The Carbon Underground 2016

Managing the Climate Risks of Fossil Fuel Companies in Investment Portfolios

July 2016

Contents

AUTHORS

Jag Alexeyev	Director of Research and Products
Stuart Braman	Founder and Chairman
Helen Cane	Coal Associate, FFI
Lynn Connolly	Director of Coal Research, FFI
Lucy Di Rosa	Director of Communications, FFI
Ryan Elivo	Oil and Gas Associate, FFI
Fredrik Fogde	Head of Investor Research, South Pole Group
Tom Francis	Director of Oil and Gas Research, FFI
Cliff Griep	Director, FFI
Maximillian Horster	Partner, Financial Industry, South Pole Group
Christopher Ito	CEO, FFI
Michael Palmieri	Director of Technology, FFI
Harshpreet Singh	Senior Consultant, South Pole Group

ABOUT FFI

FFI provides research, benchmarks, and investment tools for investors who wish to understand, measure, and act on the risks associated with climate change in their portfolio holdings. Our rankings, The Carbon Underground 200™ and The Carbon Underground Tar Sands 20™, serve as the basis for ESG/SRI index products, portfolios, funds, and managed accounts for individual investors, institutional asset owners, investment advisors, and asset managers.To stay current with our work, visit http://www.fossilfreeindexes.com and follow us on Twitter (@FossilFreeIndxs). For more information, email us at info@fossilfreeindexes.com.

ABOUT SOUTH POLE GROUP

South Pole Group has delivered climate-proven solutions to a wide range of public, private, and civil society organizations for over a decade. A pioneer in the field of climate impact assessment on investments and a world-leading advisor on sustainability-related portfolio risks, South Pole Group helps asset owners and asset managers gain actionable insights on the climate impact of over USD 2 trillion assets under management. The company's in-depth knowledge in fund and portfolio advisory ensures that investments are into promising, climate-friendly investment opportunities that trigger positive returns. South Pole Group's 150 climate change specialists in 17 offices worldwide offer project, fund, and portfolio advisory, as well as access to new sustainable finance instruments for over 1,000 clients. The Group's diverse emission reduction portfolio includes many projects that ensure financial inclusion of the local communities involved. For more information, visit www.thesouthpolegroup.com or follow the company on Twitter @southpolegroup.

Executive Summary

This report presents an analysis of the latest rankings of The Carbon Underground 200™ (CU200), FFI's list of the top publicly-traded coal, oil, and gas reserve owners ranked by the potential carbon emissions content of their reported reserves. The 2016 CU200 list was created using data available as of May 31, 2016. The reserves of these companies total 474 gigatons (Gt) of potential CO_2 emissions.

Since the release of our last report in February of 2015, 49 new companies – 35 coal companies and 14 oil companies -- were added to the CU200 list. The potential emissions owned by companies on the list declined by almost 15% from last year, but are still more than 460% of the carbon budget to 2050 allocated to the CU200.[1] The decline in emissions and the company turnover on the list are largely the result of conditions facing coal companies: coal mine suspensions and closures, along with an extensive round of due diligence assessing the reasonableness of reported coal reserves. Despite the much-publicized decline of Western coal companies, we expect that future global coal demand (and emissions) will be heavily dependent on usage trends in China and India. While the oil and gas industry also faced significant headwinds from depressed commodity prices, potential emissions from The Carbon Underground Oil and Gas 100 declined only slightly. Looking deeper, we are witnessing a shift in emissions toward natural gas and away from oil, and an increase in production and exploration of reserves by some of the largest Russian oil companies.

Investor activity prompted by climate risk is surging. These investors have diverse objectives, ranging from those seeking to promote planetary health to those seeking to manage their portfolio risks. The fossil fuel divestment movement continues to gather momentum globally, with asset owners representing over $3.4 trillion having committed to divest. In addition, shareholders that remain invested in fossil fuel companies are increasing pressure on management to address the risks of climate change on their businesses. An increasing number of investors are focusing on the financial risks associated with stranded carbon assets and using carbon footprinting to measure the financial impact that a future price on carbon emissions would have on companies across sectors. Because of the rising importance of carbon footprinting, for the first time this report also provides carbon footprint data for the CU200 itself.[2] As climate risk measurement becomes more robust, we expect that investment strategies will become more nuanced and aligned with investors' varying climate related objectives.

For information on how to obtain the 2016 CU200 list, visit www.fossilfreeindexes.com.

[1] For the world to have an 80% chance of limiting a global temperature increase of 2°C (3.6° Fahrenheit).

[2] All research and data related to carbon footprinting have been provided by South Pole Group.

The Climate-Sensitive Investor Landscape

Since the publication of our 2015 report on The Carbon Underground 200™ (CU200), market volatility and an unprecedented level of climate policy initiatives have had a dramatic impact on companies in the CU200. The number of asset owners focusing on climate risk has grown significantly during this period, especially those focused on the risks associated with carbon emissions. The following developments have increased the focus on carbon risks in the past year:

- **Paris Agreement and the Action of National Governments** The most significant moment in the climate movement was the signing of the agreement coming out of the 21st UN Climate Change Conference of the Parties (COP 21) in Paris by 178 countries,[3] which sent a message to investors that world leaders are serious about setting policies to reduce emissions and mitigate the accelerating effects of climate change. While individual countries need to ratify the Agreement in order for it to be legally binding, the difficult work of finding common ground has been completed and a framework for holding countries accountable for emissions reduction has been established.
- **Action of Local Governments** Around the world, local, state, and national governments have made visible progress in enacting climate policies. National capitals such as Stockholm, Berlin, and Washington D.C. have recently declared their intent to purge their investment portfolios of fossil fuel stocks. Others have crafted climate change plans, with San Diego becoming the largest US locality to release a legally-binding road map for transitioning to 100% renewable energy. Cities, meanwhile, have been entering into transnational partnerships; the Compact of Mayors and the Covenant of Mayors have recently united to form The Global Covenant of Mayors for Climate & Energy, a partnership of 7,100 cities worldwide representing over 600 million people. With these initiatives, municipalities are recognizing that their positions as productive and creative nodes of economic activity also make them critical parts of the solution.
- **Leadership of Religious Organizations** Over the past year, religious organizations have led the way on climate actions. According to 350.org, 26% of the institutional investors who have committed to divestment are faith-based groups. The Vatican, while not officially committing to divest the holdings of the Catholic Church, has been very vocal in its insistence on the protection of the environment, including the decrying of the burning of fossil fuels. On May 24, 2015, Pope Francis released the encyclical letter Laudato Si' – On Care for Our Common Home.[4] The document covers a variety of environmental topics, and includes the issue of human-induced climate change in several paragraphs in Chapter Five.[5] It stresses the importance of international agreements in setting limits on greenhouse gas (GHG) emissions and underlines the urgency for wealthier and more industrialized countries to take the lead on decarbonization. Just as in the investment world, different faith-based groups have adopted different strategies for addressing the issue of climate change, and these statements and actions have been influential worldwide.

[3] 195 countries consented to the agreement at the December 2015 conference. 175 parties signed the agreement on April 22, 2016 in New York. Since then, the Seychelles, Gambia, and Iran have also signed. For the agreement to come into effect, 55 countries representing 55% of global emissions must ratify the Agreement. As of June 30, 2016, 19 countries representing 0.2% of global emissions have ratified the agreement. The US and China have pledged to ratify by the end of 2016. Climate Analytics tracks the ratifications.

[4] For the full English version of Laudato Si', see http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html

[5] From Chapter Five, paragraph 165: "We know that technology based on the use of highly polluting fossil fuels – especially coal, but also oil and, to a lesser degree, gas – needs to be progressively replaced without delay. Until greater progress is made in developing widely accessible sources of renewable energy, it is legitimate to choose the less harmful alternative or to find short-term solutions."

- **Decline of Coal** The value of coal companies declined dramatically over the past year, with numerous mine closures and bankruptcies, particularly among US mining companies. For a more detailed analysis of the coal industry, see "The Carbon Underground Coal 100" on page 18.
- **Volatility of Oil Prices** The sharp decline and subsequent rise in the price of oil highlights the vulnerability of oil companies, particularly those focused on upstream activities, to changes in the supply and demand for crude. We expect the question of "lower for longer?" to shift to "lower forever?" as policies and market forces pressure demand. For a more detailed analysis of the oil industry, see "The Carbon Underground Oil and Gas 100" on page 25.
- **Increased Focus on Climate-Related Disclosures** At COP 21, the Financial Stability Board under Mark Carney established the Task Force on Climate-Related Financial Disclosures (TFCD), headed by Michael Bloomberg. The Task Force will develop voluntary climate-related financial risk disclosures for use by companies in providing information to lenders, insurers, investors, and other stakeholders. At TFCD's July 11, 2016 plenary session, Anne Simpson, investment director of global governance at the California Public Employees' Retirement System (CalPERS), noted: "A 'child with an abacus' can calculate that there are tremendous amounts of gas and oil that will need to be left in the ground yet we have boards of directors who will not talk to their shareholders about this issue."[6]
- **Development and Adoption of Climate-Risk-Sensitive Investment Tools and Products** From the creation of As You Sow's Fossil Free Funds platform and Clean Capitalist's Decarbonizer to the introduction of fossil-free and low-carbon ETFs,[7] we expect that the investment community will continue to develop tools and products that allow investors to manage carbon risks and take advantage of climate risk-sensitive opportunities.

For the remainder of the introduction, we focus on several activities that investors are undertaking to address climate risk.

[6] See "Fossil Fuel Industry Risks Losing $33 Trillion to Climate Change."

[7] See for example: https://www.spdrs.com/product/fund.seam?ticker=spyx, https://www.spdrs.com/product/fund.seam?ticker=LOWC, https://www.ishares.com/us/products/271054/ishares-msci-acwi-low-carbon-target-etf, http://www.morningstar.co.uk/uk/etf/snapshot/snapshot.aspx?id=0P0000J19U, http://www.morningstar.co.uk/uk/etf/snapshot/snapshot.aspx?id=0P00016365

Divestment

The divestment movement, led by the activities of 350.org and Divest-Invest, continues to gain global momentum. Between September of 2014 and December of 2015, the value of assets committed to divestment rose from $50 billion to $3.4 trillion.[8] The movement has been a critical component in shining attention on the risks of fossil fuels.

The dramatic increase in the value of assets committed to divestment was driven in part by a large number of divestment commitments announced leading up to COP 21. In addition, the variety of institutions divesting has increased, and the typical size of such institutions has grown. Arabella Advisors finds that "in 2014, institutions pledging to divest held $349 million in assets, on average. Today, such institutions hold $9.8 billion in assets, on average."[9]

Divestment continues to be a hot topic on college campuses. As of June 2016, 35 universities and colleges in the US, and 43 schools in Europe and Australia, have committed to either partial or full fossil fuel divestment. Active divestment campaigns are being pursued on over 375 American college campuses. Some campuses have already considered divestment and rejected it, while many others are currently deliberating. Most recently, the University of Massachusetts and the University of Maryland announced that they would divest from fossil fuel companies. College campuses represent only one area where divestment is taking place, and the sum of total assets that colleges control (about $450 billion) is relatively small in the global market. On average, colleges and universities are invested 2%-5% in fossil fuels, meaning the cap of total assets that colleges could divest from is between $9 billion and $22 billion dollars.

Public pension funds, which have more substantial market power, are also considering divestment. According to The Smith School of Enterprise and the Environment at the University of Oxford, "of the $12 trillion assets under management among university endowments and public pension funds—the likely universe of divestment candidates—the plausible upper limit of possible equity divestment for oil and gas companies is in the range of $240-600 billion (2-5%) plus about half that amount for debt."

As mentioned above, faith-based organizations have been quite active in the divestment movement. In fact, twice as many faith-based organizations are divesting as colleges and universities as of mid-July 2016, and almost as many foundations have divested.[10] In June, four Catholic orders in Australia jointly announced their complete divestment from fossil fuels, an uncommon public stance for organizations devoted to private spirituality.[11]

We expect that an increasing number of mission-oriented investors will choose to divest in order to align their portfolios with their belief systems and use their capital to influence positive environmental change.

[8] These values represent the total assets controlled by individuals and institutions that have chosen to divest, according to Divest-Invest.

[9] See "Measuring the Growth of the Global Fossil Fuel Divestment and Clean Energy Investment Movement."

[10] http://gofossilfree.org/commitments/

[11] https://www.theguardian.com/environment/2016/jun/16/catholic-orders-take-their-lead-from-the-pope-and-divest-from-fossil-fuels

Engagement

Shareholder engagement with fossil fuel companies is another option for investors who wish to address climate change. Like divestment, engagement has increased over the past five years, as investors have used their shareholder voting rights in an effort to generate positive environmental and social changes. Led by groups like CERES and As You Sow, activity has accelerated as more shareholders have made the decision to engage with fossil fuel companies.

While shareholder resolutions targeting the CU200 have increased meaningfully over the last five years, their influence, based on coverage, intent, and overall shareholder support evident in voting outcomes, appears modest. Utilizing the CERES database, we reviewed climate and carbon-risk-related shareholder resolutions filed in the oil and gas, energy, and mining sectors between 2012 to 2016, including those targeting the public companies included in the CU200. The results of the review show progress and some limited success, but are also a reminder that influencing the public policies, business strategies, governance, and transparency of the CU200 companies through shareholder engagement is a gradual process, which may not be congruent with the urgency required to address the impacts of climate change. Most promising is the increase in company commitments to consider greater risk assessment and disclosure relating to carbon asset risk.

The shareholder resolutions over the last five years have broadened in intent, seized on opportunities for influence, and increasingly incorporated demands for transparency and risk assessment regarding carbon asset risk. Resolutions have advanced well past their early 2012 focus on disclosing and mitigating the risks of hydraulic fracturing ("fracking") and of accidents, which together accounted for more than 60% of the resolutions filed that year.

While methane and fracking still represent a quarter of resolution topics, the current focus is on urging company management to reassess and change their firms' public policy on climate risk, and to assess and disclose, either through an annual sustainability report or enhanced risk management practices, their firms' exposure to carbon asset risk and the impact of anticipated low-carbon scenarios. These broader requests have somewhat replaced, and to a large degree, incorporated, the earlier resolutions that demanded lower GHG emissions targets.

Efforts to influence the governance of the oil and gas, energy, and mining sectors have focused largely on adding board expertise on the environment, and reassessing the incentive structures of executive compensation, neither of which has received much support. More recently, greater disclosure of local and national lobby efforts has also been an area of focus. The lobbying disclosure effort increased significantly in 2016, representing nearly 15% of resolutions. The extraordinary number of shareholder resolutions seeking changes in the bylaws allowing proxy access (32 in the last two years), and the strong support they received (the average vote was 46% in favor), are encouraging, and highly supportive of future engagement efforts.

Not surprisingly, nearly a quarter of shareholder resolutions filed are directed at Chevron (CU Oil and Gas 100 #9) and Exxon (CU Oil and Gas 100 #4). These two companies held 12.005 Gt of reserve-based CO_2 emissions based on FFI's 2016 estimates, or 7.8% of the total potential reserve-based emissions of the CU Oil and Gas 100. While there are some encouraging signs of shareholder support for the resolutions filed with these companies, there is also evidence that shareholder support has stalled at low levels for others. The slow uptake of shareholder support is not confined to only Chevron and Exxon. Perhaps most troubling about the engagement efforts is the limited increase in shareholder voting support over the prior five years, 2012 to 2016, for which the voting records were reviewed.

Carbon Footprints, Stranded Assets, and Climate Risk

As governments continue to set policies to reduce emissions and as renewable energy sources become increasingly competitive with fossil fuels, investor focus on climate risk will continue to grow. Investors are focused on the risks of two types of emissions: current (those generated by companies across all economic sectors) and future (those embedded in fossil fuel reserves that will be released in the future). Investors have begun to assess the risk of current GHG emissions using a technique called carbon footprinting and the risk of future emissions by evaluating the risk of stranded fossil fuel assets.

Portfolio carbon footprinting – the process of measuring the current GHG emissions of companies in an investment portfolio -- is increasingly becoming a routine management task for investors, asset managers and asset owners. Transparency initiatives from regulators in France, Sweden, and California, among other places, as well as commitments from the investment industry in the form of the Montreal Carbon Pledge, the Portfolio Decarbonization Coalition and the Task Force on Climate-Related Financial Disclosures from the Financial Stability Board have helped pave the way. Although more sophisticated investment climate impact analysis is performed on a bespoke basis, it is already possible to obtain investment footprints online through tools such as yourSRI.

While investors may realize the value of an investment carbon footprint in measuring current GHG exposure, it is also understood that such an approach addresses only one of the many dimensions of climate risk. A fundamental risk analysis needs to incorporate other factors, first and foremost exposure to oil, coal, and gas reserves, as well as forward-looking indicators on sector-specific and cross-sectorial climate risk indicators. Further analyses on avoided GHG emissions and on the compliance with a two-degree climate change roadmap[12] are thus becoming increasingly important.

In addition to more in-depth analyses, the scope of carbon footprinting is expanding to cover a greater number of asset classes beyond public equities. Assessments are now increasingly applied to sovereign and corporate bond portfolios, private equity, real assets, and hedge strategies.

[12] See http://2degrees-investing.org/.

A rapidly growing group of investors measuring their climate impact and risk are already looking at the next logical step in their journey: managing their climate impact and associated risks. Many have turned to tools such as Fossil Free Funds, which provides a platform to screen mutual funds and ETFs by the CU200 companies as well as by other filters that use different definitions of "fossil free". Another tool by CleanCapitalist allows users to "decarbonize" portfolios with a click of a mouse, and to back-test how a portfolio would have performed financially if it had been decarbonized three years earlier.

A multitude of low-carbon and climate-friendly investment strategies have also started to emerge, with index providers such as STOXX[13], Solactive[14], MSCI[15], and EDHEC[16] at the forefront with their families of climate-change-sensitive indexes. Some of these indexes are broad-based benchmarks across industry sectors and use a company's carbon footprint as the primary factor to weight index holdings. (Those with a lower footprint would receive a higher weighting and vice versa). These indexes are also available to the investing public through ETFs and commingled vehicles and are often referred to as "smart beta" products.

Asset management firms such as State Street, Blackrock, Amundi, and BNP have launched low-carbon ETFs in the US and Europe that combined have assets in excess of $500 million as of July 1, 2016.

Institutional investors are also taking initiatives to adopt low- carbon investing. The California State Teachers' Retirement System (CaLSTRS) recently announced that they will commit up to $2.5 billion to low-carbon strategies in US, non-US developed, and emerging equity markets. The Fourth Swedish National Pension Fund (AP4) has also indicated it will allocate $3.2 billion to low-carbon investments, as it continues its long-term strategy of decarbonizing its entire global equity portfolio by 2020.

Research on stranded asset risk is becoming more robust and widespread as investors begin to evaluate the individual reserve-owning companies (and geographical areas) that are most exposed.[17] Stranded asset risks of individual fossil fuel companies will vary depending on each company's business model, reserve characteristics, and willingness of management and shareholders to adapt to a low-carbon economy. For example, tar sands, deep-water, and Arctic reserves are the most costly to extract and are more likely to become stranded if government policies and market forces put pressure on demand for fossil fuels.

Importantly, stranded asset risks may affect not just the energy sector, but other industries as well. Segments of the global transportation industry that rely on shipping coal or other fossil fuels, for example, would be affected by the transition to renewables. In addition, these risks are not limited simply to corporate equity and corporate debt. Stranded assets and broader carbon and climate risks may impact the economies of countries, with implications for the pricing of sovereign debt.

[13] https://www.stoxx.com/lowcarbon

[14] http://www.solactive.com/low-carbon/

[15] https://www.msci.com/msci-low-carbon-indexes

[16] http://www.scientificbeta.com/#/

[17] See, for example, Carbon Tracker's research on evaluating gas capital expenditures. http://www.carbontracker.org/report/gascostcurve/

As more investors understand and price the risk of stranded assets, we can expect the security valuations of issuers with a higher concentrations of those risks, such as high-cost unconventional reserves, to be most vulnerable. Investors can choose to avoid investment in those securities (divestment) or go further and choose to express a negative view via short positions that profit from a decline in security prices either though equity or credit markets. Shorting strategies in general have typically been utilized by sophisticated investors or institutions through private fund structures such as hedge funds. However, liquid alternative ETFs and mutual funds are becoming more prevalent, allowing individual investors access to hedge-fund-style strategies.

Some carbon responsible investors may consider such active alpha-generating strategies in addition to divestment or engagement. In addition, a greater range of climate-oriented liquid alternative funds could soon become available for everyday investors. For example, the shorting of certain fossil fuel companies can be packaged with long investments focused on projected winners in the transition to a low-carbon economy to create long/short funds.

Long/short funds are the most popular type of hedge fund strategy, and many liquid alternative products employ this tactic. The climate change theme lends itself well to the long/short structure, as investors begin to identify both winners and losers within the renewable energy, fossil fuel, and corporate sectors. Accordingly, we expect asset managers to develop active investment strategies and products specifically designed to capture climate- and carbon-related alpha opportunities.

In summary, we foresee the continuation of the following trends:

- Accelerating numbers of mainstream investors will develop approaches to climate risk as climate risk will rise steadily among ESG concerns.
- Initiatives to quantify carbon risk will become more widespread and widely understood, allowing investors to better assess the industry sectors -- and the companies within those sectors -- that are best (and perhaps worst) positioned to succeed as the world transitions to a low carbon economy.[18]
- More regulatory or industry-driven transparency initiatives will be created around the world. This increase will come as a follow-up to the Paris climate agreement, which commits to making financial flows consistent with a low-carbon economy.
- The market will see a wide range of sophisticated new investment products that will help manage and lower an investor's climate impact or climate risk.

As the investment community comes to terms with the transition to a low-carbon economy and the risks of stranded fossil fuel assets, divestment, engagement, and active portfolio management are all appropriate responses to climate risk, and are not mutually exclusive. Asset owners and fiduciaries must decide which approaches are best aligned with their individual philosophies, investment objectives, and time horizons.

[18] See, for example, research by Mercer, and by the 2 Degrees Investing Initiative.

The Carbon Underground 200™ in 2016

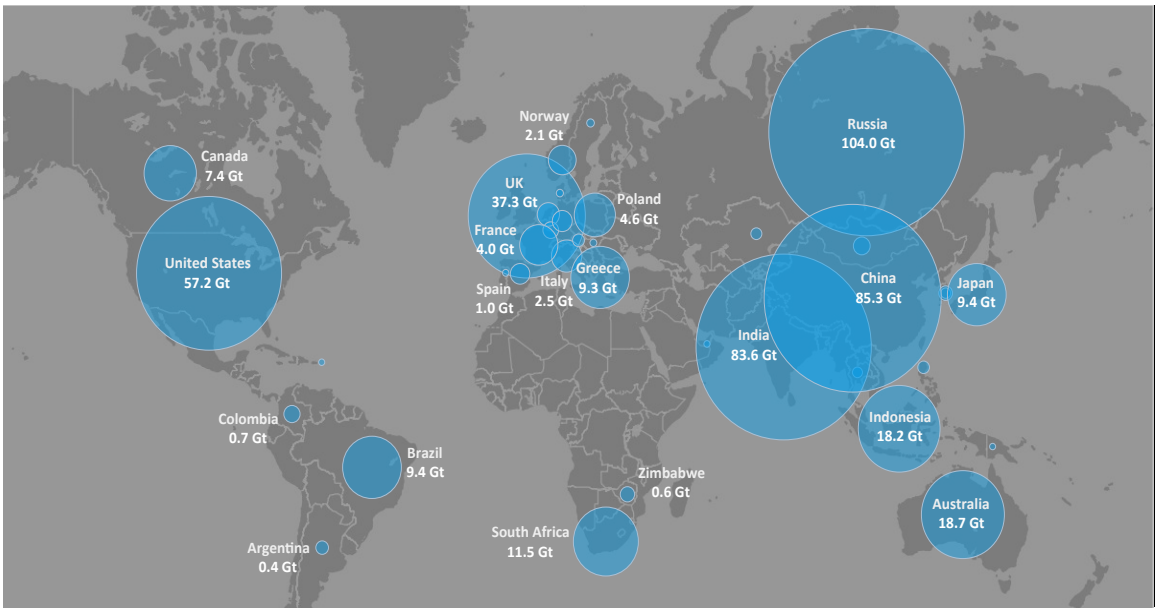

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Figure 1 Top Countries Mapped by Reserve Owner Company Headquarters 2016
Total Coal, Gas, and Oil Reserve Emissions Potential (Gt CO_2)

The Carbon Underground 200 represents the top publicly-traded coal, oil, and gas reserve-owning companies globally, ranked by the carbon emission potential of their reported fossil fuel reserves. Using data available as of May 31, 2016, we have calculated that the total potential CO_2 emissions from these reserves now exceed 474 Gt. This figure is down almost 15% from our last report (published in February 2015), but still over 460% of the allocated CU200 carbon budget to 2050.

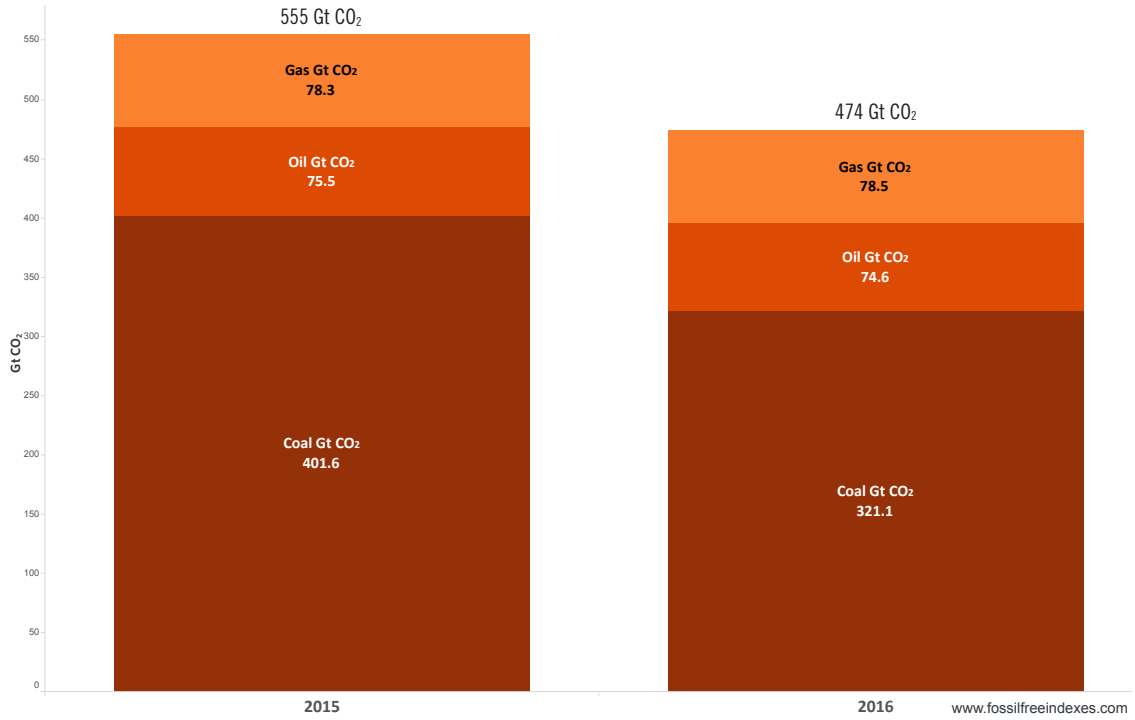

Figure 2 Potential Reserves-Based Emissions (Gt CO_2), 2015-2016

Gas and oil reserves-based potential emissions are close to the same as last year, down less than 1%, and coal reserves-based potential emissions have dropped significantly over the past 17 months, close to 20%.

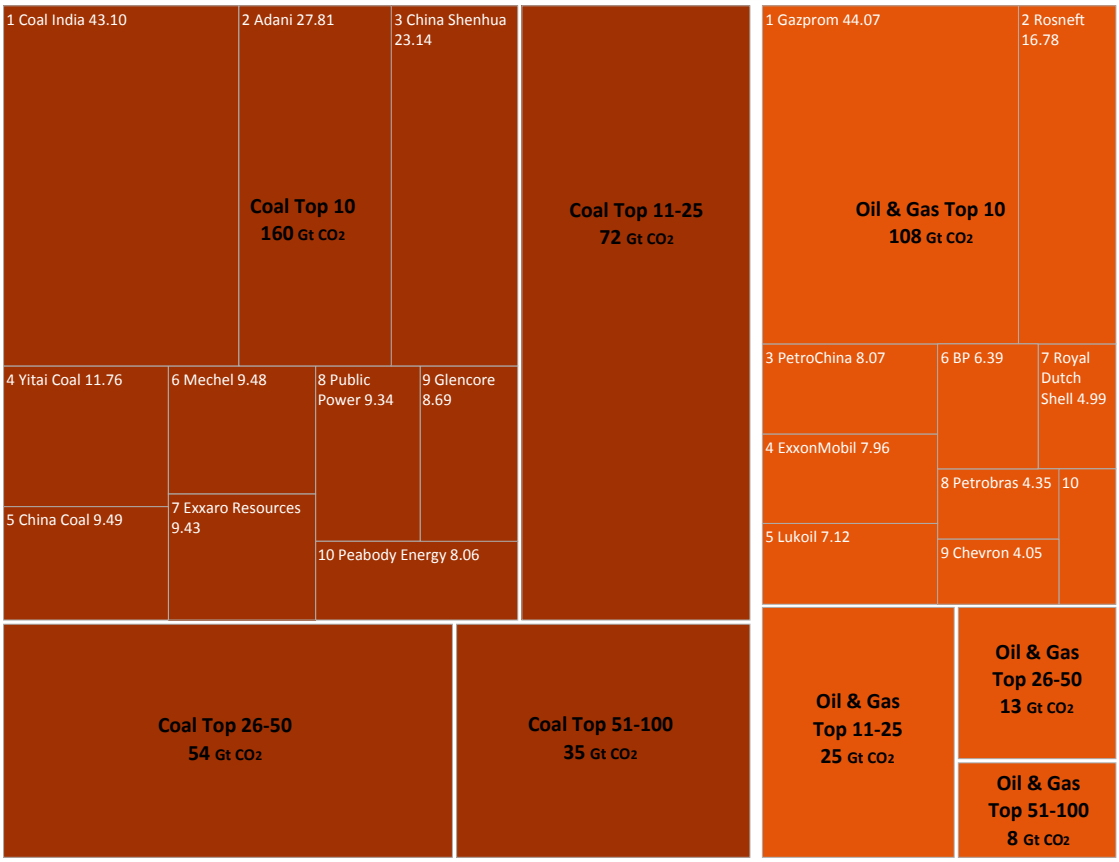

Figure 3 Relative Rankings of The Carbon Underground 200[19]

Significant movement and changes in the companies on the 2016 list have occurred over the past 18 months. Merger and acquisition activity, bankruptcy, privatization, and nationalization, along with ongoing reserves discoveries, better reserves reporting, and extensive due diligence on reported reserves data, have all impacted the rankings. Since the last report, 35 companies have changed on the coal list, and 14 companies have changed on the oil and gas list.

[19] The relative rankings are depicted by the varying sizes of the boxes. The two colors are meant to distinguish coal from oil and gas.

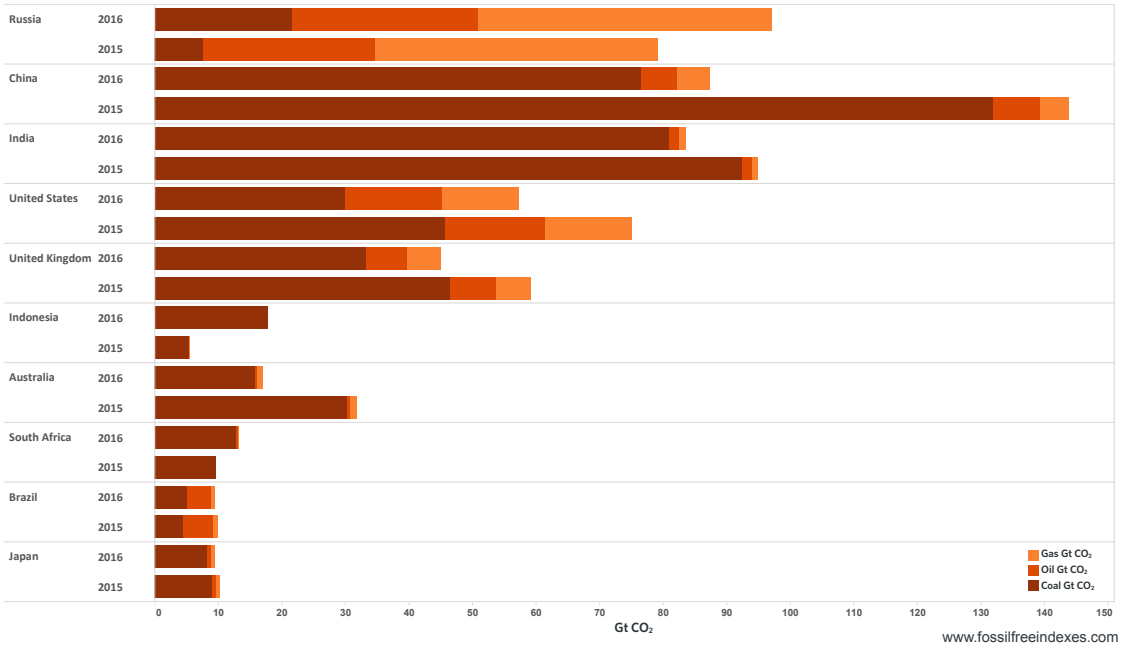

Figure 4: Top 10 Countries with Highest CU200 Emissions Traded on Exchanges, 2015-2016

Reserves-based emissions from companies traded on Russian and Indonesian exchanges have increased significantly since last year, and the South Africa exchange has seen a modest increase. The past 18 months saw a tremendous drop in reserves-based emissions from companies traded on Chinese exchanges, and smaller but significant drops have occurred in reserves-based emissions from companies traded on Indian, US, UK, and Australian exchanges.

The 2016 Carbon Budget

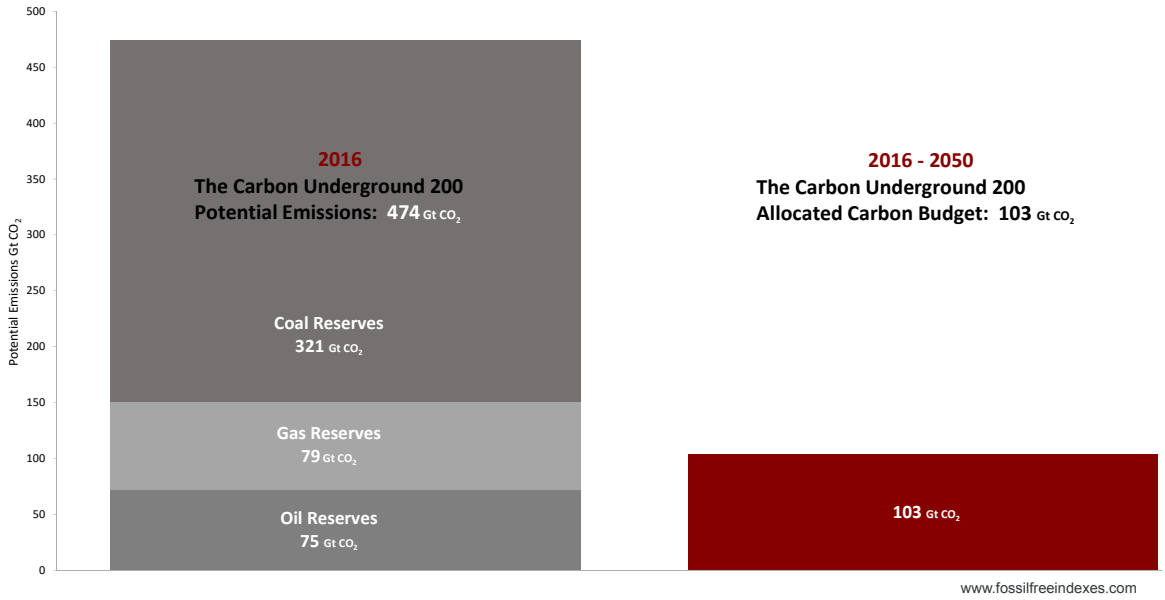

Figure 5 CU200 Potential Emissions vs Allocated Carbon Budget

Comparing the reserves held by the CU200 public fossil fuel reserve owners to the total global fossil fuel reserves yields an allocated global carbon budget for the years 2016 to 2050 of 103 Gt CO_2, which is down about 10% from last year's CU200 carbon budget. This budget is based on IPCC models and assumptions that will limit global warming to 2° C above preindustrial levels with an 80% probability.

While CU200 potential emissions are down from last year by approximately 15%, they still exceed the allocated carbon budget by over 460%.

The Top 10 Companies

The table below lists the 2016 top 10 coal and top 10 oil and gas companies of the CU200.

Rank	Coal Company	Coal Gt CO_2	Rank	Oil and Gas Company	Oil Gt CO_2	Gas Gt CO_2	Total O&G Gt CO_2
1	Coal India	43.104	1	Gazprom	6.856	37.213	44.069
2	Adani Enterprises	27.809	2	Rosneft	12.617	4.158	16.776
3	China Shenhua Energy	23.143	3	PetroChina	3.821	4.244	8.066
4	Inner Mongolia Yitai Coal	11.756	4	ExxonMobil	4.678	3.281	7.960
5	China Coal Energy	9.492	5	Lukoil	5.816	1.299	7.115
6	Mechel	9.483	6	BP	3.979	2.409	6.388
7	Exxaro Resources	9.433	7	Royal Dutch Shell	2.346	2.649	4.995
8	Public Power	9.339	8	Petrobras	3.742	0.608	4.349
9	Glencore	8.692	9	Chevron	2.441	1.604	4.045
10	Peabody Energy	8.059	10	Novatek	0.513	3.416	3.928

For information on how to obtain the 2016 CU200 list, visit www.fossilfreeindexes.com .

The Carbon Underground Coal 100

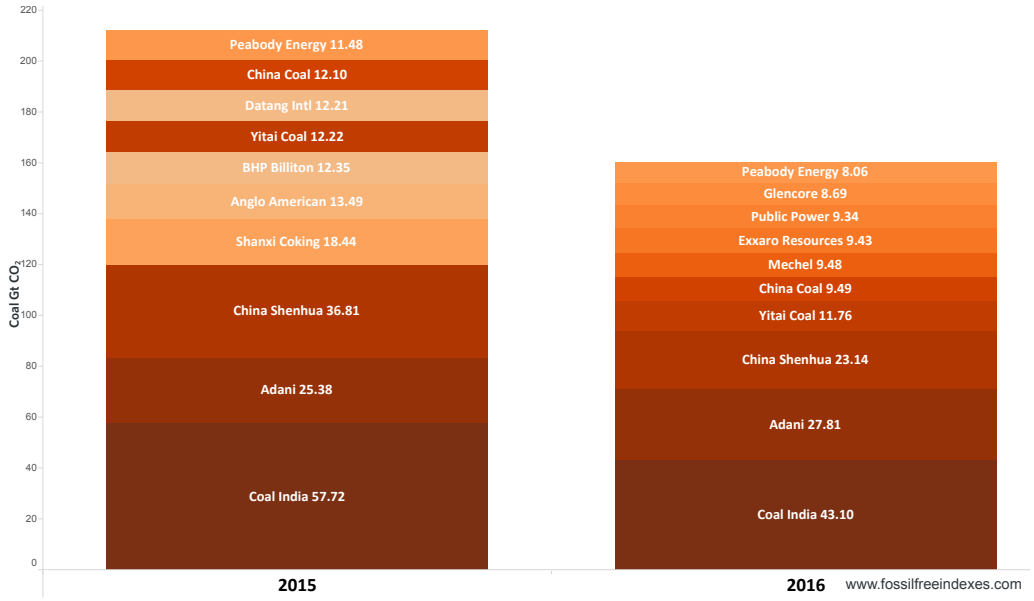

Figure 6 Top 10 Coal Companies
Change in Reserves-based Emissions (Gt CO_2), 2015-2016

The Carbon Underground Coal 100 (CU Coal 100) list for 2016 shows that overall, six companies have remained part of the CU Coal 100 top 10 year over year, with the top three CU Coal 100 companies remaining the same but changing in order, (Adani has risen to #2 and China Shenhua has dropped to #3).

The CU Coal 100 top 10 has experienced the following additional changes from 2015:

- Anglo American dropped to #19 due to sales of their coal mines.
- BHP Billiton dropped to #11 as a result of its spin-off of South32.
- Datang International (which is now at #57) and Shanxi Coking (which has dropped off the list) have both moved down as a result of new reserves information being obtained from China during the consolidation of coal data providers.
- Mechel and Exxaro have moved into the top 10 based on an increase in reported reserves.
- Glencore and Public Power Corporation SA moved up to open slots.

Despite these movements, the coal industry remains as concentrated as it was in our 2015 report from an emissions standpoint, with 50% of the CU Coal 100 emissions concentrated in the top 10 companies and 36% of those in the top five.

However, total potential emissions for the CU Coal 100 declined by approximately 20% since 2015. This decline can be attributed to mine suspensions, closures, and extensive due diligence reviews regarding the reasonableness of reported reserves and coal mine ownership during the consolidation of coal datasets as data providers merged (see "Creating The Carbon Underground 200: Methodology" on page 31).

Although there have been a number of coal company bankruptcies during the past year, they have not been the primary factor in the potential emissions decline, as declaring bankruptcy does not necessarily result in the suspension or closure of operations. Companies declaring bankruptcy may still continue to operate based on the type and terms of bankruptcy. In addition, the company stock may still be traded. Peabody is the most notable example: they have stated that they intend to continue operating their mines uninterrupted as the bankruptcy process proceeds. Therefore, bankruptcy won't necessarily cut coal mine output. In fact, coal companies seeking to pay off creditors may face pressure to maintain revenues from coal."[20] Unless the coal mine property is closed or operations are suspended, the reported reserves of a coal mine property will continue to be listed in the CU Coal 100.

The main contributors to coal mine suspensions and closures are more broad based and include oversupply and declining demand, with meaningful differences geographically.

Economic Factors

Although 2015 witnessed a sharp global decline in thermal coal prices, one may argue that thermal coal prices have reverted back to historical averages and that the coal price activity from 2007-2014 represented an unusual period of volatility with unsustainable extreme peaks. In essence, the coal companies that increased their debt load and made acquisitions during the coal price peaks bought into a bubble, and thus are currently under financial pressure.

Some coal companies increased production during the periods of elevated coal prices to take advantage of the increased prices. In doing so, they created an oversupply of coal while the global demand for coal had, in reality, stabilized or slightly declined. For example, "Peabody bought Australian mining firm MacArthur in 2011 for nearly $5 billion. It was a bet on Asian growth, planned at a time when coal prices had been on the rise for two years. That same year, coal prices began to drop. And instead of surging, growth in China was stagnant."[21]

Due to the oversupply of coal, new production declined, leading to coal mine closures and suspensions, price declines, and some companies with large debt loads being forced to declare bankruptcy.

With the coal industry reducing production and experiencing some contraction – easing the coal supply glut – the second quarter of 2016 has seen global thermal coal prices on the rebound closer to historical averages. Many market analysts are predicting a continued rise in prices, which for some is a reversal of their 2015 coal forecasts.

[20] Cohan, Daniel. "When coal companies go bankrupt, the mining doesn't always stop." The Hill. April 18, 2016.

[21] Domonoske, Camila. "U.S. Coal Giant Peabody Energy Files for Bankruptcy." NPR. April 13, 2016.

Conflicting reports in 2015 on the reason behind the decline in coal prices ranged from those predicting coal's demise due to the increase in natural gas, clean energy usage, and power plant construction; to those cautioning that this was solely due to an oversupply of coal in the global marketplace.

Peabody has cited a drop in coal prices, weaker demand from China, the rise of competition from fracking, and "ongoing regulatory challenges" as reasons for its bankruptcy filing.[22]

In addition, the average cost of alternative energy, unsubsidized, in dollars per megawatt-hour has been declining, with solar and wind energy now less expensive than coal—once the projects are built. Solar and wind energy combined with natural gas (which is also cheaper than coal) may pose a longer-term threat to coal.[23]

However, there is a cost to building these plants and to building the appropriate infrastructure. Compared to coal power plants, which have already been constructed or are nearing completion, the economics (lacking subsidies) of alternative energy sources are still not as favorable.

Bloomberg Intelligence analyst Andrew Cosgrove has predicted that demand for coal used in power plants and for making steel would remain weak through 2016, but that India and Southeast Asia would be bright spots. In Cosgrove's words, "This isn't a death knell for coal. It's the pains of a shrinking industry."[24]

Although a surge in coal prices is not expected, several analysts such as Fitch Group's research firm BMI have recently raised their thermal coal price forecasts.[25]

Citi Research's Jack Shang expects China's overall coal inventory to come down in the coming quarters as Chinese supply shrinks faster than demand. As a result, he forecasts the QHD 5,500 kcal thermal coal price (currently at Rmb376/t) to rise by 20% by year-end 2016.[26]

[22] "U.S. Coal Giant Peabody Energy Files for Bankruptcy." NPR. April 13, 2016.

[23] Lazard Levelized Cost of Energy Analysis. Lazard. November 17, 2015.

[24] "Coal Slump Sends Mining Giant Peabody Energy Into Bankruptcy." Bloomberg. April 13, 2016.

[25] "Thermal Coal Prices: Market Sees Strength; BMI Lifts Price Forecasts." Economiccalendar.com. June 30, 2016.

[26] "Citi U-Turns On china Coal: Worst Is Behind Us." Barrons.com. May 25, 2016.

US and European Decline

Coal consumption in the US and Europe appears to be in a genuine and long-term decline. Since 2014, six publicly-traded US coal mining companies sought bankruptcy protection: Alpha Natural Resources, Walter Energy, Patriot Coal, James River Coal, Arch Coal, and, most notably, Peabody Energy.

The primary reasons cited for the bankruptcy filings were a combination of a high debt load, cost of credit, global oversupply, decline in prices, increase in natural gas usage, decreasing China demand for coal, etc.

However, the US has been experiencing a continual decline in coal usage since 2007, with 2015 coal and lignite consumption levels almost 30% less than 2007 levels.[27] The combined market value of major publicly traded coal US coal companies has declined by approximately 92% since April 2011.[28]

Within Europe, several countries have now declared themselves to be coal-free including Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta, Belgium, and, most recently, Scotland.

As with the United States, Europe has experienced a steady decline in coal and lignite consumption since 2007, with 2015 levels being approximately 17% less than 2007 levels.

In addition, the IEA has forecasted that coal consumption in the US and Europe will continue to decline by as much as 1.5% - 2.1% per year through 2020, as natural gas and renewable energy usage continues to increase.

Global Coal Consumption in Context

There has been a great deal of media coverage of the fact that global coal consumption declined by 1.8% between 2014 and 2015—the largest decline since the mid-1960s when BP first started reporting data.[29] However, when reviewing the numbers and trends, a slightly different story emerges. An analysis of Enerdata's Energy Statistical Yearbook 2016: Coal and Lignite Domestic Consumption (Mt) table reveals the following:

- From 1990-1999, global coal and lignite domestic consumption generally fluctuated around 4600 Mt.
- The year 2000 saw an increase in global coal and lignite consumption by over 7% from 1999 to approximately 4900 Mt. Consumption then began to increase steadily, with several other large year-over-year jumps of 7-8% occurring in 2003 (5398 Mt), 2005 (6403 Mt), and 2011 (7724 Mt).
- Global coal and lignite consumption appears to have hit a peak in 2013 at over 8000 Mt, and has declined slightly since then, bringing us to a 2015 consumption number of 7749Mt. This is still above 2011 levels, when consumption took its last large year-over-year jump.

Are we, therefore, in a period of global coal and lignite consumption decline? Or are we in a slightly fluctuating consumption zone much like the years 1990-1999, but at a consumption level approximately 65% greater than the years 1990-1999?

[27] Enerdata Energy Statistical Yearbook 2016: Coal and Lignite Domestic Consumption (Mt).
[28] "Market Cap of U.S. Coal Companies Continues to Fall." IEEFA.org. March 23, 2016.
[29] "Global Coal Consumption Fell in 2015; Oil's Market Share Rose to a 16-Year High." IER. June 15, 2016.

Several global regions have reported 2015 coal and lignite domestic consumption levels that are **lower** than those of 1990. These areas include the United States; Canada; Europe; and the CIS, including Russia. In total, they declined from 2880 in 1990 to 1978 in 2015, a 31% decline.

Although Latin America, Africa, Australia, New Zealand, and the Middle East have increased consumption levels from 1990, their total consumption level in 2015 was reported to be 413 Mt, or 5.3% of the total 2015 global consumption level.

The majority of the global coal and lignite consumption can be attributed to China, India, and Southeast Asia. In total, their coal and lignite consumption levels have increased from 1507 Mt in 1990 to 5358 in 2015, a 256% increase. China accounted for 48% of total global coal and lignite consumption in 2015.

Demand for Thermal and Cooking Coal in Asia

Several reasons are cited for the higher numbers in recent coal price forecasts: a tighter supply chain due to production cuts at coal mines being more aggressive than initially expected; better than predicted demand in Asia, India, and Southeast Asia; and a demand surge from power plants in Indonesia.

The outlook for coking coal has also improved, primarily due to long-term demand growth for steel-making ingredients supported by rising output in emerging economies such as India. BHP Billiton has recently raised its guidance for the production of coking coal. However, BHP has reduced its guidance slightly for thermal coal while expecting demand to remain resilient for decades.[30]

While all global coal price forecasts remain well off the peaks of 2011, and not expecting prices to rise much further, it does appear that the coal industry is close to balancing supply and demand.[31]

Coal companies have been looking to all of Asia for continued coal demand, including China. At the recent annual Coaltrans Asia meeting, industry participants reported expecting strong growth from emerging Southeast Asian consumers, such as Malaysia and the Philippines, coupled with steady demand from China, India, Japan, South Korea, and Taiwan over the next few years.[32]

[30] "BHP Says India Steel Growth to Boost Coking Coal Outlook." Bloomberg. June 20, 2016.
[31] "Coal Industry Shouldn't Get Carried Away with New Found Optimism." Reuters. June 2, 2016.
[32] Ibid. Reuters. June 2, 2016.

Limited Effect of Chinese Mine Closures

China announced in February 2016 that it would aim to close more than 1,000 coal mines over this year.[33] However, the mines affected only have a total production capacity of 60 million tonnes. In comparison, the Chinese coal companies on the Coal 100 alone have reported reserves of over 36,000 million tonnes, and China Shenhua reported coal production in 2015 of approximately 260 million tonnes.

China also reported that it has total of 10,760 coal mines, and that 5,600 of them will eventually be required to close under a policy banning those with an annual output capacity of less than .09 million tonnes.[34]

Reviewing China's coal mine capacity in total, including government-owned coal mines, these amounts represent only a fraction of total production.

Increased Coal Power Plant Construction Across Asia

Globally, coal remains inexpensive, reliable, abundant, accessible, easier to transport, and simpler to store. Power plant construction data may provide an indicator of future coal usage, assuming current power plant utilization rates remain constant.

Forecasts of steady rather than declining global coal demand are based on the fact that coal-fired power plants are continuing to be constructed, with the number of additional, newly-constructed coal power plants being greater than the number of coal power plants being retired coupled with an increase in steel demand. This increased power plant construction is occurring primarily in Asia and Southeast Asia, with retirements occurring primarily in the United States and Europe.

CoalSwarm, Sierra Club, and Greenpeace issued a report, "Boom and Bust 2016: Tracking the Global Coal Plant Pipeline," in March 2016 which analyzed coal fired power plant construction, retirements, and utilization rates globally, among other findings. Some statistics provided in the report indicate:

- Since 2010, 473 GW of new coal power capacity has been built globally, of which over 90% is in Asia, led by China and India.
- Global coal plant retirements are growing, led by retirements in Europe and the United States, but worldwide levels of plant retirements are only a fifth the size of new plant building.
- Even with no further building of coal plants, emissions from current coal plants will still be 150% higher than what is consistent with scenarios limiting warming to 2°C.

[33] "China to close more than 1,000 coal mines in 2016: energy bureau." Reuters. February 22, 2016.

Although coal power plant utilization rates are declining globally and coal power plants are being retired, the increased construction is keeping coal usage at current or even increased levels.

Currently, China has approximately 880,000 MW of coal power plants, which translates into approximately 2.5 billion tonnes of coal utilized annually at full production.

Within China "the central government has reportedly ordered provincial governments to suspend new approvals in 13 provinces and regions through 2017, and to halt initiation of new construction in 15 provinces and regions…the large amount of capacity already under construction across the country, or under development in provinces and regions not covered by the new restrictions, means that much more stringent measures will be needed to stop the ballooning of capacity."[35]

Although China's coal consumption has experienced slight declines over the past couple of years, which can be attributed to policy changes and an increase in the use of alternative energy, there still exists momentum in China's coal plant building. With increasing coal fired power plant capacity, it remains to be seen if China's coal consumption does continue to decline.

India's coal production and consumption have both increased. In addition, India is also second to China in the amount of proposed coal power capacity in the pipeline, even with current coal fired power generation providing 74% of India's electricity generation in 2015.[36]

In addition, Indonesia, Viet Nam, Malaysia, and the Philippines, among other countries, plan to underpin their power generation with new coal power plants. And, half of the new coal-fired generation capacity under development in the region still uses inefficient subcritical technologies.[37]

It remains that coal consumption in all of Asia continues to almost entirely offset steady declines in coal consumption in the United States, Canada, Europe, and the CIS including Russia.

Concluding Thoughts

The next few years should prove indicative of the direction in which coal demand, particularly in all of Asia, is moving. Factoring out the short-term year-to-year comparisons, and looking at five-to-ten year trends, all emerging economies remain question marks with respect to their future coal usage, with China and India the largest unknowns. As other economies, such as Africa and other frontier markets, continue to develop, their decisions regarding energy sources are questions as well. But, for the very near term, trends in China and India will dominate the global direction of coal usage and resulting carbon emissions.

[35] "Boom and Bust 2016: Tracking the Global Coal Plant Pipeline." CoalSwarm, Sierra Club, Greenpeace. March 2016.

[36] Ibid. CoalSwarm, Sierra Club, Greenpeace. March 2016.

[37] "Global coal demand stalls after more than a decade of relentless growth." IEA. December 18, 2015.

The Carbon Underground Oil and Gas 100

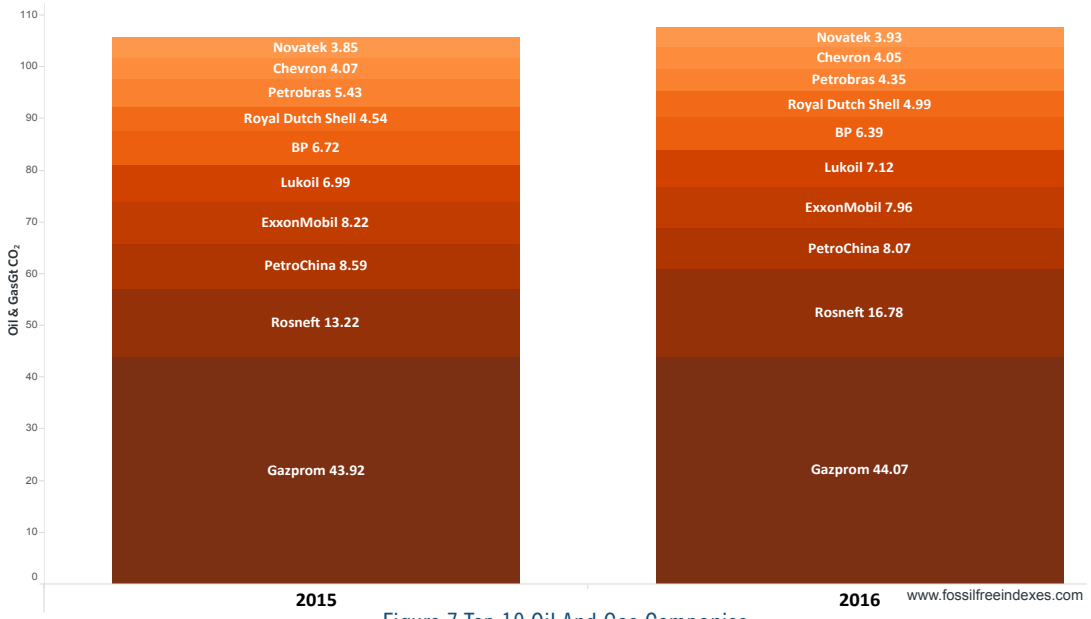

Figure 7 Top 10 Oil And Gas Companies
Change in Reserves-based Emissions (Gt CO_2), 2015-2016

In the past year, The Carbon Underground Oil and Gas 100 (CU Oil and Gas 100) companies have drastically reduced capital expenditures and engineered several high-level mergers and acquisitions, among other developments. Potential reserve-based carbon emissions for the CU Oil and Gas 100 companies contracted for the first time since 2008, although the overall change was less than one percent.

The top 10 companies continue to dominate potential CO_2 emissions, accounting for 70% of the CU Oil and Gas 100 total. Although the 10 are evenly split between potential emissions growth and contraction, as a group they increased potential emissions since the publishing of our 2015 report. The companies making up the top 10 have not changed, although Petrobras (#8) and Royal Dutch Shell (#7) have reversed places. Persistently low oil prices have rendered 20% of Petrobras' oil and gas reserves uneconomic, shrinking its potential CO_2 emissions. Despite the drop, Petrobras continues to rank above Chevron (#9).

We describe four major trends and developments in the sections that follow.

Unsustainable Russian Growth

In 2014, John McCain famously characterized Russia as "a gas station masquerading as a country."[38] In fact, over half of Russia's federal budget is financed by taxing the oil and gas industry. Western sanctions imposed in 2014 followed by the collapse of global oil prices in 2015 put the industry in a precarious position despite enormous natural resources.

Since the publishing of The Carbon Underground 2015, most Russian producers have increased production in a bid to maintain profits and finance projects in the absence of Western partners and finances. The resulting cost of this short-term strategy is linked to the intensified exploration required to replace depleted reserves. Exploration is an increasingly costly investment in the current environment. Production increases have not completely covered losses due to the sustained and drastic drop in oil prices, making the strategy increasingly risky as time passes.

Despite the financial challenges, the major Russian oil companies, Rosneft (#2), Gazprom (#1), Lukoil(#5), and Bashneft (#20) all increased potential emissions. Rosneft's increase was more than double any of the others, and the increase itself would rank 12th on the CU Oil and Gas 100 if it were a stand-alone company. Rosneft made significant acquisitions prior to sanctions and the current oil glut. In contrast to the other Russian companies, it has not increased production over the last year, focusing instead on developing existing assets.

The complicated relationships between political objectives and corporate realities in modern Russia are nearly impossible to untangle. Two years ago, it was politically important to show that Western sanctions had little effect on Russia's premier industry. Today, the slumping economy has put pressure on the Putin government to renege on a promise to hold corporate taxes flat through 2018 – especially with regard to the energy industry. The sequence of sanctions, increased exploration, decreased revenues, and looming tax increases make Russian emissions growth the key oil and gas finding in this year's report. The longer oil prices remain low, the more precarious the Russian fossil fuel sector's position becomes.

[38] Remarks made in March, 2014. http://www.politico.com/story/2014/03/john-mccain-russia-gas-station-105061.

North America: CO_2 Increases and Shale

Outside of Russia, five companies increased potential CO_2 emissions by at least 100 million tonnes without an acquisition. Of those five, four are in North America and three are shale gas plays. Antero Resources (#28), Cabot Oil and Gas (#40), and Tourmaline Oil (#64) all increased reserves and potential CO_2 emissions "organically". Organic refers to finding new reserves or using technology to increase existing reserves. Russian growth in potential CO_2 emissions is also organic.

Since the publishing of The Carbon Underground 200 in 2015, US-listed companies are evenly distributed on change in potential emissions, but the quantity of the change is skewed toward contraction. Antero Resources and Cabot Oil and Gas are on the growth side; the contraction side outweighs growth by more than three to one. This is not surprising, given the precipitous drop in rig count since its peak in the summer of 2014. A recent analysis by Wood Mackenzie found that US shale companies have been able to cut costs more effectively than the industry as a whole. This makes companies involved in Eagle Ford, Permian Basin, Bakken, and DJ Basin plays among the first to adjust to lower crude prices. In fact, Devon Energy (#31) and WPX (#63) report adding rig count.

Canadian Natural Resources Limited (#19) was the fourth North American company to increase potential CO_2 emissions by at least 100 million tonnes without an acquisition; its growth is attributable to the Horizon tar sands project. The Horizon project is just north of Fort McMurray and likely to experience delays due to the Albertan wild fires (see below).

Canada: Wild Fires and Tar Sands

While not captured in the current formulation of the CU200, it is important to note the impact of the 2016 wild fires in Fort McMurray on the Canadian fossil fuel industry. The fires did not affect the mines themselves or the extraction and upgrading facilities. Strange as it may seem, these facilities are at considerably lower risk to wild fires than the homes of workers and the infrastructure that supports them. The labor and energy intensive nature of tar sands production makes the tragic losses of workers homes and supporting businesses difficult to overcome.

The Carbon Underground Tar Sands 20 is an FFI ranking similar to the CU200 but focused on potential emissions from tar sands reserves. Of the TS20 companies, Suncor (#25) and Royal Dutch Shell (#7) top the list with roughly double the employment of the next tier. Canadian Natural Resources (#19), Imperial Oil (#32), and Husky Energy (#50) all have about 5,000 employees. Current oil prices are very close to the production cost of most tar sand operations. Interrupted production, low or non-existent margins, and increased worker costs will undoubtedly result in more losers than winners in this arena. Suncor and Royal Dutch Shell may be impacted most.

Oil Prices Fuel Acquisitions

Royal Dutch Shell (#7) and Repsol (#23) both took advantage of stress in the market and made major acquisitions. Shell saw two immediate benefits in its acquisition of BG Group: solidified access to Brazilian pre-salt oil deposits and a boost in reserves to mute downward revisions caused by low oil prices. Shell's portfolio of fossil fuel reserves suffered more than its Super Major peers, reflecting the relatively higher cost per barrel of oil for its projects. In the longer term, the BG acquisition moves Shell forward in its bid to shift toward natural gas and away from oil.

Repsol's acquisition of Talisman shares striking similarities with the Shell/BG deal: South American politics provided impetus and the collapse of oil prices created urgency. The motivations for the deals however, were different. Shell was anxious for the local access to Brazilian fields afforded by BG in the uncertain wake of the Petrobras scandal; Repsol was looking to recover from being shut out of Venezuela in the wake of YPF's seizure by the government. Given the persistence of low oil prices, Shell urgently needed to shore up reserves and avoid a repeat of the 2004 scandal when it wrote down over 20% of proven reserves; Talisman's debt heavy strategy was simply unsustainable in the current environment.

Taken together, the two deals illustrate the vast uncertainties imposed by low oil prices on companies, governments, and the interactions between the two. The actions of governments and firms in the stressed economies of Venezuela, Russia, and Saudi Arabia will play significant and unpredictable roles in future world fossil fuel markets. Investors should recognize that conditions are ripe for further transaction activity.

Concluding Thoughts

Contraction, though small, in the potential CO_2 emissions of the CU Oil and Gas 100 is a distinct change in trajectory. Since the 2015 CU200 publication, proven oil reserves have declined and proven natural gas reserves have increased slightly. The largest companies in the CU Oil and Gas 100 have increased emissions for both oil and gas. This means that the smaller firms have lost the most proven reserves in response to persistently low crude oil prices. It also indicates that companies with any flexibility are beginning to tilt their portfolio of fossil fuel reserves away from oil and toward natural gas. Growth in potential emissions at the largest fossil fuel holders on the CU Oil and Gas 100 were led by natural gas reserves by a factor of over three to one despite the lower carbon content of natural gas.

In the event of a continued oil glut, the effect of persistently low crude prices will begin to reach higher up the list. Three of the top five CU Oil and Gas companies are based in Russia. In contrast to Western-based Super Majors, the reserves held by Gazprom, Rosneft, and LukOil are primarily located in Russia and completely subject to Russian political and economic winds. ExxonMobil, Royal Dutch Shell, and BP hold reserve assets diversified across the global economy. This does not, however, insulate Western-based Super Majors from political exposure, as recent M&A activity has shown. Fossil fuel dependent economies can behave unpredictably as the public and private sectors adjust to lower crude oil prices.

The Carbon Footprint of the CU200

Current emissions and potential emissions are two different ways of evaluating carbon risk. Potential emissions are typically the most relevant factor for evaluating the risks inherent in companies whose main business is the extraction and production of coal, oil, and gas. Current emissions are more useful to evaluate the efficiency with which businesses are managing the emission of carbon via their operations. While the two measures are not additive, it is instructive to also understand carbon intensity of the process (emphasis) used by reserve owners to extract and produce fossil fuels.

Carbon footprinting is a measure of the current GHG emissions that are produced by a company's operations. Because carbon footprinting can be assessed across industry sectors, it is a useful way to evaluate an entire portfolio's financed current emissions.

South Pole Group has analyzed the current emissions of The CU200, modeling it as a market cap-weighted portfolio worth $100 million. This analysis of the CU200 is a measure of the GHGs produced by a fossil fuel company's operations, which includes the processes of exploration and extraction of reserves, but excludes the future emissions embedded in the reserves themselves.

The results of this analysis are shown below and include an ETF tracking the MSCI World Index for comparison.

The GHG Protocol defines Scope 1, 2, and 3 emissions based on direct and indirect emissions. Direct GHG emissions are emissions from sources that are owned or controlled by the reporting entity. Indirect GHG emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity. The scopes include:

Scope 1: All direct GHG emissions.

Scope 2: Indirect GHG emissions from the consumption of purchased electricity, heat, or steam.

Scope 3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities not covered in Scope 2, outsourced activities, waste disposal, etc.

	CU 200	MSCI WORLD	DIFFERENCE
Total Emissions Scope 1&2 (tCO_2e)	111,664	15,738	-95,926
Total Emissions Scope 1,2 & 3 (tCO_2e)	658,904	63,797	-595,108
Percentage of Disclosing Holdings	41%	68%	-26%
Emissions ($kgCO_2e$) per USD 100 Invested	111.7	15.74	-610%
Weighted Emissions (tCO_2e) / Weighted Revenue USD Million	379.65	135.02	-181%
Financed Emissions (tCO_2e) / Financed Revenue USD Million	677.49	221.04	-207%

A 100 million dollar investment into a hypothetical market-cap-weighted CU200 portfolio is associated with GHG emissions of 111,664 tonnes per year. An investment into such a portfolio would yield seven times more Scope 1 & 2 emissions than an investment in an average global benchmark (MSCI World). When including Scope 3 emissions, the carbon footprint is 10 times as high as the MSCI world index.

This analysis demonstrates that in addition to holding potential CO_2 emissions more than 460% of their allocated 2 degree CO_2 budget, the CU200 companies' current emissions created are significantly greater than companies in other sectors. The companies in the CU200 also perform poorly in terms of transparency in comparison to the benchmark. Only 41% of companies report their emissions compared to 68% in the benchmark.

Creating The CU200: Methodology

Introduction

We have used a reserves-based methodology to create The Carbon Underground 200™, a listing of the top 100 publicly-traded coal reserve-owning companies and the top 100 publicly-traded oil and gas reserve-owning companies, ranked by the potential carbon emissions content of their reported reserves. This approach follows that of Meinshausen from the Potsdam Institute for Climate Impact Research.29 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 when it was launched in 2012.30

Reserves Data Sources

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

For coal, IntierraRMG, the coal data provider utilized by FFI, announced that it had been acquired by SNL during 2014. However, the full integration of IntierraRMG onto the SNL platform, and the combination of the two coal data sets did not occur until the second half of 2015. Subsequently, SNL was purchased by McGraw Hill Financial in the later part of 2015 who has since combined SNL with their S&P Capital IQ division and has renamed the division S&P Global Market Intelligence. This also resulted in the consolidation of two coal data sets.

During the consolidation of these coal data sets, there were extensive quality control checks, due diligence and additional research into the sourcing and validation of reported coal reserves. There is no global requirement for the annual reporting of coal resources and reserves by mine property and FFI undertook a large effort to determine the reasonableness of the last reported reserves amount. In addition, mine property ownership was verified.

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 were checked 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, beyond the due diligence described above, was to provide support for estimating the kind 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 were 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_2 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

The calculations used to produce this third edition of The Carbon Underground 200™ are based on reserves data available as of May 31, 2016. Corporate actions through July 11, 2016 are included to ensure that all companies on the list were investable as of July 11, 2016. 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 investable companies.

The majority of proven oil and gas reserves are held by state-controlled companies, whose data are unavailable to investors. However, some state-controlled companies do turn to the equity markets to raise capital. There are 21 state-controlled companies, accounting for about 60% of the total CO_2 emissions, in The Carbon Underground Oil and Gas 100.

Emissions Calculation Process

The Carbon Underground 200™ relies on the IPCC Revised 1996 Guidelines for National Greenhouse Gas Inventories3 as a methodological framework. The calculation of CO_2 emission potential requires several conversions to the raw reserves figures.

Categorization: Coal reserves are divided into five categories and petroleum reserves into four categories as follows:

Coal

- anthracite
- coking coal (metallurgical)
- bituminous coal (thermal, PCI)
- sub-bituminous coal
- lignite

Petroleum

- oil
- natural gas liquids
- oil sands
- 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.33

CO_2 Emissions Calculation: Potential CO^2 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 x V x C x F,34 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 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 have been 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 May 31, 2016. The ranking is then adjusted based on company mergers and acquisitions following the most recent reserve reports.

Data Accuracy

FFI 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.

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