

(3) Define a “sun day “ as the amount of energy received by the whole Earth in one day from the sun. The entire U.S. coal reserves have been estimated at 10 sun days. How many cubic miles of coal does that amount to? How does it compare with the amount of carbon in the Earth’s atmosphere, of which about 1 molecule in 3000 is CO₂?

The power density in sunlight at the Earth’s distance is 1400 W/m²; πR_e^2 is 1.25×10^{14} m². Thus the energy incident on the Earth in one day is 1.5×10^{22} J. For the heat of combustion of coal I’ll assume 2×10^7 J/kg (about 5000 cal/g). Then 10 sun days will be equivalent to 7×10^{15} kg of coal. The volume of that much coal is about 6×10^{12} m³, or 1400 cubic miles. Think of the ashes! The mass of the Earth’s atmosphere, at 1 kg/cm² of Earth surface area, is 5×10^{18} kg. If one molecule in 3000 is CO₂ the mass of carbon in that form is $(12/28)5 \times 10^{18}/3000$ kg, or 7×10^{14} kg. I erred in stating that 10 sun days is the equivalent of the U.S. coal reserve. It is the estimated *world* recoverable coal reserve. Globally then, there is roughly ten times as much carbon in recoverable coal as in atmospheric CO₂. The world petroleum reserve, incidentally, is more like *one* sun day.