OIL AND GAS COMPANIES' CLIMATE STRATEGY

METHODOLOGY

To help financial institutions navigate oil and gas integrated companies' climate strategies, Reclaim Finance selected key indicators to look at when assessing the climate credibility of a company's business plans. You can find the publication in the assessment of oil and gas companies' climate strategy section of Reclaim Finance's website.

This methodological note aims to provide readers with detailed pieces of information about how these indicators have been computed.

For more details on specific financial and technical terms used by the companies, find out our glossary.

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Scope of our analysis

Reclaim Finance analyzed the current strategy and climate targets of the top 8 publicly listed integrated oil and gas companies from Europe and the United States, and the top 4 National Oil Companies worldwide selected on the 2023 oil and gas short-term expansion plans criteria according to the 2023 Global Oil and Gas Exit List (GOGEL).[1]

Companies included are the following:

- 6 European oil and gas companies: **BP, Eni, Equinor, Repsol, Shell and TotalEnergies**;
- 2 US oil and gas companies: **Chevron and ExxonMobil;**
- 4 National Oil Companies (NOC): **Abu Dhabi National Oil Company (ADNOC), Petróleo Brasileiro S.A (Petrobras), QatarEnergy and Saudi Arabian Oil Company (Saudi Aramco).**[2]

Indicators selection

We focused our analysis on indicators with a 2030 horizon as in the Paris agreement, to limit global change to 1.5°C, greenhouse gas emissions must decline by at least 43% by 2030.[3]

Moreover, short-term commitments are more credible as they need immediate action plans and adequate strategy.

To assess each company's climate strategy, Reclaim Finance selected a set of indicators to comprehend company's climate strategy. The research focused on each company's investment strategy, its fossil fuel expansion plans, its oil, gas and LNG future production and capacity, as well as its diversification plan into other energies, primarily renewable power.

[1] Urgewald, Global oil and gas exit list, 2023.
[2] While being among the top oil and gas developers in terms of short-term expansion plan in the global oil and gas exit list, Gazprom is not included in our research due to its lack of transparency on most indicators selected in our research.
[3] UNFCC, The Paris agreement, 2016

Data sources

Our research analyses climate strategies based on companies' own reporting and commitments. Therefore, our research was primarily based on publicly available company's sustainability reports, annual reports, 10-K, 20-F and 10-Q SEC filings, investor presentations and corporate plans.

Additionally, we computed production data and projections from the database Rystad Energy[4] and Liquified Natural Gas data from Enerdata database[5] and the GOGEL.[6]

Companies' data and projections were analyzed, comparing it to the International Energy Agency (IEA) Net Zero Emissions by 2050 scenario (NZE) updated in the 2023 World Energy Outlook (WEO).

[4] Rystad Energy, 2024
[5] Enerdata, 2024
[6] Urgewald, Global oil and gas exit list, 2023

Current energy production

Ratio of renewable and fossil energy production and energy mix in 2023

As climate strategy shows a trajectory, we looked in a first step at the current energy mix of the companies. To that purpose, research through companies' documents was conducted to retrieve fossil fuel production and renewable development in 2023. We also looked at the companies' diversification in other energy sources and capacities: bioenergy (Sustainable aviation fuels (SAF), biofuel, biomethane, biogas), hydrogen and gas power.

These data have then been computed in different ways on a company-per-company basis, depending on the available information. The different steps of the calculation are described below.

Step 1. Estimating fossil fuel production in 2023

We look at companies' production for oil and gas production.

Calculations can be found in our data set, available for download.

Step 2. Estimating companies' renewable power production

When disclosed, renewable power production was taken from companies' reporting.

When undisclosed, renewable power production was calculated using installed renewable capacities. As renewable energy is intermittent, their output can depend on weather or network conditions. It is possible to measure how much they produce over time, as compared to what they would produce would they be running 24/7 at full power: this is the **capacity factor**. As of 2018, this typically ranges from 10 to 21% for photovoltaic power, from 23 to 44% for onshore wind power, and from 29 to 52% for offshore wind power.[7]

Short of knowing which technology companies exploit, we calculated an average capacity factor. To that purpose, we referred to IEA[8] to estimate the relative importance of different renewable technologies across this sector, and calculated the capacity-weighted average capacity factor, that is:

$$\frac{\sum_{technologies} Capacity\ Factor\ \times Total\ Capacity}{\sum_{technologies} Total\ Capacity}$$

This average capacity factor then needs to be applied to the maximum theoretical generation of the renewable capacity, would it run 24 hours per day, 365.25 days per year:

$$Max\ Theoretical\ Generation = Renewable\ Capacity\ \times 24\ \times 365.25$$

We can then estimate the average annual generation from companies' renewable capacity targets as follow:

$$Avg\ Renewable\ Generation = Avg\ Capacity\ Factor\ \times Max\ Theoretical\ Generation$$

[7] IEA Average annual capacity factors by technology, 2018
[8] IEA Renewable 2020 Data Explorer

Step 3. Estimating companies' hydrogen production

This calculation is similar to the one made for renewables, but with a single production technology. As it is impossible to precisely know the end-use of the hydrogen produced, it is assumed that all hydrogen is used in the power sector.

To determine the generated electricity from the power of a given hydrogen production capacity for a full year of functioning, we calculate the maximum theoretical generation of this hydrogen capacity, would it run 24 hours per day, 365.25 days per year (similar calculation as for renewable energy):

$$Max\ Theoretical\ Generation = Hydrogen\ Capacity\ \times 24\ \times 365.25$$

Hydrogen capacity does not always deliver energy continuously: this may be due to variations in the energy source from which it is produced (for example, if it is an intermittent energy source), to variations in electricity demand that would reduce the need to use hydrogen capacity, or to maintenance operations. So, to determine the energy generated by this hydrogen capacity, we use a capacity factor, which accounts for the variations in utilization of this capacity over time mentioned above: to that purpose, we referred to the IEA's assumption for hydrogen capacity using electricity from the grid.[9] Hence (similar calculation as for renewable energy):

$$Energy\ delivered = Capacity\ Factor \times Max\ Theoretical\ Generation$$

Step 4. Estimating companies' gas power production

We look in the company's reportings for the gas power plants electricity production in 2023.

Step 5. Estimating companies' bioenergy production

To convert biomethane and biogas data into energetical values, we use the IEA unit converter tool.[10]

For biofuels, to convert input data into energetical values, we need to determine the amount of energy contained in each mass of biofuel, that is the specific energy conversion factor (SECF). Short of knowing which exact biofuel every company produce, we assume that the biofuel market is mostly be split between ethanol (60% of the total global production of biofuels), biodiesel (27% of the total global production of biofuels) and renewable diesel (13% of the total global production of biofuels), as projected by the IEA for 2026.[11] Then, using the specific energy conversion factors (SECFs) for ethanol,[12] biodiesel[13] and renewable diesel,[14] we calculate the average specific conversion factor for biofuels as follows:

$$SECF_{Biofuels} = SECF_{Ethanol} \times 0{,}6 + SECF_{Biodiesel} \times 0{,}27 + SECF_{renewable\ diesel} \times\ 0{,}13$$

[9] https://www.iea.org/data-and-statistics/data-product/hydrogen-production-and-infrastructure-projects-database

[10] https://www.iea.org/data-and-statistics/data-tools/unit-converter

[11] https://iea.blob.core.windows.net/assets/5ae32253-7409-4f9a-a91d-1493ffb9777a/Renewables2021-Analysisandforecastto2026.pdf page 93

[12] https://www.iea-amf.org/content/fuel_information/ethanol/e10/ethanol_properties#energy_content from Owen, 1995

[13] https://www.iea-amf.org/content/fuel_information/fatty_acid_esters/properties from Murtonen et al. 2009 and Rantanen et al. 2005

[14] Kumar et al, 2022 https://www.sciencedirect.com/science/article/abs/pii/S2213138821008420

Step 6. Comparing fossil fuel production and renewable and hydrogen production

Most of current renewable energy sources[15] as well as hydrogen capacities and gas power plants produce electricity, a form of energy directly usable by the final user, also called final energy. Each megawatt hour (MWh) produced and sent onto the grid is consumed on the other end by a client and suffers little transmission losses.

On the other hand, oil and gas products need to undergo combustion to deliver energy for the final user, or client. This process of combustion comes with significant efficiency losses. Hence, when consumed, energy contained in oil and gas products leads to final energy and energy losses. This energy contained in oil and gas products is also called primary energy. In other words, primary energy is a source of final energy, but not all of it can be turned that way.

To be comparable, it is then necessary to express production from both sources either in primary or final energy. To that purpose, we used the fossil fuel equivalence method:[16] energy produced from renewable electricity sources and hydrogen capacities is multiplied by a coefficient leading to the equivalent primary energy that would have been needed if this electricity came from thermal generation. This coefficient depends on current thermal power plant's efficiency; we referred to the 2022 BP's Statistical Review of World Energy to source the most recent thermal efficiency factor and conduct our calculations.[17]

The primary energy equivalent of renewable, hydrogen capacities and gas power plant generation is given by:

$$Renewable/Hydrogen/Gas\ power\ primary\ energy\ equivalent = \frac{Avg\ Renewable/Hydgrogen\ Capacities\ Generation/Gas\ Power\ Plant\ Generation}{Thermal\ efficiency\ factor}$$

Processing the data available for each company using the above methodology enables us to calculate some key indicators detailed below.

Ratio of renewable production to fossil fuel production in 2023

For the companies that do not disclose information about all energy sources they produce, we compute the ratio between renewable production and fossil fuel production. It is calculated based on the fossil fuel equivalent of companies forecasted renewable production, and on the companies' fossil fuel production plans, as follow:

$$X = \frac{Renewable\ primary\ energy\ equivalent}{Fossil\ fuel\ production}$$

[15] These renewable energies make the bulk of today's renewable energy as per [IEA Renewable 2020 Data Explorer]
[16] https://www.eia.gov/todayinenergy/detail.php?id=41013
[17] https://www.connaissancedesenergies.org/sites/default/files/pdf-actualites/bp-stats-review-2021-full-report.pdf

Energy mix in 2023

For the companies that disclose information about all energy sources they produce, we compute the 2023 energy mix of the company, using the companies forecasted fossil fuel equivalent renewable and hydrogen production, bioenergy production, gas power energy production and the companies' fossil fuel production plans. If an energy source is never mentioned in the company's documents, we assume that its share of the company's energy mix will be zero.

Hence, for each energy source, we compute the following:

$$Share\ of\ the\ energy\ source = \frac{Energy\ produced\ from\ this\ source\ (expressed\ in\ primary\ energy\ equivalent)\ in\ 2023}{Total\ primary\ energy\ production\ in\ 2023}$$

Cash-flow allocation

A company's future business model and greenhouse gas (GHG) emissions depend on its cash flow allocation. Past, current, and future investment directly impact the companies' future energy production and associated emissions.

The following indicators have been selected to analyze a company's cash-flow allocation.

Exploration Capital Expenditure

This is the Capital Expenditure (CAPEX) of a company for oil & gas exploration, which is the very first step in the life cycle of an asset.

At that time, the company is looking for potential new oil and gas fields. According to the IEA's NZE,[18] no new oil and gas upstream project should be sanctioned for development. New exploration – which purpose is precisely to find new oil and gas fields to develop – is not necessary to respond to the NZE long-term energy demand.

This indicator is taken from the 2023 Global Oil and Gas Exit List and is the 3-years average of companies' exploration CAPEX over 2021 – 2023.

Past cash-flow analysis

Previous year cash-flows analysis is conducted using the Annual reports or 20-F reports for the European companies, and 10-K reports for the North American companies. As privately-owned companies, NOC do not have the same mandatory reporting as the European and US listed oil and gas companies. Therefore, we lack information to analyze NOC's former cash-flow.

Past CAPEX[19] allocation of a company is indicative of activities it is developing. Depending on each company's transparency, CAPEX may be ventilated between different activities such as renewables or "low carbon" CAPEX, upstream CAPEX, other Oil and Gas CAPEX, and other CAPEX.

[18] International Energy Agency, *World Energy Outlook*, 2023
[19] Find out financial definition in the glossary.

Oil and gas to renewable or "low carbon" capital expenditure ratio

The future energy mix and GHG emissions of a company are determined by its current energy mix and its investment strategy.

Since the NZE scenario requires that no new oil and gas projects be developed, CAPEX in the oil and gas sector for the maintenance of existing projects remains possible whereas growth CAPEX for the development of new fossil projects is not. These CAPEX should be fully invested in renewable energies to meet future energy needs while limiting global warming.

Declaration on companies' past CAPEX use and companies' "low carbon" definition:

BP. BP details organic and inorganic CAPEX per business line. Renewable energy investments are included in "low carbon energy" business line that also includes low-carbon electricity, bioenergy, electrification, future mobility solutions, CCUS, hydrogen and "low carbon" trading.[20]

ENI. Eni details organic CAPEX per business line. Renewable energy investments are included in "Plenitude" business line that also includes retail, sustainable mobility and hydrogen investments as well as research in bioenergy, biochemistry and magnetic fusion.[21]

Equinor. Equinor details organic and inorganic CAPEX per business line. Renewable energy investments are included in "Renewables and Low Carbon Solution" business line that also includes CCUS, hydrogen from gas and oil and gas platforms electrification.[22]

Repsol. Repsol details operating investments per business line. Renewable energy investments are reported separately.[23]

Shell. Shell details cash CAPEX per business line. Renewable energy investments are included in "Renewables & Energy solutions" business line that also includes power generation, trading and supply, hydrogen, carbon credits and nature-based solutions.[24]

TotalEnergies. TotalEnergies details net investments per business line. Renewable energy investments are included in "Integrated Power" business line that also includes gas power.[25]

Chevron. Chevron details capital and exploratory expenditures per business line.[26]

ExxonMobil. ExxonMobil details Capital and exploration expenditures per business line.[27]

ADNOC. The company does not detail its CAPEX per Business Line.

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[20] https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/investors/bp-annual-report-and-form-20f-2023.pdf
[21] https://www.eni.com/content/dam/enicom/documents/eng/investor/presentations/2023/Plenitude-Market-Presentation.pdf
[22] https://cdn.equinor.com/files/h61q9gi9/global/a2c8355cfbd95a967441e33e0f77a1ce950e188f.pdf?2023-annual-report-equinor.pdf
[23] https://www.repsol.com/content/dam/repsol-corporate/en_gb/accionistas-e-inversores/informes-anuales/2023/integrated-management-report-2023.pdf
[24] https://reports.shell.com/annual-report/2023/_assets/downloads/shell-annual-report-2023.pdf
[25] https://totalenergies.com/system/files/documents/2024-03/totalenergies_document-enregistrement-universel-2023_2023_fr_pdf.pdf
[26] https://www.chevron.com/-/media/chevron/annual-report/2023/documents/2023-Annual-Report.pdf
[27]https://d1io3yog0oux5.cloudfront.net/_477aed56f20f51c63da352b29958d6aa/exxonmobil/db/2301/22254/annual_report/2023+ExxonMobil+Annual+Report.pdf

Petrobras. The company details its CAPEX per Business Line***.*** Sustainable energy CAPEX is included and detailed in Research & Development CAPEX.[28]

QatarEnergy. The company does not detail its CAPEX per Business Line.

Saudi Aramco. The company details its CAPEX per Business Line***.*** Sustainable energy is included in the downstream business line.[29]

Using reported data, we are able to compare investments in oil and gas and investments in renewables or "low carbon" activities.

$$Oil\ and\ gas\ to\ low\ carbon\ CAPEX\ ratio\ (in\ \%) = \frac{Upstream\ CAPEX + Other\ oil\ and\ gas\ CAPEX}{Renewable\ or\ "Low\ carbon"\ CAPEX} - 1$$

[28] https://api.mziq.com/mzfilemanager/v2/d/25fdf098-34f5-4608-b7fa-17d60b2de47d/b2e96d86-d0ae-1bfc-2bf7-df71f274a81d?origin=1

[29] https://www.aramco.com/-/media/publications/corporate-reports/annual-reports/saudi-aramco-ara-2023-english.pdf page 51

Shareholder distribution to renewable or "low carbon" capital expenditure ratios

Shareholder distributions are capital outflows for the company. By distributing cash to shareholders, companies' cash that can be allocated to renewable energy decrease.

Distribution to shareholders is the sum of dividends and share buybacks, net of share issuance.

$$Shareholder\ distribution\ to\ renewable\ or\ low\ carbon\ CAPEX\ ratio\ (in\ \%) = \frac{Dividends + net\ share\ buybacks}{Renewable\ or\ Low\ carbon\ CAPEX} - 1$$

Capital Expenditure plan

As for past CAPEX, near-term CAPEX allocation of a company is indicative of activities it is aiming to develop. Depending on each company's transparency, CAPEX may be ventilated between renewables or "low carbon" CAPEX, upstream CAPEX, other Oil and Gas CAPEX, and other CAPEX.

Too low shares of CAPEX allocations for renewable or "low carbon" indicate too slow transitions toward a more sustainable energy system, but also indicate high shares of CAPEX allocation toward fossil activities at a time where fossil production should decrease. The IEA established that oil and gas companies must allocate more than 50% of their CAPEX in clean energy by 2030.[30]

This indicator comes directly from companies' public documents.

Declaration on companies' CAPEX reportings:

BP. BP details 2024-2030 CAPEX plan with CAPEX dedicated to low carbon solutions.[31]

ENI. Eni details 2024-2027 CAPEX plan with CAPEX dedicated to renewables.[32]

Equinor. Equinor details 2025 and 2030 gross CAPEX share dedicated to renewable and low carbon solutions.[33]

Repsol. Repsol details 2024-2027 CAPEX plan with CAPEX dedicated to low carbon generation.[34]

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[30] International Energy Agency, The Oil and Gas Industry in Net Zero Transitions, page 144, 2023.
[31] https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/investors/bp-investor-update-2023-plenary.pdf
[32] https://www.eni.com/content/dam/enicom/documents/eng/investor/presentations/2024/2024-capital-markets-update/2024-capital-markets-update.pdf
[33] https://cdn.equinor.com/files/h61q9gi9/global/5c3c9f754cb6d92d7de289381a8f9da86a5eb6b7.pdf?q4-2023-and-cmu-2024-all-presentations-incl-appendices-equinor.pdf
[34] https://www.repsol.com/content/dam/repsol-corporate/en_gb/accionistas-e-inversores/cnmv/2024/ii22022024-results-presentation-fourth-quarter-full-year-2023-strategic-update-2024-2027.pdf

Shell. Shell details 2023-2025 CAPEX plan with CAPEX dedicated to renewable and energy solutions.[35]

TotalEnergies. TotalEnergies details 2024-2028 CAPEX plan. TotalEnergies details its CAPEX dedicated to "integrated power" and "new molecules" that includes renewable power, gas power, hydrogen, bioenergy. The share of growth CAPEX in oil and gas have been reported in the company's last sustainability report.[36]

Chevron. Chevron details 2023-2027 CAPEX plan. No CAPEX is reported in renewable energy.[37]

ExxonMobil. ExxonMobil details 2022-2027 CAPEX plan. No CAPEX is reported in renewable energy.[38]

ADNOC. ADNOC details 2023-2027 CAPEX. CAPEX dedicated to "low-carbon solutions and new energies" is published.[39]

Petrobras. The company details its 2023-2027 CAPEX plan per Business Line**.** No CAPEX are reported in renewable energy.[40]

QatarEnergy. The company does not detail its 2021-2025 CAPEX plan in its reportings.

Saudi Aramco. The company does not detail its CAPEX plan in its reportings.

[35] https://www.shell.com/investors/investor-presentations/_jcr_content/root/main/section_1139236432/text/links/item0.stream/1711542445625/f5c821a0488d7d3773dfc34e2e88a0fd898378c7/annual-esg-update-slide-deck-2024.pdf
[36] https://totalenergies.com/system/files/documents/2024-03/totalenergies_sustainability-climate-2024-progress-report_2024_fr_pdf.pdf
[37] https://chevroncorp.gcs-web.com/static-files/733c80ae-1571-49cf-9199-99e3b3d56da6
[38] https://corporate.exxonmobil.com/-/media/global/files/investor-relations/corporate-plan-update/2022/2022-corporate-plan-update-presentation-slides.pdf?la=en&hash=63B0F3583F26C71850CC185897EDE3885AC81E56
[39] https://www.adnoc.ae for low carbon CAPEX, https://adnocgas.ae/en/investor-relations/investment-case for total investments
[40] Petrobras 2022 annual report and sustainability report.

Fossil Fuel Strategy

To keep within carbon budgets compatible with climate requirements, companies not only need to reduce the carbon intensity of the energy products they sell, but also to decrease their energy production as per the reference scenario they chose to use. To that purpose, expansion should stop immediately in a 1.5°C scenario, as stressed by the IEA in its NZE.

The following indicators have been selected to analyze a company's fossil fuel strategy.

Upstream expansion plans

The NZE projects a halt to the development of any new oil and gas fields for which a Final Investment Decision (FID) was not approved by January 1st, 2022, plus an end to the construction of LNG terminals.

Oil and gas resources

Companies' assets[41] fall into three main categories:

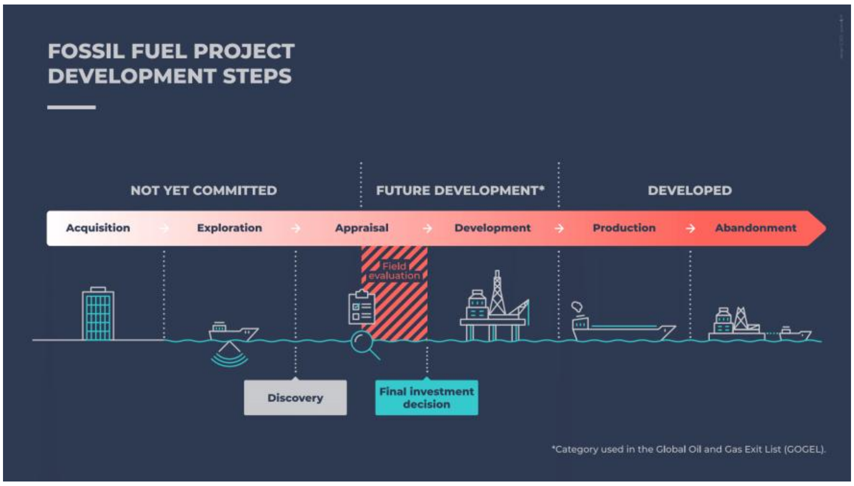
- Not yet committed:
    - Undiscovered: these assets relate to geological formation that may contain oil and gas, but that have not been explored yet.
    - Discovered: these assets relate to oil and gas fields that have been subject to a preliminary assessment, but for which no significant development investment has been made. These assets could eventually be developed, but no strategic or financial commitment has been made yet.
- Future Development, or short-term expansion: these assets relate to oil and gas fields that have been subject to further assessment and significant investment to plan for their development, or to develop them. These assets are highly likely to be developed to avoid financial losses.
- Developed: these assets relate to oil and gas fields that have already been developed and are currently producing.

Resources data were extracted from Rystad Energy UCube. Extraction date is reported in each briefing.[42]

[41] Resources, expressed in millions of barrels of oil equivalent, are a metric like Reserves. The difference lies in the fact that reserves estimate the current potential of assets, while resources also account for additional volumes that could be extracted over assets' lifetime, due to "future upside unlocked through technical revisions, improved recovery, etc." Resources is a metric computed by Rystad Energy.

[42] Production data extracted from Rystad covers production of crude oil, condensate, NGLs and gas. Contributions from minority interests are included and government entitlement to production is removed.

Graph 1. Fossil fuel projects development steps



Source: Urgewald, *Global Oil and Gas Exit List*

Despite the need in the NZE to end new oil and gas developments, companies are still engaging in expansion and even exploration activities.

This is reflected in our analysis through a set of indicators presented below.

Under production resources: This is the total amount of hydrocarbon resources still in the ground from assets that are currently producing.

Under development or field evaluation resources: This is the total amount of hydrocarbon resources from assets that are either under development or ongoing field evaluation. These assets are highly likely to enter production soon.

Discovered resources: Companies hold portfolios of discovered assets that could eventually be developed. This provides an indication of how much more resources companies could develop.

Resources are represented in million barrels of oil equivalent (mmboe) and in number of years of production, using its last year production level as a reference. Previous year production levels are taken from company reports when they are published by the company, or from Rystad Energy when they are not.

The number of years of production from under development or field evaluation resources is calculated with the following formula:

$$\text{Number of years of production from under development and evaluation resources} = \frac{\text{Under development resources} + \text{Under field evaluation resources}}{\text{last year production}}$$

Oil and gas expansion ranking

Company rankings among oil and gas developers and the percentage of oil and gas expansion plans in global expansion are extracted from the Global Oil and Gas Exit List 2023, using parent companies' "Resources under Development and Field Evaluation as of September 2023" data.

Short-term expansion plans unaligned with the NZE

Data are extracted from the parent companies' "Resources under Development and Field Evaluation as of September 2023" data in the 2023 Global Oil and Gas Exit List.

Share of a company's short-term expansion, which is not aligned with the IEA's NZE published in 2021 and updated in 2022 and 2023, comes from the "1.5°C Expansion Overshoot based on IEA NZE (2021/2022)" data in the 2023 Global Oil and Gas Exit List. For non-shale assets, this overshoot includes all non-producing assets, which were approved for development after December 31, 2021, or are currently in the process of being approved (field evaluation). For shale assets, this overshoot includes all expansion beyond Drilled but Uncompleted Wells (DUCs). According to the model assumptions of the NZE scenario (2021/2022), the resources depicted in this column exceed the IEA-modeled oil & gas demand in a 1.5°C world. Therefore, the underlying assets are at risk of becoming stranded and represent severe transition risk.

Upstream production

Oil and gas production should decrease globally by 20.9% and 17.9%, respectively, between 2022 and 2030 according to the NZE. While the relative production decrease may slightly differ depending on each company, the NZE also projects that no new fields must enter into production except the ones approved before January 1st, 2022.

Forecasted 2030 production levels

This indicator shows the evolution of oil and gas production by 2030, using different forecasts:

- Production from fields sanctioned under the IEA NZE scenario is computed using Rystad Energy UCube: it is the aggregate of future oil and gas production[43] from fields currently under production, under development, or under field evaluation, and that obtained their Final Investment Decision before 2022 as defined in the NZE.
- Production from fields unsanctioned under the NZE is computed using Rystad Energy UCube: it is the aggregate of future oil and gas production[44] from fields currently under production, under development, or under field evaluation, and that did not obtain their Final Investment Decision before 2022.
- Company production targets are provided by the companies in their financial reports, investor presentations or sustainability reports. For companies only publishing production capacity targets, the indicator calculation was based on capacity rather than actual production.

$$Target\ based\ production\ overshoot = \frac{Company's\ 2030\ production\ target}{Production\ from\ fields\ that\ obtained\ their\ FID\ before\ 2022} - 1$$

$$Target\ based\ production\ overshoot\ at\ full\ capacity = \frac{Company's\ 2030\ production\ capacity\ target}{Production\ from\ fields\ that\ obtained\ the\ FID\ before\ 2022} - 1$$

Companies' production forecasts declaration:

BP. The company announced it "anticipates its oil and gas production will be around 2.3 million barrels of oil equivalent a day (mmboe/d) in 2025 and aims for it to be around 2.0 mmboe/d in 2030. This 2030 production would be around 25% lower than bp's production in 2019, excluding production from Rosneft".[45]

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[43] To do these forecast, Rystad Energy UCube runs algorithms that takes as input characteristics of assets such as their location, their physical characteristics, and their content, to determine their outputs such as their net present value, their starting date, and their production profile.

[44] To do these forecast, Rystad Energy UCube runs algorithms that takes as input characteristics of assets such as their location, their physical characteristics, and their content, to determine their outputs such as their net present value, their starting date, and their production profile.

[45] https://www.bp.com/en/global/corporate/news-and-insights/press-releases/4q-2022-update-on-strategic-progress.html

ENI. The company declared its underlying production will grow up by 3 to 4% per year to 2027, while its reported production will rise by 2% per year to 2027.[46]

Equinor. The company declared on its Capital Market Day, on the 15th of June 2021, that "over the next years, our oil and gas production will grow before expected to return to around same level as for 2020 in 2030."

Repsol. The company announced a production level of around 550-600 kboe/d over 2024 – 2027,[47] but also stated it will be "maintaining production level in 2025-2030".[48]

Shell. The company announced its oil production will remain stable by 2030.[49] At the same time, it anticipated its gas share of hydrocarbon production to reach 55% by 2030.[50] This enables us to calculate 2030 level of oil production, then to access the 2030 level of gas production using the ratio 45%/55%.

TotalEnergies. The company "plans to grow Oil & Gas production by 2-3 % per year over the next five years, predominantly from LNG".[51]

Chevron. The company aims to increase its production by 3% per year through 2026.[52] To integrate the 2030 production overshoot compared to the company's target, we input the conservative hypothesis that Chevron's production will plateau from 2026 while the company's strategy relies on production increase by 2026 and did not make any comment about a production reduction.

ExxonMobil. The company aims to increase its production to 4.2 mmboe/d in 2027.[53] To integrate the 2030 production overshoot compared to the company's target, we input the conservative hypothesis that ExxonMobil's production will plateau from 2027 while the company's strategy relies on production increase by then and did not make any comment about a production reduction.

ADNOC. The company aims to increase its oil production capacity to 5 mmboe/d in 2027[54] and to rise its gas production capacity to 11 billion cubic feet per day (bcf/d) by 2030.[55] To integrate the 2030 production capacity overshoot compared to the company's target, we input the conservative hypothesis that ADNOC's oil production capacity will plateau from 2027 while the company's strategy relies on production increase by then and did not make any comment about a production reduction.

[46] https://www.eni.com/en-IT/media/press-release/2024/03/PR-2024-capital-markets-update.html
[47] https://www.repsol.com/content/dam/repsol-corporate/en_gb/accionistas-e-inversores/cnmv/2024/ii22022024-results-presentation-fourth-quarter-full-year-2023-strategic-update-2024-2027.pdf
[48] Stepping up the Transition, Driving growth and value, 2020
[49] https://www.shell.com/sustainability/our-climate-target/shell-energy-transition-strategy.html
[50] https://www.shell.com/investors/investor-presentations/2021-investor-presentations/shell-energy-transition-strategy-2021/_jcr_content/par/textimage.stream/1620389862956/ac95286779fb51553cc144afc77f201744c907e0/shell-energy-transition-strategy-2021-presentation.pdf
[51] https://totalenergies.com/media/news/press-releases/strategy-outlook-presentation-2023
[52] https://chevroncorp.gcs-web.com/static-files/5a798840-e083-4339-a83b-f0f565227655
[53] https://corporate.exxonmobil.com/investors/investor-relations/corporate-plan-update
[54] https://www.adnoc.ae/en/ourstrategy/responsible-growth
[55] https://adnocdrilling.ae/en/investor-relations/Investment-Case/Strategy#:~:text=Capitalize%20on%20ADNOC's%20plans%20to%20increase%20crude%20oil%20production%20capacity,per%20day%20of%20unconventional%20gas

Petrobras. The company aims to increase its oil production to 2.5 mmboe/d its gas production to 0.3 mmboe/d by 2027.[56] To integrate the 2030 production overshoot compared to the company's target, we input the conservative hypothesis that Petrobras' production will plateau from 2027 while the company's strategy relies on production increase by then and did not make any comment about a production reduction.

QatarEnergy. The company does not report production nor production capacity targets.

Saudi Aramco. The company aims to increase its oil production capacity to 13 mmboe/d in 2027 and to expand its gas production by 50% by 2030.[57] To integrate the 2030 production capacity overshoot compared to the company's target, we input the conservative hypothesis that Saudi Aramco's oil production capacity will plateau from 2027 while the company's strategy relies on production increase by then and did not make any comment about a production reduction. We also considered that gas production and gas production capacity target were similar.

Overshoot based on companies' plans

The company's 2030 production target is compared to the theoretical production of the company if it followed the IEA NZE scenario. The overshoot is expressed in %:

$$Target\ based\ production\ overshoot\ = \frac{Company's\ 2030\ production\ \ target}{Production\ from\ fields\ that\ obtained\ their\ FID\ before\ 2022} - 1$$

For companies only publishing production capacity targets, the indicator was based on capacity rather than actual production, considering their production reach full capacity.

$$Target\ based\ production\ overshoot\ at\ full\ capacity = \frac{Company's\ 2030\ production\ capacity\ \ target}{Production\ from\ fields\ that\ obtained\ the\ FID\ before\ 2022} - 1$$

Overshoot based on companies' current portfolio

The 2030 company's production trajectory if it produces oil and gas from under production, under development and under field evaluation assets is compared to the production trajectories from fields sanctioned under the IEA NZE scenario.

$$Portfolio\ based\ production\ overshoot\ (in\ \%) = \frac{\begin{array}{c}Company's\ 2030\ production\ \ from\ under\ production,\\ under\ development\ and\ under\ field\ evaluation\ fields\end{array}}{Production\ from\ fields\ that\ obtained\ the\ FID\ before\ 2022} - 1$$

Future production may be impacted by oil and gas expansion, as well as acquisition, sale of oil and gas assets or geopolitical decision such as OPEC's production target.

[56] Petrobras, 2022 20-F Report, p.169
[57] Saudi Aramco, FY 2022 Results Presentation, 2023

Share of oil and gas in the company's 2030 energy mix and in global production

For the share of oil and gas in the company's 2030 energy mix, see the calculation of the 2030 energy mix below. The share of the company's oil and gas production in the global oil and gas production is extracted from the Global Oil and Gas Exit List 2023.

Liquefied Natural Gas

Past and current LNG terminal capacities

Current regasification and liquefaction capacities are calculated using Enerdata LNG database with data extracted at the date indicated in each briefing. The net capacities are calculated using the prorated capacities using company's ownership share of the LNG terminal infrastructures.

Future LNG capacities

Future liquefaction and regasification capacities are calculated using the 2023 Global Oil and Gas Exit List database, updated when companies involved in an LNG terminal published a press release on LNG terminal infrastructures. Infrastructures are classified as operational, under construction and planned. Only infrastructure with a planned commissioned date or FID date were added to the calculation.

Net capacities sanctioned under the NZE are capacities that are operational in 2023. Net capacities sanctioned under the APS are capacities that are operational or under construction in 2023. This threshold relates to the IEA's 2023 WEO that indicates that "*Since natural gas demand peaks in all WEO scenarios by 2030, there is little headroom remaining for either pipeline or LNG trade to grow beyond then. With around 650 bcm of annual liquefaction capacity in operation and a further 250 bcm under construction, global LNG markets look amply supplied in the STEPS until at least 2040. In the APS, LNG demand peaks by 2030 and projects under construction today are sufficient to meet demand. In the NZE Scenario, a global supply glut forms in the mid-2020s and under construction projects are no longer necessary*".[58]

Overshoot based on the companies's current portfolio (as of January 2024):

The 2030 company's production trajectory if it owns liquefaction capacities that are under production, under development or under field evaluation assets is compared to the production trajectories from capacities sanctioned under the IEA NZE and APS scenarios. The overshoot is expressed in %.

For the NZE:

$$Overshoot_{NZE}(in\ \%) = \frac{Operational\ + under\ construction + under\ development\ liquefaction\ capacity}{Operational\ liquefaction\ capacities} - 1$$

For the APS:

$$Overshoot_{APS}(in\ \%) = \frac{Operational\ + under\ construction + under\ development\ liquefaction\ capacity}{Operational + under\ construction\ liquefaction\ capacities} - 1$$

[58] https://iea.blob.core.windows.net/assets/42b23c45-78bc-4482-b0f9-eb826ae2da3d/WorldEnergyOutlook2023.pdf, p.139

Diversification strategy

Forecasted energy production for 2030

Ratio of renewable and fossil energy production and energy mix in 2030

Another indicator we looked at is the future energy mix when the necessary data is available, or the ratio of renewable and fossil energy production in 2030 otherwise. The methodology used for this calculation is similar to that used for the calculation of companies' current energy mix, except that the data used are those of companies' targets up to 2030.

The only methodological difference concerns gas power plant energy generation: if the data on energy production target in 2030 with gas power plants is not available, we determine the company's current and future gas power capacity, using the Global Energy Monitor Tracker.[59] If for every gas plant, the company's precise ownership share is known, we add the prorated capacities of the company's gas plants, otherwise we simply add the capacities of all gas plants in which the company holds a share (in case the second method is used, it is mentioned in the briefing). This calculation does not allow us to calculate the energy production of gas power plants, and therefore does not allow us to calculate the company's energy mix. However, it does provide additional information for estimating a company's involvement in the gas energy sector.

Processing the data available for each company using the above methodology enables us to calculate the following indicators:

Ratio of renewable production to fossil fuel production in 2030

For the companies that do not disclose information about all energy sources they produce, we compute the ratio between renewable production and fossil fuel production. It is calculated based on the fossil fuel equivalent of companies forecasted renewable production, and on the companies' fossil fuel production plans, as follow:

$$Ratio\ of\ renewable\ production\ to\ fossil\ fuel\ production\ in\ 2030 = \frac{Renewable\ primary\ energy\ equivalent}{Fossil\ fuel\ production}$$

Energy mix in 2030

For the companies that disclose information about all energy sources they produce, we compute the 2030 energy mix of the company, using the companies forecasted fossil fuel equivalent renewable and hydrogen production, bioenergy production, gas power plant energy production and the companies' fossil fuel production plans. If an energy source is never mentioned in the company's documents, we assume that its share of the company's 2030 energy mix will be zero. If an energy source is mentioned, but no target is set for 2030, it is assumed that energy production from this source will remain constant until 2030.

[59] https://globalenergymonitor.org/projects/global-oil-gas-plant-tracker/tracker-map/

Hence, for each energy source, we compute the following:

$$Share\ of\ the\ energy\ source = \frac{Energy\ produced\ from\ this\ source\ (expressed\ in\ primary\ energy\ equivalent)\ in\ 2030}{Total\ primary\ energy\ production\ in\ 2030}$$

BP. The company announced a target of 10 gigawatt (GW) of net installed renewable capacity by 2030.[60] Assuming an average capacity factor of 25%,[61] we calculated the average annual electricity generation. Finally, this annual electricity generation has been converted into primary energy using the fossil fuel equivalence method. See Below for more details on this method.

ENI. The company announced a target of 15 GW of renewable capacity by 2030.[62] Assuming an average capacity factor of 25%,[61] we calculated the average annual electricity generation for a renewable capacity. Finally, this annual electricity generation has been converted into primary energy using the fossil fuel equivalence method. See Below for more details on this method.

Equinor. The company announced a target of 15 GW of renewable capacity by 2030 (12 GW of renewables generation and 3 GW of battery storage).[63] Assuming an average capacity factor of 25%,[61] we calculated the average annual electricity generation for a renewable capacity. Finally, this annual electricity generation has been converted into primary energy using the fossil fuel equivalence method. See Below for more details on this method.

Repsol. The company announced a target of 15 to 20 GW of renewable capacity by 2030.[64] Assuming an average capacity factor of 25%,[61] we calculated the average annual electricity generation for a renewable capacity. Finally, this annual electricity generation has been converted into primary energy using the fossil fuel equivalence method. See Below for more details on this method.

Shell. Shell is currently developing 4.1 GW of additional renewable capacity, which will be added to the 2.5 GW of already installed renewable capacity.[65] Assuming that these projects will be carried out, that Shell does not develop additional capacities that would enter in production by 2030, and that Shell will not buy or sell renewable capacities and therefore, Shell will therefore have 6.6 GW renewable capacities in 2030. Assuming an average capacity factor of 25%,[61] we calculated the average annual electricity generation for a renewable capacity. Finally, this annual electricity generation has been converted into primary energy using the fossil fuel equivalence method. See Below for more details on this method.

TotalEnergies. The company announced a target of 100 GW of gross renewable capacity by 2030,[66] that is equivalent to 66 GW net renewable capacity when calculating the share of these capacities owned by Totalenergies. Assuming an average capacity factor of 25%,[61] we calculated the average annual electricity generation for a renewable capacity. Finally, this annual electricity generation has

[60] https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/investors/bp-fourth-quarter-2022-results-presentation-slides-and-script.pdf
[61] Using IEA Average annual capacity factors by technology, 2018; solar ranges from 10% to 21%, onshore wind from 23% to 44%, and offshore wind from 29 to 52%. The average capacity factor has been calculated over technologies according to their relative installed capacity, sourced from IEA Renewable 2020 Data Explorer
[62] https://www.eni.com/en-IT/investors/long-term-plan.html
[63] https://cdn.equinor.com/files/h61q9gi9/global/5c3c9f754cb6d92d7de289381a8f9da86a5eb6b7.pdf?q4-2023-and-cmu-2024-all-presentations-incl-appendices-equinor.pdf p.48
[64] https://www.repsol.com/content/dam/repsol-corporate/en_gb/accionistas-e-inversores/informes-anuales/2023/integrated-management-report-2023.pdf p.76
[65] https://reports.shell.com/annual-report/2023/_assets/downloads/shell-annual-report-2023.pdf p.77
[66] https://totalenergies.com/system/files/documents/2022-03/DEU_21_VA.pdf

been converted into primary energy using the fossil fuel equivalence method. See Below for more details on this method.

Chevron. The company did not announce a renewable capacity target.

ExxonMobil. The company did not announce a renewable capacity target.

ADNOC. Masdar, 24% detained by ADNOC, announced a target of 20 GW of renewable capacity by 2030.[67] That represents a prorated capacity of 4.8 GW for ADNOC. Assuming an average capacity factor of 25%,[61] we calculated the average annual electricity generation for a renewable capacity. Finally, this annual electricity generation has been converted into primary energy using the fossil fuel equivalence method. See Below for more details on this method.

Petrobras. The company did not announce a renewable capacity target.

QatarEnergy. The company announced a target of 3 GW of renewable capacity by 2030.[68] Assuming an average capacity factor of 25%,[61] we calculated the average annual electricity generation for a renewable capacity. Finally, this annual electricity generation has been converted into primary energy using the fossil fuel equivalence method. See Below for more details on this method.

Saudi Aramco. The company announced a target of 3 GW of renewable capacity by 2030.[69] Assuming an average capacity factor of 25%,[61] we calculated the average annual electricity generation for a renewable capacity. Finally, this annual electricity generation has been converted into primary energy using the fossil fuel equivalence method. See Below for more details on this method.

Ratio of a company's energy production from an energy source in 2030 to the global energy production from this energy source in the NZE in 2030

For each company and each energy source, we have calculated the ratio between the company's projected energy production in 2030 using this source, and global energy production in 2030 from this source in the NZE scenario. [70]

[67] https://www.adnoc.ae/en/sustainability-net-zero/growing-our-lower-carbon-solutions/renewables
[68] QatarEnergy, 2022 sustainability report
[69] Saudi Aramco, 2022 sustainability report
[70] https://iea.blob.core.windows.net/assets/86ede39e-4436-42d7-ba2a-edf61467e070/WorldEnergyOutlook2023.pdf p.276

Emission targets

A critical indicator to assess if a company's decarbonization pathway is at the scale required and aligned is whether it fits within the 1.5°C budget. This requires two types of calculations:

- Calculating the allocated carbon budget[71] for the company until 2030 in a 1.5°C pathway, building on sectoral decarbonization pathways provided by the IEA, the IPCC and the Transition Pathway Initiative (TPI) (part A)
- Calculating the projected volumes of absolute carbon emissions each year until 2030 by the company, building on the company's decarbonization targets and energy production volumes.

Why is our approach conservative?

To calculate carbon intensity targets and associated absolute emissions, we had to make hypotheses:

- *(H1) About current emissions: **we assumed the companies' disclosure cover all significant emission sources** as they are expected to do,*
- *(H2) About future emissions: **we assumed the companies will meet their decarbonization targets**, regardless of how likely they are to do so given the means set in place. For instance, some targets are dependent on customer actions and hereby defer part of the target's accomplishment responsibility: it does not show signs of a strong commitment and strategy, but it is still assumed the target will be met.*

Calculating the carbon intensity pathways and absolute carbon emissions

Step 1. Build on IEA's and TPI's decarbonization pathways for the oil and gas sector

We didn't start from scratch. To define decarbonization expectations from the oil and gas sector, we used the two sectoral decarbonization pathway computed by TPI: the "1.5 Degree's scenario";[72] drawing on IEA scenario for CO_2 emissions and energy demand, and on IPCC scenario for methane emissions.[73]

- **What is a decarbonization pathway?** It's a series of year-on-year carbon intensity targets and energy production levels. Carbon intensity is given in gCO2e/MJ, which is the amount of greenhouse gases emitted per megajoule produced. Taken together with the energy production levels, this gives a series of year-on-year absolute carbon emission targets, the magnitude of which depends on the size of the company at the beginning of the timeframe.

- **Why do we need a sectoral decarbonization pathway?** It stems from the fact that emissions and the short-term ability to decarbonize vary across industries. As such, it would not make

[71] Carbon budget refers to the amount of greenhouse gases that can be emitted expressed in CO2 equivalent.
[72] This scenario gives a probability of 50% of holding the global temperature increase to 1.5°C.
[73] https://www.transitionpathwayinitiative.org/publications/96.pdf?type=Publication

sense to ask each economic actor to decrease its emissions at the same rate. Hence, for each sector, a different decarbonization pathway is computed.

- **What kind of data is required to compute a sectoral decarbonization pathway?** It relies on three key inputs:
    - A timeseries for absolute carbon emissions up to 2030, whose total stays below the carbon budget associated with the scenario's global warming limit.
    - A breakdown of this absolute greenhouse gas emission timeseries in between key economic sectors (becomes the numerator of sectoral emissions intensity).
    - Forecasts, for each economic sector, of the timeseries of the sector's activity (becomes the denominator of sectoral emissions intensity).

- **Which data sources did TPI use?** TPI drew on three pathways ("1.5 degrees", "Below 2 degrees", and "National Pledges") computed by the IEA using a least-cost model and different underlying hypotheses.[74] Given that the IEA's pathways look only at carbon emissions and do not take into account other potent greenhouse gases such as methane, TPI factored in methane emissions (by using one of IPCC's Oil and Gas-related methane emissions projections consistent with a 1.5°C global warming, and using a 100-year global warming potential factor of 28).

For our analysis, we focused and sourced the carbon intensity[75] pathways modeled by TPI using the IEA's NZE from November 2022, consistent with keeping global warming respectively below 1.5°C.[76] These scenarios are the **1.5°C reference scenarios** for our analysis. This allowed us, after calculating a company's total GHG emissions, to compare plans to reduce carbon intensity and figure out whether or not these plans are in line with the IEA 1.5°C scenario.

Step 2. Calculate the company's carbon intensity pathway based on its current targets.

All covered companies set targets to reduce their emissions against a base year. Consequently, their carbon intensity is expected to decrease over the years to come. **Our carbon intensity pathway calculations reflect the impact of these pledged reduction targets**.

There are different methodologies to calculate carbon intensity. As the purpose of this analysis is not to put forward one methodology in particular, but to assess the company's pledged decarbonation plan, we used the data disclosed by the company instead of calculating it ourselves.

Companies disclosed their emissions originating from scope 1, 2, and 3, as well as their carbon intensity of sold energy products. Given these companies are essentially energy providers, it is assumed their emissions are mostly related to their energy production[77]. As such, carbon intensity can be split in

[74] The IEA models the path of emissions and the supply of energy in various sectors consuming energy from fossil fuels under key assumptions such as population and economic growth or technology improvement. To figure out where to reduce carbon emissions, IEA models run a least-cost approach: emissions cut are made wherever it is cheaper to make them. The outputs are then cost-effective.

[75] Carbon intensity refers to the greenhouse gasses intensity expressed in CO2 equivalent.
[76] https://www.transitionpathwayinitiative.org/sectors/user_download_all
[77] A less constraining assumption is that the company has the same share of non-energy product related emissions over its base year and 2019.

between contributions prorated to the different scopes' absolute figures. Hence, whenever an emission reduction target applies to:

- Absolute GHG emissions: we compute the future level of absolute GHG emissions for that scope, and the future emission intensity at a future date assuming an energy production growing as in IEA's NZE and APS.
- Carbon intensity: we compute that scope's contribution to the carbon intensity directly.

If a company sets incomplete targets (e.g. some targets are set for some scopes, but not all scopes), we assume that uncovered scopes' contributions of the carbon intensity remain constant from the most recent previous target.

Target scopes can overlap. For instance, one target can cover scope 1+2 while a second one can cover scope 1+2+3, or a target can cover the world while a second one can cover a specific subregion. When two targets with different coverages overlap, we assume that the target with the broader one takes precedence. If two targets have the same coverage, the most ambitious one takes precedence.

For each date for which targets have been set, we compute the impact on carbon intensity scope-by-scope, as described above, then sum them up to calculate overall expected carbon intensity.

Example:

Company A has a carbon intensity of 100gCO2e/MJ, 10 gCO2e/MJ coming from scope 1, 10 gCO2e/MJ from scope 2, and 80 gCO2e/MJ from scope 3.

In 2025, Company A pledged to reduce its scope 1 emission intensity by 20%: the new contribution of scope 1 emissions to the carbon intensity is 8 gCO2e/MJ, leading to a carbon intensity of 8 + 10 + 80 = 98 gCO2e/MJ.

In 2030, Company A pledged to reduce its scope 3 emissions by 50%; the new contribution of scope 3 emissions to the carbon intensity is 40 gCO2e/MJ. Referring to the most recent previous target, scope 1 and scope 2 contributions are respectively 8 and 10 gCO2/MJ. As a result, Company A's pledged carbon intensity for 2030 is 8 + 10 + 40 = 58 gCO2e/MJ.

Five companies, ExxonMobil, ADNOC, Petrobras, QatarEnergy and Saudi Aramco do not give sufficient details on scope 3 emissions and scope 3 decarbonization targets to allow us to calculate their emission intensity.

2030 Carbon intensity excess

We defined the 2030 carbon intensity excess in relative terms:

$$2030\ carbon\ intensity\ excess\ (in\ \%) = \frac{\begin{bmatrix} average\ (Company's\ pledge\ carbon\ intensity) \\ over\ 2023-2030 \end{bmatrix} - \begin{bmatrix} average\ (reference\ scenario\ carbon\ intensity) \\ over\ 2023-2030 \end{bmatrix}}{\begin{matrix} average\ (reference\ scenario\ carbon\ intensity) \\ over\ 2023-2030 \end{matrix}}$$

Reliance on Carbon Capture, Utilization and Storage (CCUS) and Offset mechanisms

<u>Step 1. Calculate the company's GHG emissions using their annual carbon intensity levels.</u>

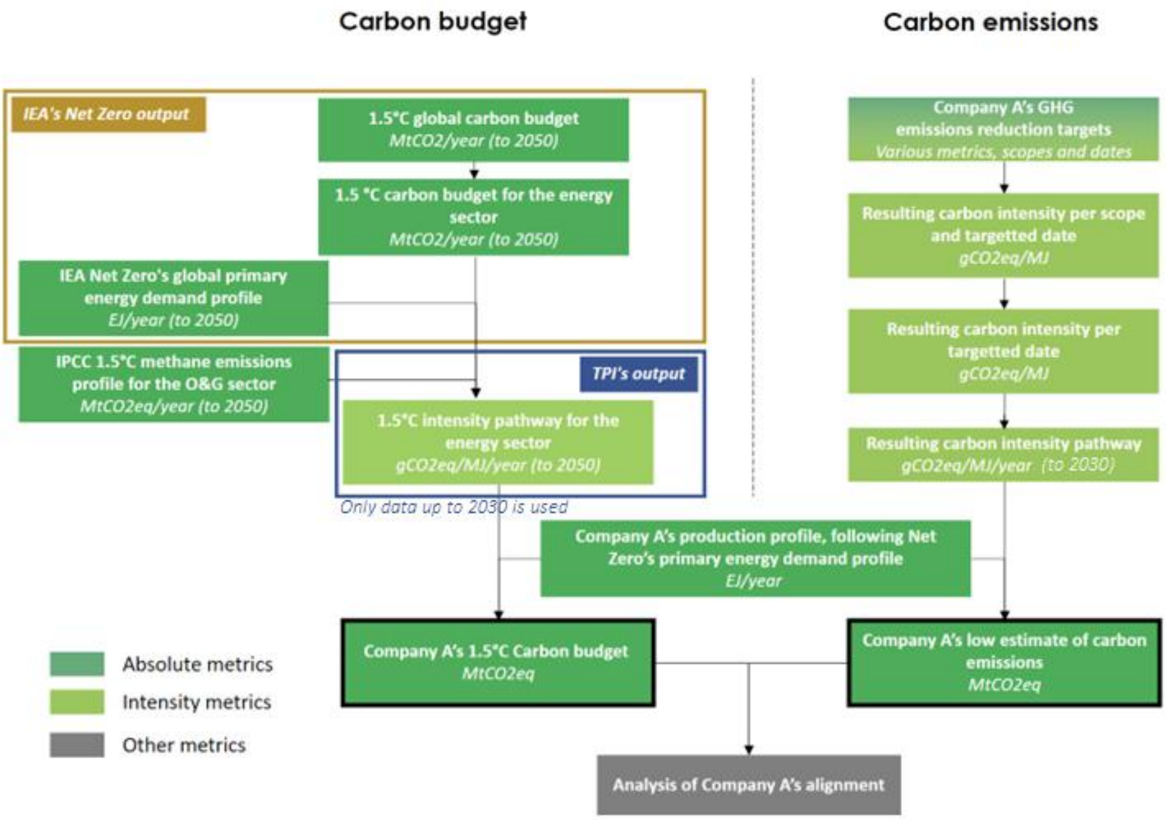
By design, for any year, one company's emissions are given by:

$$Absolute\ emissions = Carbon\ intensity\ \times Production$$

The cumulated emissions of a company are then the sum of its absolute emissions over a given period. Such emissions can be calculated in several ways, and leads to different quantities:

- Assuming the company's production grows as in the reference scenario, and its carbon intensity pathways equals the one of the reference scenarios, the calculation gives the **total amount of greenhouse gases the company can emit**, or its **allocated carbon budget.**
- Assuming the company's production grows as in the reference scenario, but using the company's pledged carbon intensity pathway, the calculation gives a **low estimate of the cumulated emissions of the company's pledged strategy**. This estimate is highly conservative, as it assumes companies will meet their decarbonization targets, but will also align their production with the reference scenario: this latter hypothesis is already proven wrong, as detailed in the research.

Graph 2. Schematic representation of carbon emissions and budget calculations under the NZE scenario hypotheses



Step 2. Calculate reliance on CCUS and Offsets

CCUS and offset figures have been sourced directly from companies document or websites. To collect this data, we have been looking through companies' annual reports, sustainability plans, strategic reports, and investor presentations. We then aimed to assess to what extend offsets are part of companies' decarbonization strategies.

1. Company's pledged reliance on offset.

This indicator aims to measure to what extent a company relies on offsets to meet its decarbonization targets. To do so, we:

- Consider the latest offset targets, expressed in MtCO2e captured per year.
- Look, on the same year, at the ambitioned absolute emissions reduction of the company, expressed in MtCO2e emitted per year.
- Calculate the ratio of the two quantities.

This gives the magnitude of reliance on captured emissions and offset to meet decarbonization targets, in percentages. This calculation has been conducted separately for CCUS and Nature-Based Solutions, two popular but problematic ways of offsetting emissions.

2. Feasibility of this reliance on CCUS and NBS:

Finally, to give sense of how realistic offsets targets are, we processed pledged offsets targets and *forecasted needs of offset by 2030* as follow:

- CCUS: at the end of 2020, there were 28 CCUS centers of average capture capacity of 1.5 MtCO2e per year.[78] This value is used to translate companies' ambitioned use of CCUS into number of needed centers, to illustrate how likely or unlikely companies are to reach this goal. Let's also emphasize that most of these centers are economically viable since the carbon is used to enhanced oil and gas recovery; without this, CCUS is not expected to be economic unless a high enough price of carbon emission.
- NBS: Nature-Based Solution are highly space-consuming. To give a sense of it, all NBS targets are translated into equivalent area using a coefficient of 1.16kgCO2e/m^2/year. This coefficient is the result of a peer-reviewed study. [79]

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[78] https://carbontracker.org/oil-companies-should-hedge-their-bets-on-ccus-and-offsetting/
[79] https://doi.org/10.1038/s41586-020-2686-x; In this study, authors calculated the area-weighted average of carbon accumulation potential of lands in 10 countries showing variable climatic conditions, which are key factors driving carbon accumulation potential through reforestation.