



# CARBON TRACKER METHODOLOGIES

Oil and Gas Companies



## About Carbon Tracker

---

The Carbon Tracker Initiative is a team of financial specialists making climate risk real in today's capital markets. Our research to date on unburnable carbon and stranded assets has started a new debate on how to align the financial system in the transition to a low carbon economy.

[www.carbontracker.org](http://www.carbontracker.org) | [hello@carbontracker.org](mailto:hello@carbontracker.org)

## About Carbon Tracker Methodologies

---

Overview of methodologies and metrics for the alignment assessments which complement Indicator 6 of the Disclosure Framework within the Climate Action 100+ Net Zero Company Benchmark.

As a research provider to Climate Action 100+, Carbon Tracker Initiative conducts financial analysis and has developed a set of alignment assessments to help investors identify, quantify, and assess transition risk exposure for 30 upstream oil & gas companies' investment plans.

Full details of Carbon Tracker Initiative's research and methodologies are available on [www.carbontracker.org](http://www.carbontracker.org). Please direct questions and enquiries to [ca100@carbontracker.org](mailto:ca100@carbontracker.org)

### Copyright Statement

Readers are allowed to reproduce material from Carbon Tracker reports for their own publications, as long as they are not being sold commercially. As copyright holder, Carbon Tracker requests due acknowledgement and a copy of the publication. For online use, we ask readers to link to the original resource on the Carbon Tracker website.

© Carbon Tracker 2023.

# Table of Contents

<b>1</b>	<b>Carbon Tracker – Research and Analysis</b>	<b>1</b>
<b>2</b>	<b>The need to reduce emissions</b>	<b>1</b>
<b>3</b>	<b>Carbon Tracker’s least cost framework for oil and gas</b>	<b>2</b>
<b>4</b>	<b>Alignment Assessments for Upstream oil and gas</b>	<b>3</b>
<b>5</b>	<b>Carbon Tracker’s oil &amp; gas least-cost analysis</b>	<b>11</b>

# 1 Carbon Tracker – Research and Analysis

Carbon Tracker carries out scenario analysis to examine and understand the impact of the energy transition on future demand for oil and gas products, and thus the impact for companies participating in the oil and gas value chain. This analysis helps the investment community better understand the financial implications of the energy transition required to address climate change.

- 1) Our analytical research identifies the highest cost (and thus most at risk) investments enabling greater scrutiny by investment analysts, asset owners, financial institutions, policy makers and financial regulators.
- 2) Our regulatory research builds the case for reform of the financial regulatory system to improve transparency of climate-related financial risks and articulates the key changes to be made.
- 3) We provide expert insight for those engaging with energy companies around future strategy and capital expenditures.

Our research is grounded in conventional financial analysis and focuses on forward-looking material issues. As a not-for-profit research house, Carbon Tracker are free from the constraints that would be imposed by a commercial financial research business model. This allows us to challenge business-as-usual approaches that we consider to be unsustainable in the face of the unprecedented challenge posed by climate change.

## 2 The need to reduce oil and gas emissions

Emissions of greenhouse gases will need to fall significantly if the world is to avoid catastrophic levels of global warming. Such constraints will have profound effects on the supply of and demand for fossil fuels, which account for the largest human source of greenhouse emissions.

Our Upstream oil and gas analysis is focused on the financially material risks posed to companies by the continued development of new oil and gas production projects. Our research aims to prevent capital being deployed on assets that risk becoming financially stranded – that is those that may not yield expected returns – as demand falls away through the energy transition. Our focus is therefore on advancing the energy transition through the stewardship of capital.

Notwithstanding this focus, our analysis is highly appropriate for the CA100+ Net Zero Company Benchmark because it enables investors to build factual, independent knowledge of investee companies' future production and investment plans, and how these plans relate to different demand scenarios. Investors can use this knowledge to better understand the financial exposure companies may have in a world moving towards a lower carbon energy system; those investors with Paris-alignment mandates or products, can also use this analysis to help identify companies for inclusion.

Our research publications are freely available on our website [www.carbontracker.org](http://www.carbontracker.org) as well as on research platforms such as Bloomberg, FactSet, Refinitiv and S&P Capital IQ.

### 3 Carbon Tracker's least cost framework for oil and gas

In a series of reports since 2011, Carbon Tracker has explored the financial implications of the shift to a lower carbon economy in line with international climate ambitions for the oil & gas sector.

Carbon Tracker's lens is that of the market – assessing which potential oil and gas developments do not make economic sense and might erode significant value in the energy transition, at the same time as taking the planet into a progressively more dangerous climate.

Underlying this analysis is the logic that in a world of limited demand, the lowest cost supply options will be most competitive and the higher cost options may fail to deliver economic returns – in other words, becoming economically “stranded”.

Our focus is on the risks posed to fossil fuel companies if they continue to invest in projects that are not needed as the world transitions towards a cleaner energy system, and thus the risk of value loss that investors in these companies – in both the primary and secondary markets - are exposed to.

By using classic supply and demand curves, we can illustrate what proportion of potential investment is in low-cost projects that are potentially financially-viable under different transition scenarios towards a low-carbon world, and what proportion is on higher-cost projects that are unlikely to be viable. Investment in the latter runs a greater risk of eroding shareholder value.

## 4 Alignment Assessments for Upstream oil and gas

Carbon Tracker has developed **four assessments for upstream oil & gas** for the Climate Action 100+ Net Zero Company Benchmark, focused on investment and capital allocation plans for 30 companies with upstream oil & gas exploration and production operations. The purpose of these assessments is to help investors identify, quantify, and assess the degree of climate alignment and thus transition risk exposure for 30 Climate Action 100+ focus companies.

These independent alignment assessments complement Indicator 6 of the Disclosure Framework within the Climate Action 100+ Net-Zero Company Benchmark. They present helpful insights to investors about the compatibility of oil & gas companies' announced upstream capital expenditure and future production plans. Three of the four assessments are based on Carbon Tracker's least cost methodology for modelling global oil and gas supply and demand. A more detailed description of this methodology is outlined later in this document and summaries of how this approach is implemented for each assessment is included alongside each CA100+ Benchmark indicator below.

Carbon Tracker's least cost methodology, the modelling that underpins these assessments, uses supply (production) data from Rystad Energy, alongside the following demand scenarios from the International Energy Agency (IEA) to quantify different levels of climate alignment and transition risk exposure.

### International Energy Agency (IEA) demand scenarios used by Carbon Tracker

Stated Policies Scenario (STEPS): Our business-as-usual proxy. STEPS is consistent with c.2.7°C warming (50% chance) and describes a projection of the future energy system whereby already enacted, and already announced yet to be enacted, legislation on climate change is assumed to continue, but not be developed further. *Source: IEA, World Energy Outlook 2022.*

Announced Pledges Scenario (APS). The APS assumes that in addition to following through with their policies, governments will also deliver on the promises that have yet to be passed into law. In other words, it looks into what stakeholders are saying they will do. This scenario is included as we recognize that some investors seek to understand alignment against a looser "well below 2 degree" interpretation of the Paris Agreement goals. It also enables investors to have an indication of the extent to which companies are not aligned with 1.5°C. *Source: IEA, World Energy Outlook 2022*

Net Zero Emissions By 2050 Scenario (NZE): A faster decarbonization pathway, equivalent to 1.5°C of warming in this century with little overshoot (i.e., limited reliance on post-2050 negative emissions). As the name suggests, net zero is reached by 2050. *Source: IEA, World Energy Outlook 2022*

*Source: 'Paris Mismatched' (Carbon Tracker, 2022)*

**CTI's Climate 100+ Benchmark Oil & Gas Assessments:**

For the CA100+ Net Zero Company Benchmark, we have developed a set of four assessments to evaluate the risks posed to fossil fuel companies if they continue to invest in projects that are not needed as the world transitions towards a cleaner energy system, and thus the risk of value loss that investors in these companies – in both the primary and secondary markets - are exposed to.

The CA100+ Net Zero Company Benchmark categorises company assessments into traffic light colours with Green, indicating that the company meets the expectations set out in the title of the Indicator, Amber, indicating that the company partially meets this criteria, and Red, indicating that the company does not meet the expectations of the Indicator.

CTI has also provided supplementary information for these assessments which does not align to specific traffic light colours but is helpful for understanding the analysis behind each of our Indicator assessments. This supplementary information is provided in the CA100+ Benchmark Downloadable Excel tool rather than as part of the scorecard pages on the CA100+ Website.

Alignment Assessment – Oil and Gas	Traffic light assessment
<p><b>INDICATOR 1: RECENT INVESTMENTS – Compatibility of the company’s <u>recent</u> upstream oil and gas investment (capex) with a Paris-aligned pathway</b></p> <p>In the most recent full year (2022), all of the upstream oil and gas investments sanctioned by the company were assessed not to be incompatible with the IEA’s Net Zero Emissions by 2050 Scenario (NZE, 1.5°C).</p> <p>*Failing that, companies will be assessed against the IEA’s Announced Pledges Scenario (APS, 1.7°C).</p>	<p><b>Green:</b> Recent upstream oil and gas investment (capex) is not incompatible with NZE (1.5°C)</p> <p><b>Amber:</b> Recent upstream oil and gas investment (capex) is not incompatible with APS (1.7°C)</p> <p><b>Red:</b> Recent upstream oil and gas investment (capex) is incompatible with both NZE (1.5°C) and APS (1.7°C)</p> <p>*Recent here refers to investments sanctioned in the past year (2022).</p>
<p><b>Assessment Methodology:</b></p> <p>Assets which are assessed to be incompatible (i.e. not economically competitive under) with ambitious Paris-aligned scenarios, are more likely to become financially stranded. Accordingly, those companies which sanctioned such assets are more exposed to associated transition risk.</p> <p>This assessment gives an indicator of the above risk for recent investments (CapEx), and uses the results of Carbon Tracker’s least cost methodology to determine if recently-sanctioned upstream oil and gas investments were compatible (on a cost basis) with either the NZE (1.5°C) and/or APS (1.7°C) scenario. This provides an indication of the company’s transition risk exposure.</p> <p><i>The more investment (CapEx) that the company has committed to projects which are incompatible with a given scenario, the greater the stranded asset risk.</i></p>	

The threshold for whether a project is compatible - or not - with a given scenario is derived from Carbon Tracker’s least cost modelling: it is the marginal breakeven price of the last project needed to satisfy demand under a given scenario.

- A green ‘yes’ score indicates that the company’s investment approach is not incompatible with the NZE (1.5°C) scenario, as only projects with a breakeven price lower than the NZE threshold price were sanctioned in the past year.
- An amber ‘yes’ score indicates that the company’s investment approach is not incompatible with the APS (1.7°C) scenario, as only projects with a breakeven price lower than the APS threshold price were sanctioned in the past year.
- A red ‘no’ score indicates that the company’s investment approach is incompatible with both the NZE (1.5°C) and the APS (1.7°C) scenario, as projects with a breakeven price higher than the APS were sanctioned in the past year. The percentage of a company’s upstream CapEx on projects incompatible with APS scenario is included within the ‘no’ score.

Please note: The assessment is made on new asset investments as consistent with Rystad’s definition of assets and what qualifies as a new upstream oil or gas asset investment. The caveat to this approach relates to what constitutes a new shale asset, and how shale assets are captured within Rystad’s datasets. Accordingly, others may view some shale investment classified as being into existing assets as being into “new” assets.

Additional datapoints which support this assessment are included within the CA100+ Benchmark Downloadable Excel.

**Supplementary data points applicable to CTI Oil and Gas Indicator 1 assessments.**

This data is provided within the CA100+ Benchmark Downloadable Excel only.

Supplementary Data Topic	Data points
<p><b>CapEx committed to recent projects assessed not to be compatible with the NZE (a 1.5°C pathway)</b></p> <ul style="list-style-type: none"> <li>• Proportion of the company’s overall upstream oil and gas CapEx allocated in the most recent year to projects that are assessed not to be compatible with the NZE.</li> <li>• Absolute dollar value of CapEx allocated in the most recent year to projects assessed not to be compatible with the NZE.</li> </ul>	<p>% of upstream oil and gas CapEx</p> <p>\$ value</p>
<p><b>CapEx committed to recent projects assessed not to be compatible with the APS (a 1.7°C pathway)</b></p> <ul style="list-style-type: none"> <li>• Proportion of the company’s overall upstream oil and gas CapEx allocated in the most recent year to projects assessed not to be compatible with the APS.</li> <li>• Absolute dollar value of CapEx allocated in the most recent year to projects assessed not to be compatible with the APS.</li> </ul>	<p>% of upstream oil and gas CapEx</p> <p>\$ value</p>

Supplementary data is only applicable where a company receives either a red or amber traffic light assessment. The additional datapoints provide further granularity to the traffic light scores, showing both the proportion, and the absolute value, of upstream CapEx on new projects assessed not to be compatible with each of the NZE and APS.



Please note: this is the capital committed to in the year via the sanction (final investment decision); the investment itself may be spread over a period of a number of years.

See the description of the least cost methodology in Section 3 for further detail.

**Alignment Assessment – Oil and Gas**

**Traffic light assessment**

**INDICATOR 2: FUTURE INVESTMENTS – Compatibility of the company’s potential future investment on new upstream oil and gas projects with a Paris-aligned pathway**

The company’s potential future capex in new upstream oil and gas projects are assessed not to be incompatible with the IEA’s Net Zero Emissions by 2050 Scenario (NZE, 1.5°C).

\*Failing that, companies will be assessed against the IEA’s Announced Pledges Scenario (APS, 1.7°C).

**Green: Future upstream CapEx is not incompatible with the NZE (1.5°C)**

**Amber: <50% of future CapEx is incompatible with the APS (1.7°C)**

**Red: 50-100% future CapEx is incompatible with the APS (1.7°C)**

**Assessment Methodology:**

Potential upstream investments that are assessed to be incompatible with (i.e. not economically competitive under) ambitious Paris-aligned scenarios, are more likely to become financially stranded. Accordingly, those companies which are considering investing in such assets are more likely to be exposed to transition risk.

This assessment gives an indicator of that risk for potential future investments (capex), and uses the results of Carbon Tracker’s least cost methodology to determine if the extent to which a company’s portfolio of potential upstream oil and gas investments is compatible (on a cost basis) with either the NZE (1.5°C) and/or APS (1.7°C) scenario, to give an indication of transition risk exposure.

*The higher the percentage of incompatible CapEx opportunities, the less climate-aligned the investment plan, and the more exposed the company is to the risk of stranded upstream assets*

This assessment uses the IEA’s Stated Policies Scenario (STEPS, 2.5°C) as a proxy for potential “business as usual” investment in new projects; individual projects are then assessed for compatibility with either the NZE (1.5°C) or the APS (1.7°C), based on relative breakeven price (cost-competitiveness). This analysis excludes consideration of projects so costly they are also incompatible with even STEPS.

The assessment of the compatibility of a company with a given scenario is based on the compatibility of the individual upstream projects within its portfolio, and thus the company’s potential investment approach on new upstream oil and gas projects. Where individual projects are assessed to be incompatible with the APS, then the potential CapEx associated with those projects is aggregated and expressed as a percentage of the company’s total business-as-usual capex.

- A green ‘yes’ score indicates that the company’s investment approach (in terms of potential future upstream capex) is assessed to be not incompatible with the NZE (1.5°C)

- An amber 'yes' score indicates that the company's investment approach (in terms of potential future upstream capex) is assessed to be no more than 50% incompatible with the APS (1.7°C).
- A red 'no' score indicates that the company's investment approach (in terms of potential future upstream capex) is assessed to be 50-100% incompatible with the APS (1.7°C).

To support this assessment, the exact % of CapEx incompatible with APS is included within the description of of the assessment.

#### Alignment Assessment – Oil and Gas

#### Traffic light assessment options

#### INDICATOR 3: Future PRODUCTION SENSITIVITY – Compatibility of the company's potential future upstream oil and gas production with a Paris-aligned pathway.

The company's potential future (2030s) oil and gas production is at or below that which would be expected from projects that are assessed not to be incompatible with the IEA's Net Zero Emissions by 2050 Scenario (NZE, 1.5°C).

**Green:** Potential upstream production is not incompatible with the NZE (1.5°C)

**Amber:** Potential upstream production exceeds the NZE not incompatible production by 0-50%

**Red:** Potential upstream production exceeds the NZE not incompatible production by >50%

#### Assessment Methodology:

Meeting the goals of the Paris Agreement requires oil and gas production to fall over time. Companies that are planning to develop new projects which are incompatible with ambitious Paris-aligned scenarios can not be considered Paris-aligned, and are increasing their exposure to future commodity price reductions through the transition.

This assessment analyses the company's potential future production under a business-as-usual investment strategy, and compares this to that resulting of an investment strategy where only new oil and gas projects which are not incompatible with the NZE (1.5°C) are developed. It complements the investment indicators (Indicators 1 and 2).

*The greater the extent to which future production exceeds that from NZE-compatible projects, the less the company can be viewed as being Paris-aligned, and the more the company is exposed to longer-term commodity price fluctuations.*

The assessment uses the IEA's Stated Policies Scenario (STEPS) as a proxy for potential "business as usual" investment in new projects and thus potential business-as-usual future production from both existing and new projects. It compares this potential business-as-usual future production in the 2030s with the future production resulting from just existing and NZE-compatible new projects. Production data is based on Rystad Energy's production forecasts.

- A green 'yes' score indicates that the company's future production from a business-as-usual investment approach does not exceed that from projects assessed not to be incompatible with the NZE.
- An amber 'partial' score indicates that the company's potential business-as-usual investment approach is 0-50% more than that from NZE-compatible projects.
- A red 'no' score indicates that the production resulting from a company's potential business-as-usual investment is more than 50% higher than that from NZE-compatible projects.

<b>Supplementary data points applicable to CTI Oil and Gas Indicator 3 assessments.</b>	
<b>Supplementary Data Topic</b>	<b>Data points</b>
<p><b>Production decline under the NZE (a 1.5°C pathway)</b></p> <ul style="list-style-type: none"> <li>The % decline of the company's implied oil &amp; gas production level in the 2030s vs 2022 baseline, assuming the sanction of only new oil &amp; gas projects assessed not to be incompatible with the NZE (1.5°C).</li> </ul>	% production decline from 2022
<p><b>Production decline under the APS (a 1.7°C pathway)</b></p> <ul style="list-style-type: none"> <li>The % decline of the company's implied oil &amp; gas production level in the 2030s vs 2022 baseline, assuming the sanction of only new oil &amp; gas projects assessed not to be incompatible with the APS (1.7°C).</li> </ul>	% production decline from 2022
<p>The supplementary data points show the magnitude of the production declines that would result from a company only developing new projects that are not incompatible with the NZE (1.5°C) and the APS (1.7°C) scenarios. Whereas the indicator shows the <i>extent</i> to which future production exceeds that from NZE-compatible project – and thus the degree of Paris-alignment – these data points give an indication of the rate at which Paris-aligned production declines for each company. The faster the decline rate, the more insulated from future commodity price variations, but the faster the potential impact to cash flows, and thus the strategic challenge to replace earnings if a diversification strategy is pursued.</p> <p>See the description of the least cost methodology in Section 3 for further detail.</p>	
<b>Alignment Assessment – Oil and Gas</b>	<b>Traffic light assessment options</b>
<p><b>INDICATOR 4: OIL PRICES - Compatibility of the company's oil price forecasts with a Paris-aligned pathway</b></p> <p>The company is planning for the long-term oil prices used in its impairment testing to fall, in accordance with expectations under Paris-aligned scenarios.</p>	<p><b>Green: Oil price not incompatible with NZE (1.5°C)</b></p> <p><b>Amber: Oil price not incompatible with APS (1.7°C)</b></p> <p><b>Red: Oil price is incompatible with APS (1.7°C) OR is not disclosed</b></p> <p>The company's maximum oil price forecast and the shape of the price forecast curve is provided in brackets next to its score</p>
<p><b>Assessment Methodology:</b></p> <p>To assess the value of a company's upstream projects for financial reporting purposes, it must offer a reasonable estimate of what future oil prices will be. Other things being equal, in a world of increased oil demand, prices might be expected to rise, while in a world of decreased demand, they might be expected to fall. Meeting the Paris Agreement requires oil demand (and so prices) to fall.</p>	

This assessment analyses the company’s oil price outlook, as used in its financial reports, to identify what climate-related risks have been priced into its upstream asset base. This is a proxy for the extent to which the company is planning for the long-term oil prices used in its impairment testing to fall in accordance with expectations under the Paris-aligned scenarios.

The higher the long-term oil price used within impairment testing, the greater the risk that the company will be required to take impairments in the future as the transition unfolds.

Companies with more aggressive (i.e. higher) long-term oil price assumptions (e.g., forecasting prolonged periods of high future oil prices) are more likely to sanction projects that are at risk of becoming stranded in a carbon emission constrained world.

From the most recent annual report, we collect the disclosed oil pricing curve and price assumptions used for impairment test of the company’s relevant fixed assets, when disclosed, which we use as a proxy for management’s internal oil price assumptions used for strategic planning. Oil prices have been converted to US Dollar 2022 real terms brent equivalent for comparability. We characterize the oil price curve as increasing, decreasing, flat, concave (declining, then rising) or convex (rising, then declining). Where companies have price forecasts which initially decline but then flatten out and are adjusted upwards for inflation in the long term, we have characterized these curves as ‘flat’.

The crude oil price forecast used to benchmark the company in the NZE (1.5°C) scenario is \$35/bbl for 2030 and \$24/bbl for 2050. The forecast used in the APS (1.7°C) scenario is \$64/bbl for 2030 and \$60/bbl for 2050. All are in US Dollar 2021 real terms.<sup>1</sup> The maximum oil price forecast used by the company (adjusted to real terms US Dollar 2022 when necessary) is provided in supplementary information within the Downloadable Data file on the CA100+ website (see below). Where prices are expressed in non-Brent benchmarks we have adjusted those figures to reflect Brent prices using spreads between the benchmark prices of the disclosure and Brent.

- A green ‘yes’ score indicates that the company’s disclosed oil price forecasts are not incompatible with (i.e., the same or lower than) the NZE (1.5°C) scenario.
- An amber ‘partial’ score indicates that the company’s disclosed oil price forecasts are not incompatible with (i.e., the same or lower than) the APS (1.7°C) scenario.
- A red ‘no’ score indicates that either the company has not disclosed its oil price assumptions in the financial statements **OR** that the company’s disclosed oil price forecasts are incompatible with (i.e., higher than) the APS (1.7°C) scenario.

Because oil price forecasts may rise and fall over time in different ways, this indicator also provides the maximum oil price disclosed at any point in the time period disclosed and the year in which that oil price is reached. This is presented as supplementary information (See below)

**Supplementary data points applicable to CTI Oil and Gas Indicator 4 assessments.**

**Supplementary Data Topic**

Data points

<sup>1</sup>International Energy Agency *World Energy Outlook 2022* price scenarios, p. 110.

<p><b>Maximum price used in the company's oil price forecast</b></p> <ul style="list-style-type: none"><li>• The maximum price in the company's oil price forecast used in impairment testing, and in what year is it forecasted?</li></ul>	<p>\$ maximum price (year)</p>
---	--------------------------------

## 5 Carbon Tracker's oil & gas least-cost analysis

Carbon Tracker's least cost methodology has been developed across a series of reports over the past decade, exploring the financial implications for the oil and gas sector of the transition to a lower carbon economy. The most recent report which describes the modelling alongside associated company-commentary is *Paris Maligned*<sup>2</sup> (December 2022).

The modelling is used to assess whether individual projects are compatible with a given climate/energy transition scenario, and this forms the basis of Indicators 1, 2 and 3 for Upstream oil and gas.

### Identification of individual project compatibility

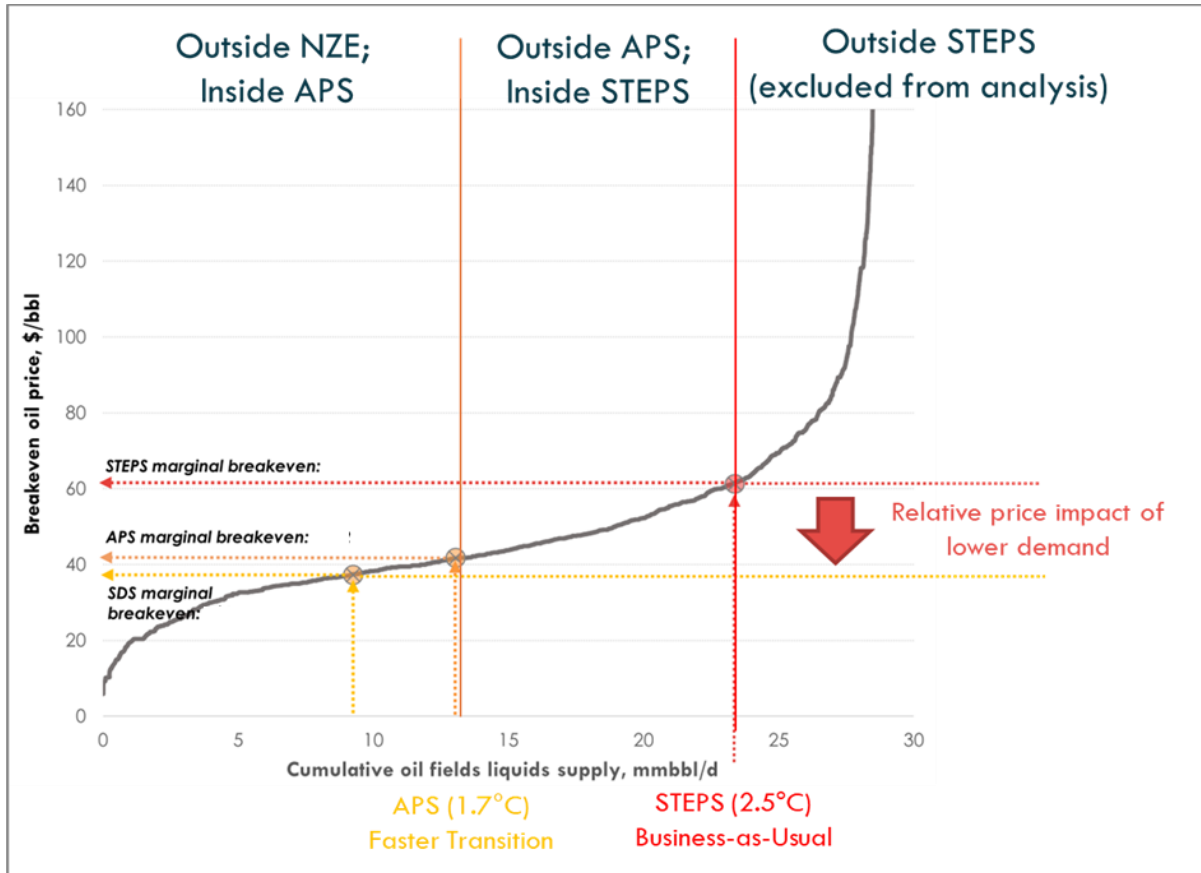
A summary of the methodology is described here, and is illustrated in the Figure 1, showing an example cost curve with the cumulative potential oil supply (2022-2040) from unsanctioned oil fields using Rystad Energy's base case supply curve, showing APS and STEPS supply gaps.

- Future oil and gas demand under a given scenario (e.g. from the International Energy Agency, IEA) is compared to the future production from existing oil and gas fields (using supply data from Rystad Energy), to give a supply gap for both oil and gas.
  - Oil is considered a global market
  - Gas is modelled in four regional markets and then rest of the world, plus global LNG trade.
- To understand how this supply gap could be filled, a cost-curve is created from all potential projects within a given market by ordering them by project breakeven price (Figure 1).
- Starting with the lowest cost project, and moving up the curve, projects are identified as being compatible, or "inside", a scenario until the supply gap (shown on the x-axis for each scenario) is filled.
  - In the example shown in Figure 1, the aggregate supply gap under APS is 13mmbbl/day for the period 2022-2040.
- The resultant marginal breakeven price of the last project needed to satisfy demand is shown on the y-axis.
  - In the example shown in Figure 1, the marginal breakeven price for APS is \$42/bbl, using a 15% IRR.
- Those higher-cost projects that are not identified as being inside the scenario – i.e. those that have a breakeven price higher than the marginal breakeven price are considered as incompatible, or "outside", that scenario.

---

<sup>2</sup> Carbon Tracker, *Paris Maligned* (December 2022). Available at: <https://carbontracker.org/reports/paris-maligned/>

FIGURE 1. ILLUSTRATIVE COST CURVE FOR GLOBAL OIL PROJECTS



Source: Adapted from *Paris Maligned*, Carbon Tracker

Notes: Cost curve is illustrative, and should not be used to read volume or breakeven price information for individual scenarios.

This modelling forms the basis of three of the four indicators within the benchmark. Further details is given below, which complements the details shown within the indicator table.

### INDICATOR 1: RECENT INVESTMENTS – Compatibility of the company's recent upstream oil and gas investment with a Paris-aligned pathway

To assess the compatibility of recent upstream investments with a given scenario, the breakeven price of the marginal project required to satisfy demand under that scenario is used as a threshold price to assess the previous year's investments – in the example shown in Figure 1 that price is \$42/bbl. As per the details in the indicator table, the CapEx associated with projects that are assessed as incompatible with a given scenario is aggregated by company, expressed both in absolute terms, and as a proportion of overall capex.

## INDICATOR 2: FUTURE INVESTMENTS – Compatibility of the company’s potential future investment on new upstream oil and gas projects with a Paris-aligned pathway

To assess the degree of alignment of a specific company’s potential investment plans, the proportion of capital associated with project options assessed as incompatible with a given scenario is expressed as a percentage of capital associated with all projects which would go ahead under a business-as-usual scenario (STEPS). In the example shown in Figure 1, those projects with a breakeven price of \$42/bbl or lower are assessed as not incompatible with APS, and those with a breakeven price greater than \$42/bbl are assessed as incompatible with APS.

To derive an overall figure for the % of a company’s potential portfolio that is incompatible with a given scenario, the CapEx associated with projects that are assessed as incompatible is aggregated and compared to the potential business-as-usual projects – see the equation that follows.

$$\% \text{ of CapEx incompatible with APS} = \frac{\text{CapEx associated with projects that are incompatible with APS}}{\text{total CapEx with projects that are compatible with STEPS (the business-as-usual scenario)}}$$

A company with a higher % of business-as-usual CapEx associated with projects that fall outside a given scenario is relatively more exposed to transition risk than its peers, as a greater proportion of assets potentially at risk of stranding if developed. The higher the number, the less aligned the company’s potential projects with the scenario, and the greater the stranded asset risk.

### Additional notes to the least cost methodology

#### A note on NZE and its changing definition

Projects with a breakeven price of greater than that of the breakeven price of the marginal project needed to satisfy STEPS demand (c.\$60/bbl in the example) are excluded. Over the past decade oil & gas companies have refocused on value rather than growth, and some projects are now seen as less likely than they might have been previously. High-cost projects have therefore been excluded by reference to STEPS, the IEA’s central scenario that assumes no further climate policy developments beyond those already enacted or announced and is consistent with a global temperature rise of 2.5°C with a 50% probability.

Any high-cost projects above the level required in this scenario have been assumed not to go ahead and therefore excluded from this analysis. This approach in effect assumes that companies are already aligned with the STEPS scenario and our modelling therefore focuses on the “surprise” or “misread” of demand levels under the APS or the NZE. This shows the capital at risk if companies collectively (but not necessarily consciously) invest to deliver STEPS demand but are caught out by a lower level of demand.



**Focus on relative project positioning rather than the implicit absolute level of the oil or gas price.** We stress that for climate constrained scenario analyses the relative positioning of projects (and relative differences between companies) are more important than the absolute level of the marginal oil or gas price. As we have seen in recent years, the supply curve can move up and down, which would affect the marginal price, but not necessarily the order of whether projects are relatively high cost or low cost compared to each other.

Similarly, while companies may contend that their projects are lower cost than the estimates in our data, the key is not the absolute cost level of those projects (even assuming an “apples-with-apples” basis of cost estimates for comparison) but where they stand relative to competitors. Not all companies can be winners; by using a third party, global database, enable projects to be compared on a similar basis, and hence derive relative company transition risk.

**Market segmentation.** Oil is reasonably approximated as a global market. Natural gas demand markets are highly regionalized with transport primarily happening by pipeline with LNG capacity more limited – we match supply and demand separately within five markets (Europe, North America, Russia, Australia, and the rest of the world) instead. LNG markets are assumed to be global; for these projects, we match supply against the IEA’s LNG trade demand figures.

**Supply curve data.** Our least cost modelling is based on the global supply cost curve with underlying asset and project level data from Rystad Energy Group’s UCube database<sup>3</sup> that covers more than 85,000 oil & gas assets owned by 3,000+ companies globally. We publish results for approx. 60-70 of the largest listed companies included in S&P Global Energy Index (sub-categories – Integrated and Exploration & Production) plus select Climate Action 100+ companies, along with extended discussion and commentary of industry and company results.

**15% hurdle rate.** Each company’s results are derived from a full market supply curve showing the amount of potential production (including uncommercial assets) at each level of production cost. The measure of cost we use here is the breakeven price – the oil or gas price needed for each individual project’s future cash flows to yield a NPV = 0 with a given discount rate of 15%. Alternatively, these could be seen as the oil or gas prices that give each project an internal rate of return (IRR) of 15%, an approximation of a minimum return required to justify sanction given risks such as cost overruns and delays, and the need to provide a minimum return to investors.

For further discussion about Carbon Tracker’s methodology, please see [www.carbontracker.org](http://www.carbontracker.org) and most recent oil & gas CapEx and climate – ‘[Paris Maligned](#)’, Carbon Tracker (2022).

### **Oil & Gas**

- [2 Degrees of Separation, Transition risk for oil and gas in a low carbon world, 2017](#)
- [2 Degrees of Separation, Company-level transition risks, 2018](#)
- [Breaking the Habit, 2019](#)
- [Fault Lines, 2020](#)
- [Adapt to Survive, 2021](#)
- [Paris Maligned’, 2022](#)

---

<sup>3</sup> See more information on <https://www.rystadenergy.com/energy-themes/oil--gas/upstream/u-cube/>

## Disclaimer

Carbon Tracker is a non-profit company set up to produce new thinking on climate risk. The organisation is funded by a range of European and American foundations. Carbon Tracker is not an investment adviser and makes no representation regarding the advisability of investing in any particular company or investment fund or other vehicle. A decision to invest in any such investment fund or other entity should not be made in reliance on any of the statements set forth in this publication. While the organisations have obtained information believed to be reliable, they shall not be liable for any claims or losses of any nature in connection with information contained in this document, including but not limited to, lost profits or punitive or consequential damages. The information used to compile this report has been collected from a number of sources in the public domain and from Carbon Tracker licensors. Some of its content may be proprietary and belong to Carbon Tracker or its licensors. The information contained in this research report does not constitute an offer to sell securities or the solicitation of an offer to buy, or recommendation for investment in, any securities within any jurisdiction. The information is not intended as financial advice. This research report provides general information only. The information and opinions constitute a judgment as at the date indicated and are subject to change without notice. The information may therefore not be accurate or current. The information and opinions contained in this report have been compiled or arrived at from sources believed to be reliable and in good faith, but no representation or warranty, express or implied, is made by Carbon Tracker as to their accuracy, completeness or correctness and Carbon Tracker does also not warrant that the information is up-to-date.

To know more please visit:

**[www.carbontracker.org](http://www.carbontracker.org)**

[@carbonbubble](https://twitter.com/carbonbubble)