

## Introduction

We use a reserves-based methodology to create The Carbon Underground 200, our list of the top 200 publicly-owned oil, gas, and coal reserve owners ranked by the carbon emissions embedded in their reserves. This approach follows that of Meinshausen from the Potsdam Institute for Climate Impact Research. It is largely consistent with the methodology reported to be the basis of the original list published by the Carbon Tracker Initiative in 2011 and used by the fossil fuel divestment campaign launched in 2012.

## Reserves Data Sources

The core data underlying The Carbon Underground 200 is based on reported reserves.

For coal, S&P Global Market Intelligence is utilized as the primary provider of reserves data.

For oil and gas, Evaluate Energy with its Global Oil & Gas Database (“EE Oil & Gas Database”) and CANOILS Database (“EE CANOILS Database”) is utilized as the primary provider of reserves information.

In each case, data from the coal and oil and gas data providers is validated against, and in some cases supplemented during the analysis with, data from publicly available primary sources and from other secondary data providers. The primary use of supplemental data is to provide support for estimating the type of coal predominating in a mine.

## Reserves Definitions and Approach

Coal reserves are reported in the S&P Global Market Intelligence Coal Database as the sum of proven and probable reserves. Reserves are the economically mineable portion of a measured or indicated resource. The reporting of reserves by coal mine on an annual basis is not consistent among companies with exchange listings, nor is it consistent for each mine in which a company has a controlling interest. Due to the sporadic reporting of reserves by listed companies, this analysis uses the last reported reserves amount by mine following a reasonableness test as part of the due diligence described above. Reserves are allocated to listed companies based on percentage ownership of individual mines.

Oil and gas reserves are distinguished between proven (1P) and proven and probable (2P). Proven reserves are defined in the oil and gas industry as having a 90% probability of near-term extraction, generally accepted to be within 10-15 years. Probable reserves are defined as having a 50% probability of extraction. This analysis uses proven reserves (1P) as the basis for ranking the top 100 oil and gas companies. Most oil and gas companies report proven reserves, while fewer than half of the public oil and gas companies report proven plus probable reserves. This research does not include any portion of probable oil and gas reserves, nor does it include any status quo assumptions of continued discovery and development to replenish oil reserves as they are utilized, both of which would increase the potential CO<sub>2</sub> emissions from these firms. In order to maintain a consistent data set, oil and gas reserves data are represented net of royalty payments. Royalties are the government’s share of a company’s reserves, and vary by country and by project. The convention to represent reserves data net of royalties is consistent across all Evaluate Energy databases.

## Data Coverage and Updates

The Carbon Underground 200 is updated quarterly. The calculations used to produce the rankings are based on reserves data available as of each calendar quarter end. Corporate actions are applied prior to release, typically 14 days after quarter end. The Carbon Underground Coal 100 covers 98% of proven and probable coal reserves from listed companies. The Carbon Underground Oil and Gas 100 covers 98% of proven gas reserves and 97% of proven oil reserves held by publicly listed companies. State controlled companies that have turned to the equity markets to raise capital are included.

## Emissions Calculation Process

The Carbon Underground 200 relies on the most recent IPCC Revised Guidelines for National Greenhouse Gas Inventories as a methodological framework. The calculation of CO<sub>2</sub> emission potential requires several conversions to the raw reserves figures.

Coal reserves are reported by any combination of four major types (or “ranks”) found in the mine. Each type is further reflected in terms of the eventual use for the coal, which can be any combination of three coal use categories:

### Coal Rank (Type):

- anthracite
- bituminous coal
- sub-bituminous coal
- lignite

### Coal Use:

- thermal
- metallurgical
- PCI (Pulverized coal for injection)

Petroleum reserves are further divided into four categories:

- oil
- oil sands
- natural gas liquids
- natural gas

In cases where the S&P Global Market Intelligence database does not indicate the coal rank for a specific mine, all available sources of information are used to estimate the coal rank, including the coal use and the predominant rank of coal in the basin, the coalfield, the state or province, the region, and/or the country. In cases where none of these sources provided sufficient information to estimate the coal rank, the most common global coal rank, bituminous, was assumed.

Evaluate Energy reports oil and natural gas liquids in aggregate. Reported annual production figures for oil and for natural gas liquids are used to estimate the relative proportion of oil reserves to natural gas liquids reserves. Additionally, where proven (1P) reserves are unavailable (five of the top 100), they are estimated using proven and probable (2P) reserves and a ratio based on the mean relationship between 1P and 2P for the companies that report both.

## Normalization

Coal reserves are universally reported in millions of tonnes. Petroleum reserves are reported in a variety of volume units. All reserves figures are converted into gigagrams using average factors specific to each type of fossil fuel.

## Energy and Carbon Content Factors

Fossil fuels vary widely in energy potential and carbon content across reserve types. Following the IPCC framework, net calorific values are assigned to each reserve type, to convert mass into energy units. IPCC carbon content factors indicating the amount of carbon released during combustion are assigned based on reserve type.

## CO<sub>2</sub> Emissions Calculation

Potential CO<sub>2</sub> emissions for reserves reported by each company are calculated based on the IPCC framework and the Potsdam Institute for Climate Impact Research formula  $E = R \times V \times C \times F$  where E = emissions, R is reserves, V is net calorific value, and C is carbon content. F is a conversion factor accounting for transforming carbon into carbon dioxide and converting grams to gigatons.

## Listed Companies

Given the continual mergers and acquisitions, closures, de-listings, and IPO activities in the coal, oil, and gas industries, this work is an ongoing best-efforts attempt at researching listed companies and basing the analysis on the latest available information. If subsidiaries are listed separately on an exchange from their parent, and their reserves are reported separately from their parent, they are eligible to be included in The Carbon Underground 200. Companies that publicly trade only a portion of their overall shares are eligible to be included, as well.

## Constructing the List

Separate rankings are created for the top 100 public coal companies globally and the top 100 public oil and gas companies globally. The rankings are based on calculated carbon emissions data using reserves reported as of the calendar quarter end. The ranking is then adjusted based on company mergers and acquisitions following the most recent reserve reports.

## Data Accuracy

FFI Solutions has utilized best efforts to include the most recent and consistent data available. Reserves data and company ownership interest data are only as accurate and as timely as the data contained within company reports. While starting with reserves database suppliers, a data verification process including a check of a sample of data points against primary sources was conducted. Going forward, each update to the list will incorporate the most recent data available at the time.