

How much coal is required to run a 100-watt light bulb 24 hours a day for a year?

We'll start by figuring out how much energy in kilowatt-hours the light bulb uses per year. We multiply how much power it uses in kilowatts, by the number of hours in a year. That gives $0.1 \text{ kW} \times 8,760 \text{ hours}$ or **876 kWh**.

The thermal energy content of coal is 6,150 kWh/ton. Although coal fired power generators are very efficient, they are still limited by the laws of thermodynamics. Only about 40 percent of the thermal energy in coal is converted to electricity. So the electricity generated per ton of coal is $0.4 \times 6,150 \text{ kWh}$ or **2,460 kWh/ton**.

To find out how many tons of coal were burned for our light bulb we divide 876 kWh by 2,460 kWh/ton. That equals 0.357 tons. Multiplying by 2,000 pounds/ton we get **714 pounds (325 kg)** of coal. That is a pretty big pile of coal, but let's look at what else was produced to power that light bulb.

A typical 500 megawatt coal power plant produces 3.5 billion kWh per year. That is enough energy for 4 million of our light bulbs to operate year round. To produce this amount of electrical energy, the plant burns 1.43 million tons of coal. It also produces:

Pollutant	Total for Power Plant	One Light Bulb-Year's Worth
Sulfur Dioxide - Main cause of acid rain	10,000 Tons	5 pounds
Nitrogen Oxides - Causes smog and acid rain	10,200 Tons	5.1 pounds
Carbon Dioxide - Greenhouse gas suspected of causing global warming	3,700,000 Tons	1852 pounds

It also produces smaller amounts of just about every element on the periodic table, including the [radioactive ones](#). In fact, a coal-burning power plant emits more radiation than a (properly functioning) [nuclear power plant](#)!