Carbon Tracker Initiative

PRI Principles for Responsible Investment

2 degrees of separation

Company-level transition risk
July 2018 update

Introduction

In June 2017, Carbon Tracker and PRI launched "2 Degrees of Separation" in partnership with 5 institutional investors. The report laid out a framework for estimating relative transition risk to a universe of major oil & gas producers, looking through the lens of capital expenditure that might in future be committed to high cost projects that would be outside a 2°C pathway for their products – a 2°C "budget" in aggregate.

This note updates those company-level numbers. In response to user feedback, we have made some tweaks to methodology, as explained below. In general these are consistent with the methodology used in Carbon Tracker's "Mind the Gap" report, published in March 2018[1].

Mind the Gap – advancing climate ambition

2 Degrees of Separation used a single climate outcome as a benchmark – a 2°C scenario based on the IEA's 450 Scenario[2]. However, in the light of the Paris agreement to hold warming to "well below 2°C", and "pursue efforts" for 1.5°C, there has been investor appetite to see the implications of scenarios that reflect better climate outcomes.

Accordingly, in this update, we include a 1.75°C global warming scenario based on the IEA's Beyond 2 Degrees Scenario (B2DS). We continue to include an IEA 2°C scenario; the 450 scenario has been replaced by the *Sustainable Development Scenario* (SDS) in the IEA's most recent publications. This scenario further incorporates universal energy access and air quality ambitions, but with limited impact on oil & gas demand overall compared to its predecessor.

Both scenarios assume a 50% probability of success in achieving its respective level of warming. Accordingly, the SDS is really at the very upper limit of what might be considered compliant with the target agreed in Paris, and even the B2DS could be tightened further[3].

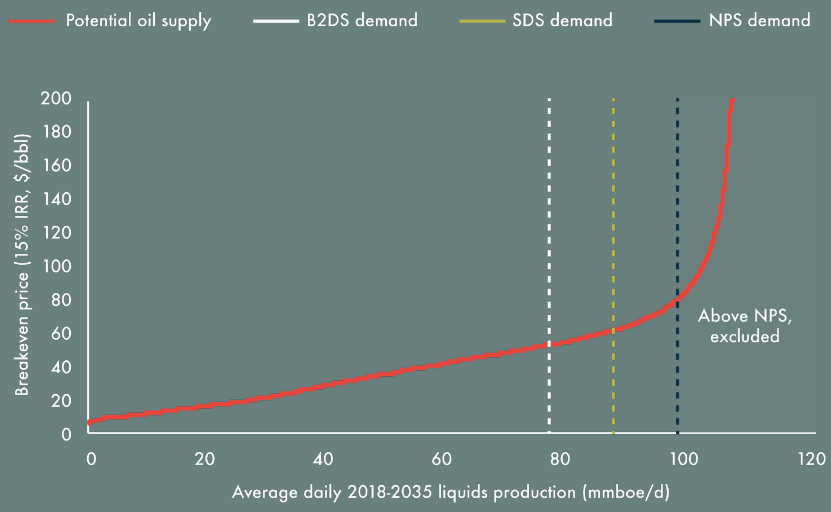
1 *Carbon Tracker, "Mind the Gap: the $1.6 trillion energy transition risk", March 2018*
2 *As interpreted from the IEA's World Energy Outlook 2016*
3 *See appendix for further details of the IEA scenarios*

The highest cost projects assumed to be taken off the table – for now

In the previous iteration of these numbers, the 2°C demand scenario for oil & gas was compared to a potential supply curve from Rystad Energy's UCube database that comprised their assumed base case level of supply from all projects including those considered uncommercial. While this baseline was thus not reflective of full supply potential, the recent capital discipline forced on the oil & gas industry following the price declines since 2014 suggest that the inclusion of high-cost projects should be limited. Furthermore, the level of supply used was difficult to compare to a transparent benchmark.

For this update we have sought to address this by limiting our curves of potential supply by reference to another IEA scenario – the *New Policies Scenario* (NPS). The NPS is the IEA's central scenario, assuming no further climate policy developments beyond those already enacted or announced, and is consistent with a temperature rise of 2.7°C (again, based on a 50% probability). Any high-cost projects above this level have been assumed not to go ahead and therefore excluded from the main metrics in this analysis.

Global oil aggregate potential cost curve, 2018-2035



Source: Rystad Energy, IEA, Carbon Tracker analysis

This approach in effect assumes that companies are already aligned with this scenario, and focuses on the "surprise" or "misread" differentials down to the SDS and B2DS demand levels – the capital at risk if companies collectively (but not necessarily consciously) invest to deliver NPS demand but are caught out by a lower level.

Increased conservatism

When selecting the level of potential supply against which to compare demand in order to quantify potential stranded assets, there is always a trade-off. Including a lower level of supply gives more conservative numbers and a better focus on the most likely and nearer-term projects; however, it also means that outputs are liable to not include some plausible opportunities to destroy value. This may be particularly the case as oil and gas prices move into a higher stage of the cycle.

We would further note that disclosures to date do not suggest that all companies expect long-term demand to be as low as NPS, even if appreciation of the energy transition appears to be increasing in industry. We therefore consider it important to view the results holistically and not ignore the higher cost projects completely.

As noted above, the NPS assumes no further policy efforts to deliver climate outcomes, for example the 5-yearly reviews of commitments under Paris. However, we consider that the direction of travel as a whole is for increased climate policy, even if still very much inadequate to deliver stated international aims, plus technological advance increasingly providing genuine and cost-competitive alternatives to fossil fuels. This therefore raises the prospect of the NPS "cut-off" potentially shifting down in future years.

Amendments to the company universe

The previous iteration covered the 68 companies in the S&P Global Oil Index that were categorised as either "integrated oil & gas" or "oil & gas exploration and production" at the time, plus Saudi Aramco.

In the interim, Rice Energy has been acquired by EQT and therefore is no longer on the list as a separate entity. RSP Permian is to be acquired by Concho Resources, but at the time of update remains a separate entity and is treated as such accordingly.

There have been two new entrants to the S&P Global Oil index in the above categories, namely Aker BP and WPX Energy. These companies have been added to the list along with two others, BHP Billiton and Sasol. The covered universe therefore now stands at 72 companies net.

Using this note

To the extent that such higher cost projects are not committed to yet, they represent an element of optionality – companies will sanction projects when they believe that they are likely to be economic. We would therefore point out that we would not expect all of the potential capital at risk to be committed under deteriorating demand conditions. Basing the methodology on this potential future capital is intended to provide a proxy for the opportunity to destroy capital if future fossil demand takes a path closer to that needed for success in international climate ambitions, rather than industry expectations.

Accordingly, while the numbers from this exercise should not be used precisely, we feel that they are representative of the broad themes and illustrative of the relative positioning of future supply options. We generally see a focus on the general and relative as more instructive than assuming precision that isn't warranted given the nature of multi-decade projections that aren't designed for that purpose. Please see the appendix for further details of methodology.

Furthermore, the use of capex as a metric does not include the time value of money or subsequent cashflows from this capex that, while not necessarily delivering positive returns, would serve to pay back some of the initial capital. We would therefore caution against using potential capex outside a given budget as a read across for value at risk or an implication that any given company's share price is overvalued or undervalued. We would argue that for most oil and gas companies (and the larger ones in particular), the most significant valuation risks lie largely in the future; the extent to which companies ultimately act to mitigate these risks will lie with management.

Company outcomes

In the previous iteration of this exercise, companies were assigned rankings based on their relative capex positioning. % of potential capex outside a 2°C budget was presented in bands, to encourage readers to view the outcomes in relative rather than absolute terms and avoid reading in undue precision. We believe that the positionings are most useful when interpreted in a general sense – which companies are around the top or bottom? To further pursue this aim, in the latest iteration we present the companies organised alphabetically within quartiles, rather than assigning rankings.

Quartiles are allocated based on the percentage of each company's 2018-2025 potential capex under the New Policies Scenario which is outside the 2°C Sustainable Development Scenario, and the % of NPS capex which is outside the 1.75°C Beyond 2 Degrees Scenario is also shown.

The average levels of NPS capex outside the SDS and B2DS budgets for industry as a whole are 16% and 33% respectively (excluding open acreage); company-level figures should be considered with this in mind.

Quartile	Company (alphabetically by quartile)	Country of headquarters	% of NPS upstream capex outside 2°C/SDS budget (% band)	% of NPS upstream capex outside 1.75°C/B2D budget (% band)
4	Apache	United States	**30% - 40%**	**50% - 60%**
4	Concho Resources	United States	**40% - 50%**	**60% - 70%**
4	Crescent Point Energy	Canada	**40% - 50%**	**40% - 50%**
4	Devon Energy	United States	**20% - 30%**	**30% - 40%**
4	Ecopetrol	Colombia	**20% - 30%**	**40% - 50%**
4	Energen	United States	**50% - 60%**	**50% - 60%**
4	ExxonMobil	United States	**20% - 30%**	**40% - 50%**
4	Hess	United States	**20% - 30%**	**40% - 50%**
4	Imperial Oil (Public traded part)	Canada	**20% - 30%**	**60% - 70%**
4	Murphy Oil	United States	**20% - 30%**	**30% - 40%**

Quartile	Company (alphabetically by quartile)	Country of headquarters	% of NPS upstream capex outside 2°C/SDS budget (% band)	% of NPS upstream capex outside 1.75°C/B2D budget (% band)
4	Petrobras	Brazil	20% - 30%	40% - 50%
4	Repsol	Spain	20% - 30%	30% - 40%
4	Sinopec	China	30% - 40%	40% - 50%
4	Surgutneftegas	Russia	20% - 30%	40% - 50%
4	Total	France	20% - 30%	30% - 40%
4	Tullow Oil	United Kingdom	30% - 40%	40% - 50%
4	Vermilion Energy	Canada	30% - 40%	50% - 60%
4	WPX Energy	United States	40% - 50%	60% - 70%
3	Aker BP	Norway	20% - 30%	40% - 50%
3	Canadian Natural Resources (CNRL)	Canada	20% - 30%	20% - 30%
3	Chevron	United States	10% - 20%	30% - 40%
3	CNOOC	China	20% - 30%	30% - 40%
3	Encana	Canada	10% - 20%	30% - 40%
3	Eni	Italy	10% - 20%	30% - 40%
3	Galp Energia SA	Portugal	10% - 20%	40% - 50%
3	Gazprom	Russia	10% - 20%	30% - 40%
3	Gulfport Energy	United States	20% - 30%	50% - 60%
3	Husky Energy	Canada	20% - 30%	60% - 70%
3	Lukoil	Russia	20% - 30%	40% - 50%
3	Marathon Oil	United States	10% - 20%	50% - 60%
3	OMV	Austria	20% - 30%	40% - 50%
3	PetroChina	China	10% - 20%	20% - 30%
3	Rosneft	Russia	20% - 30%	40% - 50%
3	Shell	Netherlands	20% - 30%	30% - 40%

Quartile	Company (alphabetically by quartile)	Country of headquarters	% of NPS upstream capex outside 2°C/SDS budget (% band)	% of NPS upstream capex outside 1.75°C/B2D budget (% band)
3	Statoil	Norway	**20% - 30%**	**40% - 50%**
3	Suncor Energy	Canada	**10% - 20%**	**10% - 20%**
2	Anadarko	United States	**0% - 10%**	**10% - 20%**
2	Arc Resources	Canada	**0% - 10%**	**50% - 60%**
2	BP	United Kingdom	**10% - 20%**	**20% - 30%**
2	Cenovus Energy	Canada	**10% - 20%**	**20% - 30%**
2	Chesapeake	United States	**0% - 10%**	**20% - 30%**
2	ConocoPhillips	United States	**0% - 10%**	**30% - 40%**
2	Continental Resources	United States	**0% - 10%**	**20% - 30%**
2	Diamondback Energy	United States	**10% - 20%**	**10% - 20%**
2	Inpex	Japan	**0% - 10%**	**10% - 20%**
2	Newfield Exploration	United States	**10% - 20%**	**20% - 30%**
2	Noble Energy	United States	**0% - 10%**	**20% - 30%**
2	QEP Resources	United States	**10% - 20%**	**50% - 60%**
2	Range Resources	United States	**10% - 20%**	**30% - 40%**
2	RSP Permian	United States	**0% - 10%**	**0% - 10%**
2	Santos	Australia	**0% - 10%**	**10% - 20%**
2	Tatneft	Russia	**0% - 10%**	**10% - 20%**
2	Tourmaline Oil	Canada	**0% - 10%**	**0% - 10%**
2	Woodside	Australia	**10% - 20%**	**10% - 20%**

Quartile (4 is highest % of capex outside 2°C/SDS budget, 1 is lowest)	**Company** (alphabetically by quartile)	**Country of headquarters**	**% of NPS upstream capex outside 2°C/SDS budget** (% band)	**% of NPS upstream capex outside 1.75°C/B2DS budget** (% band)
1	Antero Resources	United States	**0% - 10%**	**0% - 10%**
1	BHP Billiton	Australia	**0% - 10%**	**20% - 30%**
1	Cabot Oil and Gas	United States	**0% - 10%**	**0% - 10%**
1	Cimarex Energy	United States	**0% - 10%**	**20% - 30%**
1	EOG Resources	United States	**0% - 10%**	**20% - 30%**
1	EQT Corporation	United States	**0% - 10%**	**10% - 20%**
1	Lundin Petroleum	Sweden	**0% - 10%**	**0% - 10%**
1	Novatek	Russia	**0% - 10%**	**20% - 30%**
1	Oil Search	Papua New Guinea	**0% - 10%**	**0% - 10%**
1	Origin Energy	Australia	**0% - 10%**	**0% - 10%**
1	Oxy	United States	**0% - 10%**	**30% - 40%**
1	Parsley Energy	United States	**0% - 10%**	**40% - 50%**
1	Peyto	Canada	**0% - 10%**	**10% - 20%**
1	Pioneer Natural Resources	United States	**0% - 10%**	**0% - 10%**
1	Sasol	South Africa	**0% - 10%**	**10% - 20%**
1	Saudi Aramco	Saudi Arabia	**0% - 10%**	**0% - 10%**
1	Seven Generations Energy	Canada	**0% - 10%**	**0% - 10%**
1	Southwestern Energy	United States	**0% - 10%**	**0% - 10%**

Explaining changes in relative positioning

In addition to the significant change to methodology described above, the nearly year and a half period since the last data update[1] demonstrates the effects of corporate activity and a continued feed-through of industry cost deflation into the data. The latter factor has resulted in significant reductions to the marginal breakeven costs (used as the dividing line between in/out of a given budget) in some markets, but with effects varying throughout industry. This may be manifested for example in a project which was previously considered inside the budget now being forced out by competitive supply having experienced greater reductions in costs.

Accordingly, as would be expected, there have been some material moves in relative positioning since the previous 2 Degrees of Separation report.

Reasons for these movements for a given company vary, but generally fall into one or more of several broad themes:

Category	Relative exposure improvement	Relative exposure worsening
Corporate activity	**Asset divestment**, particularly of non-core positions	**Acquisition of new projects** outside budget
Data update	**Reduction in individual project breakeven costs**, sometimes related to improved resource estimates, resulting in project moving inside the budget **Deferral of capex** on high-cost projects beyond 2025 timeframe **Reduction in capex** for projects outside budget	**Reduction in marginal industry breakeven cost** (demarcating in/out of budget) resulting in projects that were inside the budget now being outside **Upwards revision to breakeven cost estimates**
Methodology	**Exclusion of high-cost projects** outside NPS	**Lower than average proportion of high cost assets** outside NPS excluded

1 *The data used in this study was downloaded from Rystad Energy's UCube database in May 2018, compared to January 2017 for the previous iteration*

Given the size of the universe of companies and number of projects involved across industry, we briefly explore some of companies with the largest movements (and the main reasons for such) in order to illustrate these points.

Improved relative positioning:

- Cabot Resources – increase in resource estimates and cost improvements at Marcellus gas acreage;
- Noble Energy – sale of non-core DJ Basin acreage, sale of Marcellus acreage;
- Inpex – delay to capex timelines for Kashagan (Kazakhstan) and Bestari (Malaysia), sale of Tunu (Indonesia), reduction in reserves and cost estimate for Vorwata (Indonesia);
- Newfield Exploration – reduction in cost estimates for Woodford shale STACK play resource potential, reduction in capex for Uinta shale gas assets;
- Eni – delay to capex timelines for Kashagan (Kazakhstan), reduction in capex and resource for Coral LNG (Mozambique) and Mirakes (Indonesia), reduction in costs for Mamba South LNG (Mozambique), Mizton oil project (Mexico), NC041-E deepwater gas discovery (Libya);
- Southwestern Energy – Fayetteville and Niobrara Green River Basin acreage excluded as above NPS;
- EQT Corporation – certain Upper Devonian, Marcellus and Utica acreage excluded as above NPS

Worsened relative positioning:

- Tourmaline Oil – Spirit River and Notikewin/Falher & Cardium assets now outside budget due to reduction in US gas marginal breakeven;
- Range Resources – Marcellus dry gas now outside budget;
- Tullow Oil – reduction in marginal breakeven for oil pushed Ngamia (Kenya) and Jobi-Rii (Uganda) oil projects outside budget, 2018 addition of six licences in Peru outside budget;
- Sinopec – Shengli heavy oil project (China) now outside budget due to reduction in marginal breakeven, increased capex estimates at Duverney shale (Canada);
- Lundin Petroleum – Alta/Gohta arctic oil field now outside budget despite slight fall in costs
- Gulfport Energy – certain tranches of Utica and Springer shale acreage now outside budget due to fall in marginal costs
- Petrobras – Marlim revitalization, Mero pilot now outside budget despite falls in costs

Appendix I: IEA Demand Scenarios

In this paper we examine the range of outcomes for the potential supply of oil and gas in terms of production and capex required under three different demand scenarios, each of which can be thought of as approximating a "carbon budget" resulting in a different level of global warming. This approach is consistent with Carbon Tracker's recent "Mind the Gap" report, and extends it to the company level.

Our usual focus to date has been on levels of demand that result in 2°C of global warming above pre-industrial times, consistent with prior international targets. However, following the 2015 Paris Agreement to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C", there has been increased interest in the results of scenarios that assume a higher level of climate ambition.

In this study, we therefore compare potential oil supply to demand levels based as closely as possible on the International Energy Agency's (IEA) 1.75°C Beyond 2 Degrees Scenario (B2DS) as well as the 2°C Sustainable Development Scenario (SDS), and include the 2.7°C New Policies Scenario (NPS) for reference.

A brief description of these three scenarios is provided below. The IEA is explicit that none of them should be taken as a long-term forecast.

- **IEA New Policies Scenario:** The NPS is the central scenario published in the World Energy Outlook. It is "designed to show where existing policies as well as announced policy intentions might lead the energy sector". "It incorporates not just the policies and measures that governments around the world have already put in place, but also the likely effects of announced policies, as expressed in official targets or plans"[2]. As there are no assumptions relating to potential future policies beyond those announced, it may be seen as lagging given the general direction of travel towards greater climate-related regulation. It is consistent with a course that gives a 50% probability of a global temperature rise of roughly **2.7°C**.

- **IEA Sustainable Development Scenario:** The SDS replaces the previous 450 Scenario in the 2017 World Energy Outlook as the main decarbonisation scenario. It is "consistent with the direction needed to achieve the objectives of the Paris Agreement", and further incorporates ambitions relating to universal energy access and improvements in air quality. While the temperature increase that would result from this scenario is dependent on measures that would take place after the period that it covers, it is consistent with a roughly 50% chance of

2 *See IEA, World Energy Outlook 2017*

limiting global warming to **2°C** above pre-industrial temperatures. It is therefore at the upper limit of the amount of emissions that can be considered to comply with the Paris Agreement.

- **IEA Beyond 2 Degrees Scenario:** The B2DS was published for the first time in the 2017 Energy Technology Perspectives. Like the SDS, it is driven by outcomes rather than inputs; that is, the demand pathway results from the ultimate goal, in this case limiting global warming to **1.75°C** by 2100, "the midpoint of the Paris Agreement's ambition range"[3]. Again, the associated level of cumulative emissions has a 50% chance of successfully delivering this temperature outcome.

As each of these scenarios ultimately results in a given level of global warming, the modelled resulting aggregate amount of demand for each fossil fuel can be thought of as a "budget" for that fossil fuel to result in that warming outcome.

The documents published by the IEA that describe these scenarios provide a great deal of information on each, including some coverage at a regional level. However, it does not provide the entirety of the detail needed in order to apply a fully comprehensive demand scenario at the asset level, particularly in some gas markets. Accordingly, we have attempted to make some reasonable approximations where necessary, and annual points in between those disclosed by the IEA have been interpolated.

This approach of comparing a single stack of potential supply to three demand scenarios is an extension of previous Carbon Tracker studies, where we have tended to focus on a single scenario[4]. Providing analysis of additional options allows investors different interpretations of the results depending on their outlook and risk tolerance; for example, allowing them to test against a climate outcome with a higher ambition than the 2°C warming scenario we have used as our main benchmark to date, or allowing them to be more conservative on potential supply by cutting off at the demand attributed to the NPS rather than the full extent of potential supply, for example.

3 *See IEA, Energy Technology Perspectives 2017*
4 *See for example Carbon Tracker, "2 Degrees of Separation", June 2017. Available at 2degreeseparation.com*

NPS demand used as upper limit of supply

In our "2 Degrees of Separation" report, we noted that the full extent of potential supply of oil and gas was not much higher than NPS levels of demand, and hence felt justified in calling potential supply business-as-usual ("BAU").

However, due in part to an increase in potential supply options on the source databases relative to demand since that analysis was undertaken in January 2017, we have reconsidered this approach. In the recent environment of drastically reduced sanction activity and renewed focus on margin rather than volume growth, it is clear that many of the higher cost options are not on the table at the moment (although industry sentiment has improved markedly, and a number of previously deferred projects are now being dusted off). Therefore in this study we will focus on the increments of supply/capex between the B2DS and SDS and an upper limit to potential supply equal to NPS demand.

The report in effect assumes that shareholders are already assuming that projects beyond this level will not get built, and focuses on the "surprise" or "misread" differentials down to the SDS and B2DS demand levels – the capital at risk if companies invest to deliver NPS demand but are caught out by a lower level.

We doubt that there is a single perfect method of determining the extent of potential supply which reflects the full fossil fuel development opportunity set whilst balancing this against a desire to prioritise more immediate projects in a way that will satisfy all interested parties. This approach thus does not capture all the opportunities to destroy value in the industry, indeed it would be well accepted that some initially prospective options would inevitably fail to pass sanction even in higher demand scenarios. However, on balance and reflecting feedback from investors on previous research, in this instance we prefer the conservativeness and greater focus on nearer term, more likely projects that come with assuming lower levels of potential supply. We continue to consider the most appropriate approach.

Appendix II: Methodology

Summary of methodology

Methodology used is similar to that used in Carbon Tracker's Carbon Supply Cost Curve papers, in particular the June 2017 "2 Degrees of Separation" and March 2018 "Mind the Gap" reports. It is based on the comparison of carbon-constrained demand scenarios (or "budgets") to cost curves of potential supply.

Demand/budgets: We firstly derive demand pathways for the chosen fossil fuel from those provided by the International Energy Agency for the various scenarios that they produce. The aggregate level of demand for each fuel can be thought of as its total "budget" over a given timeframe – here 2018-2035. A carbon budget is the total amount of carbon which can be emitted during that period and to deliver a given climate outcome.

Potential supply cost curves: We then overlay our cost curves of potential supply (based on underlying data sourced from industry databases), to ascertain which potential fossil fuel project options, and their associated investments or capex, would fall outside of the maximum allowed budget. This determination is based on the core assumption that markets are rational, and that the highest cost (or lowest returning) projects would be outcompeted by lower cost supply sources under the demand-constrained scenario we have outlined. Accordingly we have identified which upstream projects appear to be outside the budget in a given demand scenario. Our ranking of projects is based on the breakeven oil/gas/coal price required to meet a 15% IRR hurdle rate.

Key points of the methodology used are summarised in the below table.

Demand scenarios	SDS, NPS – IEA World Energy Outlook (published November 2017) B2DS – IEA Energy Technology Perspectives (published June 2017)
Timeframe	Supply and demand have been compared over the period 2018-2035
Capex figures	Presented in real US dollars, over the time frame 2018-2025
CO_2 budgets	CO_2 budgets are based on life cycle emission estimates, which take into account other factors beyond combustion. As these factors are based on the total emissions arising in the scenarios, they therefore incorporate the differing assumptions used in each scenario. For example, the scenarios assume differing degrees of carbon capture and storage (CCS) deployment. Should CCS not live up to these assumptions, then the volume of fossil fuel demand, which results in the same level of emissions, and hence global warming outcome, will be lower. The emissions examined in this report and previous Carbon Tracker reports relate to CO_2 only, with no additional analysis of the impact of "fugitive" methane emissions or other associated products. We highlight that CO_2 figures are an output used for presentation; the comparison of supply/demand is done using demanded volumes of fuel in bcm or boe.
Potential supply	All oil supply data has been sourced from Rystad Energy UCube, as at May 2018. Potential supply is initially estimated using Rystad Energy's base case, including uncommercial assets. Fossil fuel options should therefore be thought of as being conceptually closer in scale to contemplated or possible production and capex rather than relative to full supply potential. However, this does not mean that all the projects in this study are planned or even under consideration at this point. Potential supply includes production and capex estimates for discoveries and as yet undiscovered (yet to find) resources. As discussed, the extent of potential supply available beyond IEA NPS demand levels has been excluded, meaning that aggregate potential supply/capex is closer to a proxy for industry expectations as a baseline for comparison.
Breakeven prices	Calculated as the Brent-equivalent oil price that gives an NPV of a project's future cash flows of 0 using a 15% discount rate/IRR. The NPV calculation includes exploration costs, development investment, maintenance investments, production costs and the impact of fiscal regime. It can be thought of as the price required to deliver a minimum return including a contingency accounting for possible delays/cost overruns.
Life-cycle stage	Assets categorised as at the discovery and undiscovered stages have been aggregated as "new", and those at the producing and under development stages have been aggregated as "existing".

Supply databases

Oil & gas data source: Rystad UCube

All oil & gas data has been provided to us as a custom download by Rystad Energy, sourced from their UCube database as at May 2018[5].

UCube (Upstream Database) is an online, complete and integrated field-by-field database, including reserves, production profiles, financial figures, ownership and other key parameters for all oil and gas fields, discoveries and exploration licenses globally. UCube includes 65,000 oil and gas fields and licenses, portfolios of 3,200 companies, and it covers the time span from 1900 to 2100.

5 *See www.rystadenergy.com for more information about the UCube upstream database*

Appendix III: Amendments to web portal

Amendments to website content

We previously provided further detail in an accompanying website accessible by PRI signatories. Whilst adding in the above additional companies and scenarios, we have removed two aspects of the website functionality in this update.

- Index filter – given changes in constituents over time and addition of further companies from outside the original index/sector focus, the ability to filter companies by membership of the relevant S&P or MSCI index is no longer included.

- NPV sensitivity – all things being equal, a lower demand scenario (e.g. B2DS) would be expected to result in a lower price environment than another with higher demand (e.g. NPS). The previous NPV sensitivity analysis compared portfolios generated under the three scenarios at the same prices; we are therefore concerned that this is somewhat misleading and have removed.

Further, to encourage a relative interpretation of the positioning and to avoid the impression of undue precision, the company positionings are now organised in quartiles rather than rankings as previously.

Disclaimer

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