



Concepts, Data Sources, and Techniques

**Handbook of Energy
Modeling Methods**

World Energy Projection System (WEPS): Greenhouse Gases Module



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1. Introduction

The WEPS Greenhouse Gases Model projects energy-related carbon dioxide emissions by taking the consumption projections of the other WEPS models and applying carbon dioxide emissions factors and combustion fractions to them. We calibrated the emissions factors and combustion fractions to recent historical data from EIA's [International Energy Statistics](#) database. The model accounts for fuel used as a petrochemical feedstock that captures carbon by reducing the combustion fraction, as well as energy that is used by carbon capture and storage facilities. The model does not account for carbon dioxide emissions from non-energy consumption sources, such as process emissions from the manufacture of cement, or for non-carbon dioxide greenhouse gas emissions that may be related to energy production, such as fugitive methane emissions. Also, it does not account for carbon transfers (flux) related to land use and changes in land use.

2. Calculating Emissions

For every sector, fuel, region, and year, carbon dioxide emissions (million metric tons) are estimated by the following formula:

$$\text{Emissions} = \frac{(\text{Energy Consumption} - \text{ECCE}) \times \text{Emissions Factor} \times \text{Combustion Fraction}}{1,000}$$

where CCE=Energy Consumption with Captured Emissions

The Consumption estimate for each fuel is expressed in trillion Btu, and the Emissions Factor is in kilograms of carbon dioxide emitted per million Btu of consumption. The Combustion Fraction is the fraction of fuel actually combusted and not sequestered.