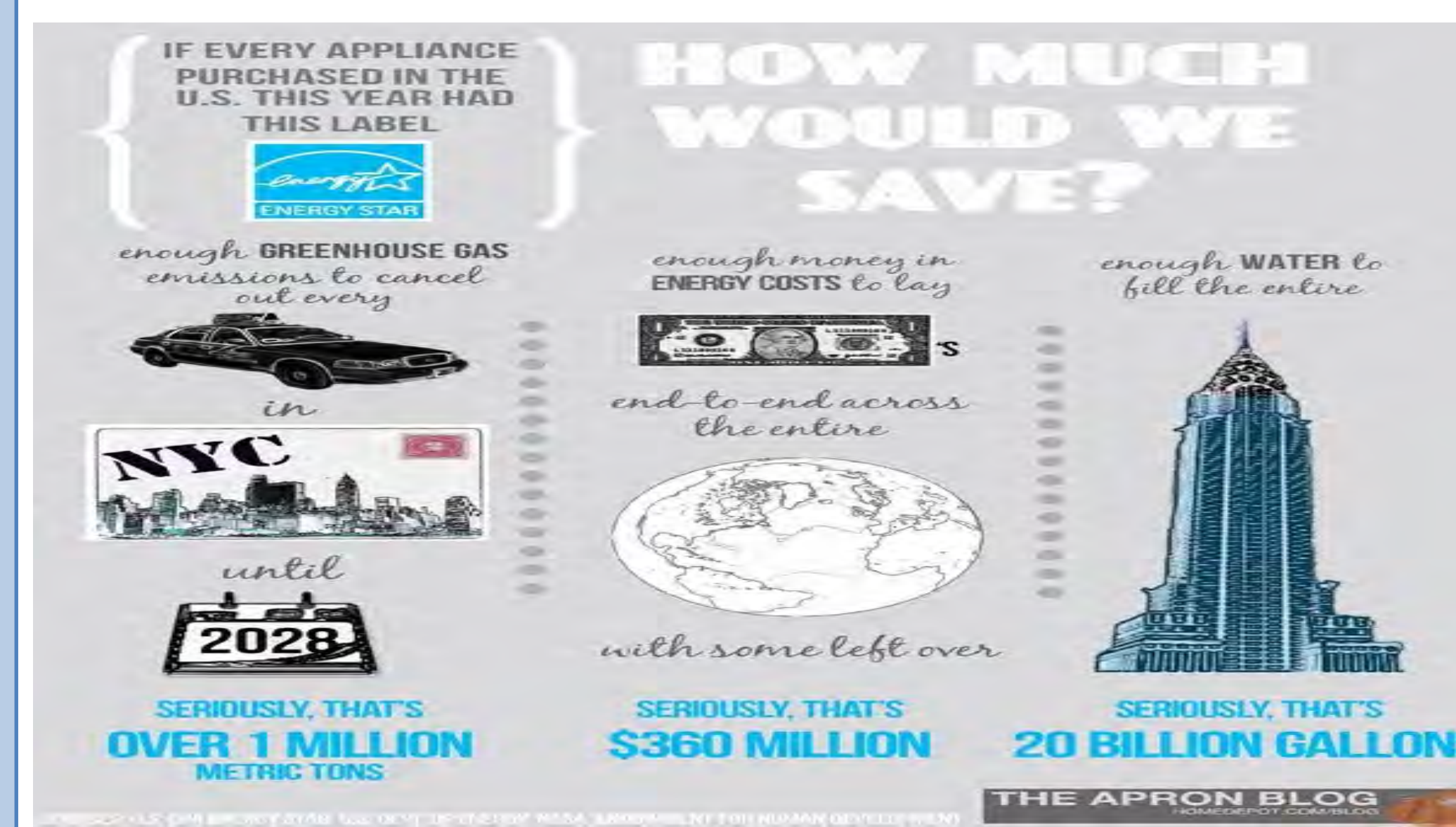
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Air Sealing:

Preventing air leakage can reduce energy consumption up to 20%. Air leaks contribute to heating/cooling loss as well as create moisture issues. Air leakage from gaps in electrical outlets and air vents can be corrected by using caulk, weatherstrip and/or foil tape.

ENERGY STAR® Appliances:

Replacing old and inefficient appliances with ENERGY STAR® certified products saves up to 30% in energy use. An estimated annual energy cost reduction indicates higher efficiency.



Thermostats:

Most efficient thermostats allow scheduling and reports on energy usage. Setting temperature based on room occupancy, as well as outside temperature, is critical. Setting indoor temperature closer to outdoor temperature can increase efficiency.

Alternative Energy Sources

Wind

To find the best way to achieve carbon neutrality at Chestnut Mountain, we have contacted several companies requesting price estimates and timeframes for installing renewable energy. We will assess the information and conclude which company offers the most efficient and cost effective option for wind energy at Chestnut Mountain. Initial research found that wind energy is potentially the most cost effective and environmentally friendly way to produce renewable energy.

Solar

Several locations on Chestnut Mountain are suitable to capture the solar energy provided by the sun. As with anything, there are pros and cons. We believe the pros outweigh the cons.

PROS

- Lower electric bill
- Long lifespan of equipment
- Reduces carbon footprint

CONS

- Expensive
- Difficult to DIY
- No sun = No electricity

Electric Equipment

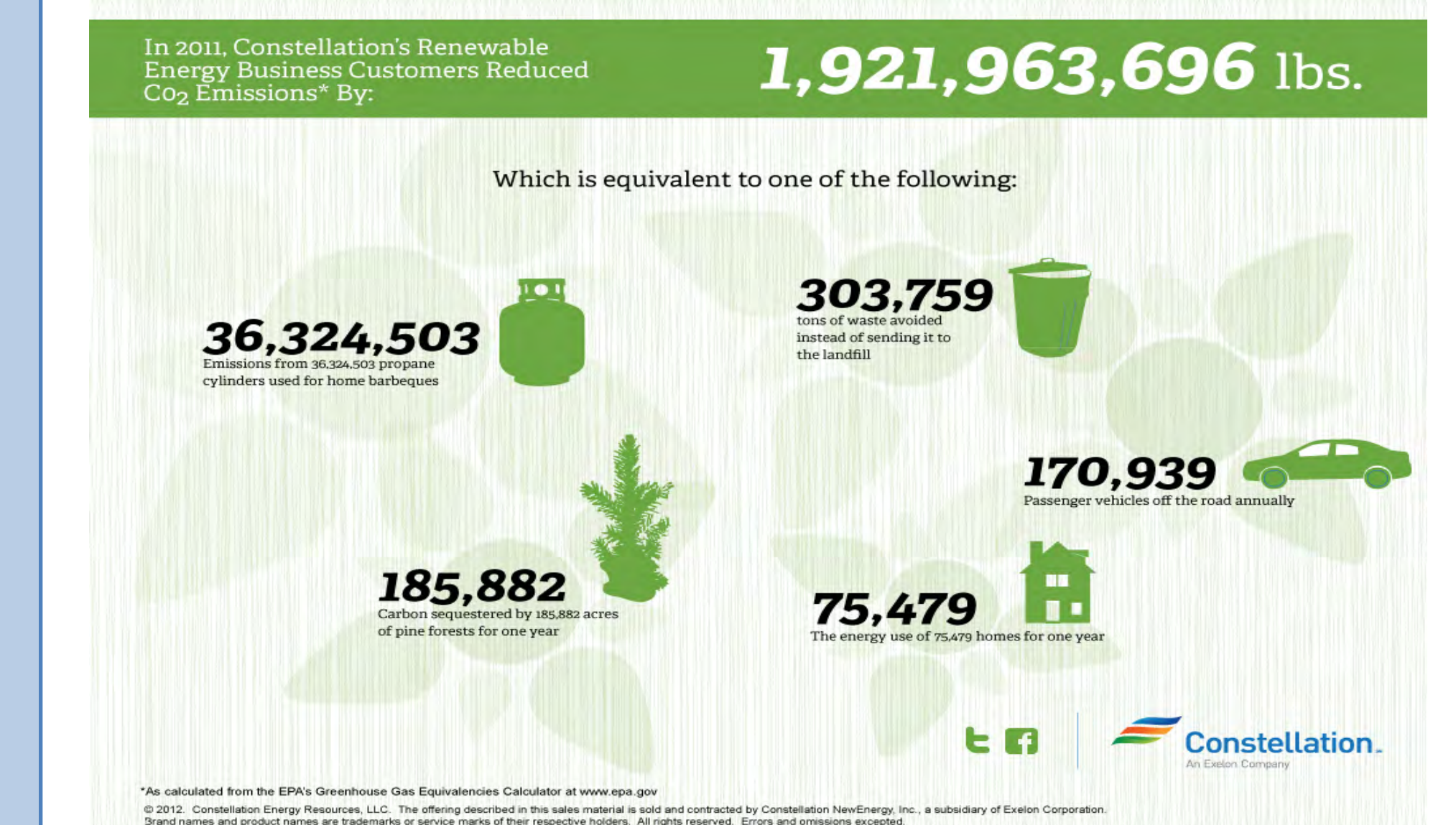
Gas powered tools and equipment can be replaced with battery-powered models (chainsaw, UTV/ATV, string trimmer, leaf blower, and tractor). There are numerous benefits to switching to battery-powered equipment. It is not only better for the environment but also better for the person using it.

- Lighter and more portable
- Quieter
- Reduces or eliminates carbon emission



Recommendations

We concluded that small enhancements, such as adding insulation and replacing appliances, can maximize energy efficiency and reduce carbon footprint. We also contacted outside entities to conduct formal commercial energy audits and provide cost estimates for installing a wind turbine and solar panels. Our final proposal includes estimated cost and timeline of transitioning all facilities and equipment from commercial energy production and fossil fuel use to renewable energy. The use of carbon offsets with forested land is a potential temporary measure to achieve carbon neutrality. Full carbon neutrality can be achieved at this facility through a combination of energy use reduction, renewable energy generation, and allocation of a small piece of forested land for carbon sequestration.



Acknowledgements

We would like to thank Trisha Johnson and Brittney Townsend of The Nature Conservancy for providing us necessary resources to complete the project. We would also like to thank Dr. Tammy Boles, Dr. Steve Sharp and our classmates for assisting this project.

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