

Calculator Methodology

Revised May 2013

Computations of environmental benefits from renewable energy and carbon offset purchases from NC GreenPower are derived from the following:

One block of renewable energy = 100 kWh

Annual energy output supported by one block subscribed monthly:
 $100 \text{ kWh} \times 12 \text{ months} = 1200 \text{ kWh}$

Amount of coal needed to generate one kWh:
 $10,500 \text{ BTU/kWh} / 13,000 \text{ BTU/lb. coal} = .81 \text{ lb coal/kWh}$

Source: **Economic Sciences Corporation**, [Efficient Heat Rate Benchmarks](#)

“Clearly, most of the heat rates are concentrated in the range of 9,000 – 12,000 BTU/KWh.” – Average 10,500 BTU/kWh

Source: **Kentucky Educational Television**, [American Coal Foundation Definitions](#)

“Bituminous coal has a carbon content ranging from 45 to 86 percent carbon and a heat value of 10,500 to 15,500 BTUs-per-pound.” Average 13,000 BTU/lb. coal

Amount of indirect CO₂ offset annually by one block of renewable energy subscribed monthly (12 blocks over one year):

$56.7 \text{ lb carbon per } 100 \text{ kWh} \times 3.67 \text{ lbs. of CO}_2 \text{ per lb. of carbon} \times 12 \text{ months} = 2497 \text{ lbs.}$

Conversion used is 1670.57 Lbs of CO₂ per MWh of electricity produced – provided by eGrid2012 for annual CO₂ non-base load output emission rate for SERC Reliability Corporation – the North American Electric Reliability Corporation (NERC) region which includes North Carolina.

1 Block per month = 1200 kWh = 2004.7 lbs of CO₂

Source: Marks Standard Handbook for Mechanical Engineers, 8th Edition, page 7-4.

Shows ultimate analysis of bituminous coal to be 60-80% carbon – 70% average

Formula: (56.7 lb C per 100 kWh block): If coal is 70% carbon, then 81 lb coal/kWh x 0.7 = .567 lb C/kWh or 56.7 lb C/100 kWh.

If one 100 kWh block is subscribed monthly, the annual savings in carbon is 56.7 lb.

Formula: (3.67 lbs. of CO₂ per lb. of carbon): Atomic weight of CO₂ = 44;
atomic weight of C = 12; 44 lbs of CO₂ / 12 lbs of C = 3.67
or 3.67 pounds of CO₂ per pound of carbon.

Amount of NO_x offset annually by one block of renewable energy subscribed monthly (12 blocks/year): .0026 lbs. NO_x per kWh x 100 kWh per block x 12 months = 3.12 lbs NO_x

Source: EPA Power Profiler – eGRID 2002

Pounds of NO_x per kWh in North Carolina region: .0026

Amount of SO₂ offset annually by one block of renewable energy subscribed monthly (12 blocks/year): .0065 lbs SO₂ per kWh x 100 kWh per block x 12 months = 7.8 lbs. SO₂

Source: EPA Power Profiler – eGRID 2002

Pounds of SO₂ per kWh in North Carolina region: .0065

Annual reduction of CO₂ emissions per block of renewable energy subscribed monthly as environmentally equivalent to trees planted: 2497 lbs / 13 lbs CO₂ = 192 trees planted

Source: 56.7 lb carbon per 100 kWh block x 3.67 lbs. of CO₂ per lb. of carbon x 12 months = 2497 lbs. CO₂ offset annually per block of renewable energy subscribed monthly (see above methodology)

Source: Urban Forestry Network, [Tree Facts](#)

“One acre of new forest will sequester about 2.5 tons of carbon annually.
Trees can absorb CO₂ at the rate of 13 lbs./tree/year.”

One block of Carbon Offset = 1,000 pounds (increase from 500 pounds as of 8/1/11)
Annual reduction of CO₂ emissions per block of carbon offset subscribed monthly as environmentally equivalent to days not driven: 3039 miles not driven annually / 15,000 average miles per year driven * 365 days in one year = 73.949 days not driven

10,500 BTU of coal required to make 1 kWh of electricity x 100 kWh per block of carbon offset x 12 months / 4145 BTU per mile driven = 3039 miles not driven annually per block of carbon offset subscribed monthly (see above methodology)

Source: AAA NewsRoom, [Cost of Owning and Operating Vehicle in 2013](#)

\$9,122 (estimated sedan average automobile operating cost per year) / \$0.608 per mile operating cost based on 15,000 miles average annual miles driven

Annual reduction of CO₂ emissions per block of carbon offset subscribed monthly directly equivalent to miles not driven:

CO₂ emissions from a gallon of gasoline = 19.7 pounds/gallon

Source: EPA, [Clean Energy Calculations](#)

0.125 mmbtu/gallon x 71.35 kg CO₂/mmbtu x 1 metric ton/1,000 kg = **8.92 x 10⁻³ metric tons CO₂/gallon of gasoline or 19.66523716 pounds/gallon of gasoline**

8.92 x 10⁻³ metric tons CO₂/gallon gasoline x 11,493 VMT_{car/truck average} x 1/21.5 miles per gallon_{car/truck average} x 1 CO₂, CH₄, and N₂O/0.985 CO₂ = **4.8 metric tons CO₂E /vehicle/year**

NHTSA estimates that the MY 2011 standards will raise the industry-wide combined average to 27.3 MPG Source: NHTSA, [CAFE Fuel Economy Standards](#)

15,000 miles (gal/27.5 miles) (.114mmbTU/gal) (154.4lbs/mBTU) (1 block/1,000 lbs)
19.4 lbs/gal x 27.5mi/gal, [EIA Environment](#)

Annual reduction of direct CO₂ emissions per block of carbon offset subscribed monthly as environmentally equivalent to trees planted:

6000 lbs / 13 lbs CO₂ = 462 trees planted

Source: Urban Forestry Network, [Tree Facts](#)

“One acre of new forest will sequester about 2.5 tons of carbon annually.
Trees can absorb CO₂ at the rate of 13 lbs./tree/year.”