RECLAIM Finance

ARE EUROPEAN OIL AND GAS MAJORS ON TRACK FOR 1.5°C?

METHODOLOGY

To help financial actors navigates oil and gas majors so-called “transition plans”, Reclaim Finance selected key indicators to look at when assessing the climate credibility of a company’s business plans. This data is sourced directly from companies’ documents, or results from our calculations.

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

Scope of our analysis

European oil and gas producers are regularly presented as “best in class” on the climate front by investors, banks and insurers. However, does “best in class” mean that they are on track to achieve climate goals?

To answer this question, Reclaim Finance scrutinized the current plans and climate targets of the six major European oil and gas producers with international activities: **TotalEnergies, Shell, BP, Eni, Equinor and Repsol.**

N°1. Are the companies’ pledged decarbonization targets aligned with a 1.5°C carbon budget?

A critical indicator to assess if a company’s decarbonization pathway is at the scale required and “aligned” is whether or not it fits within the 1.5°C carbon budget. This requires two types of calculations:

- Calculating the allocated carbon budget[1] for the company until 2050 in a 1.5°C pathway, building on sectoral decarbonization pathways provided by the IEA, the IPCC and TPI (part A)
- Calculating the projected volumes of absolute carbon emissions each year until 2050 by the company, building on the company’s decarbonization targets and energy production volumes.

[1] Carbon budget refers to the amount of greenhouse gases that can be emitted expressed in CO2 equivalent.

Why is our approach conservative

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

- *About current emissions:* ***we assumed the companies' disclosure cover all significant emission sources*** *as they are expected to do,*
- *About future emissions:* ***we assumed the companies will meet their decarbonization targets****, regardless of how likely they are to actually do so given the means set in place. For instance, some targets (such as TotalEnergies's scope 3 net zero by 2050, or Shell's 2035 and 2050 carbon intensity reductions) are dependent on customer actions and hereby defers 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. Indicators N°2 to N°5 are here to discuss the likelihood and impact of this hypothesis*
- *About future production:* ***we assumed the companies will keep the same market share over their energy activities****, and will consequently see their energy supply decrease in line with the IEA Net Zero scenario. Indicators N°3 and N°4 are here to discuss the likelihood and impact of this hypothesis.*

Note that hypotheses 2 and 3 are conservative and to the companies' advantage.

A. 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 sectoral decarbonization pathway computed by TPI, drawing on IEA scenario for CO_2 emissions and energy demand, and on IPCC scenario for methane emissions.[2]

- **What is a decarbonization pathway?** It's a series of year-on-year carbon intensity targets and energy production levels, aiming to achieve carbon neutrality by 2050. 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 sense to ask from each and every economic actor to decrease its emissions at the same rate. Hence, for each sector, a different decarbonization pathway is computed.

[2] https://www.transitionpathwayinitiative.org/publications/96.pdf?type=Publication

- **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 2050, 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 (Net Zero, Sustainable Development, and STEP) computed by the IEA using a least-cost model and different underlying hypotheses.[3] 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[4] pathway modeled by TPI using the International Energy Agency's (IEA) Net Zero (NZ) scenario as it is the only one that aims for 1.5°C.[5] This scenario is the **1.5°C reference scenario** 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 carbon budget.

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

All covered companies set intermediary targets to reduce their emissions against a base year. Consequently, their carbon intensity is expected to decrease over 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 make an assessment of the company's pledged transition 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[6]. As such, carbon intensity can be split in between contributions prorated to the different scopes' absolute figures. Hence, whenever an emission reduction target applies to:

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[3] 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.

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

- 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 Net Zero scenario.
- Carbon intensity: we compute that scope's contribution to the carbon intensity directly.

If a company sets incomplete targets (e.g. some targets are sets 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.

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 emission 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 2030, 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 2040, 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 2040 is 8 + 10 + 40 = 58 gCO2e/MJ

Step 3. Calculate the company's GHG emissions using their annual carbon intensity levels

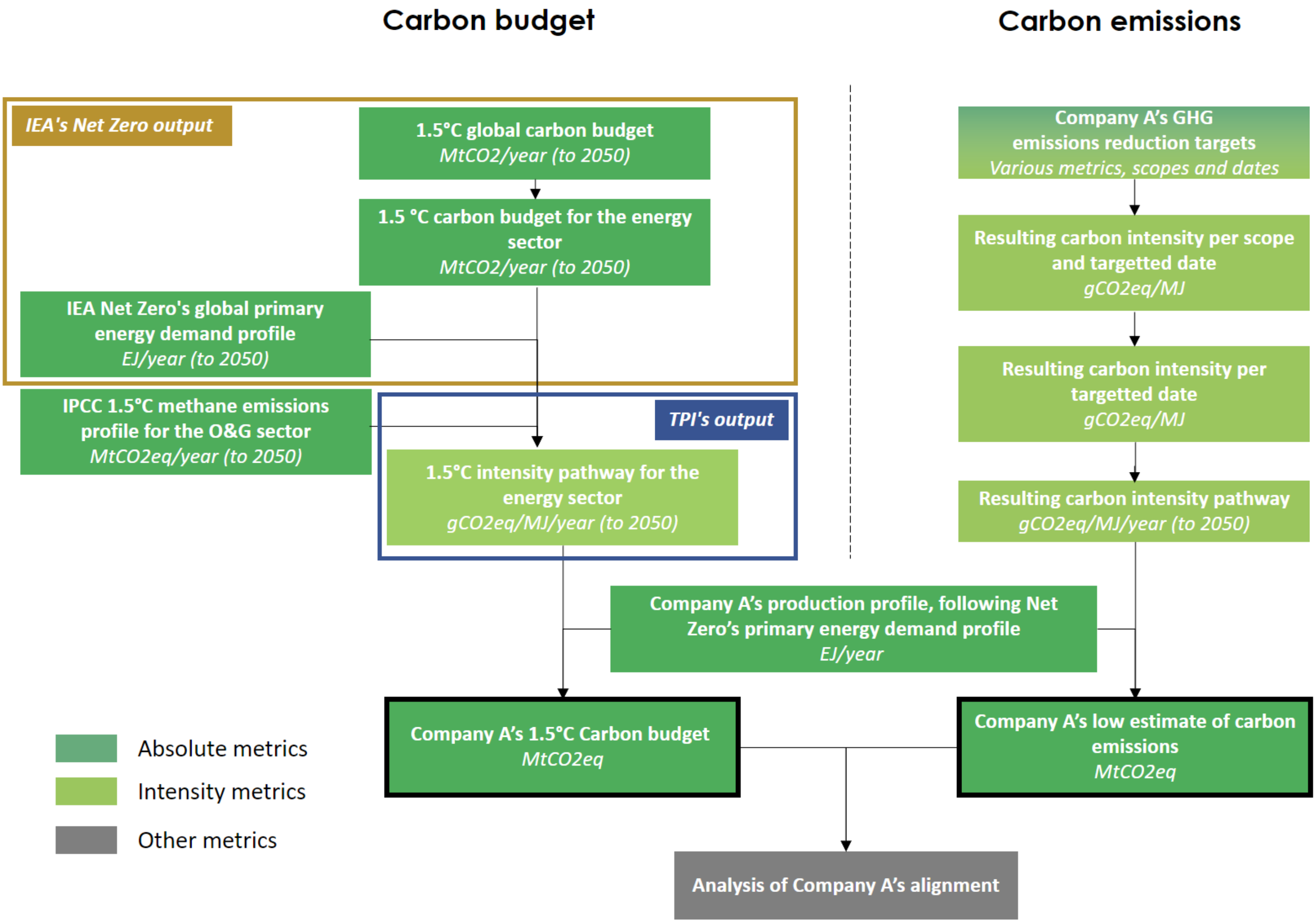
By design, for any year, one company's emissions is given by:

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

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

- Assuming the company's production grows as in the 1.5°C reference scenario, and its carbon intensity pathways equals the one of the 1.5°C reference scenario, 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 1.5°C 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 1.5°C reference scenario : this latter hypothesis is already proven wrong, as detailed in the briefing.

Graph 1. Schematic representation of carbon emissions and budget calculations



<u>Step 4. What does it mean to be aligned on such a pathway?</u>

Sectoral decarbonization pathways are created to guide the decarbonization effort at the sector level and keep sectors' absolute emissions within limits. Its purpose is therefore to limit absolute emissions. To be aligned on such a pathway, it then takes for a company to not overshoot its allocated carbon budget.

This can happen in two ways:

- The company energy production is too carbon intensive. Even if the production is aligned with the 1.5°C reference scenario, it emits too much GHG per unit of produced energy. This would be the **case of a company reducing its production without transitioning toward other clean energy generation**.
- The company has too high a production: even if the carbon intensity is aligned, an extra production will bring extra emissions. This would be the **case of a company diversifying its production - for instance with renewable - without reducing its fossil production**.

We acknowledge this methodology is not suited to state on a company's alignment, but only to state on misalignment. Indeed, short of knowing the company's future production plans, and as explained in step 3, we can only calculate a low estimate of the cumulated emissions of the company's pledged strategy. Would this low-estimate exceed the company's *allocated carbon budget*, then the company's future cumulated emissions are highly likely to exceed this target too. On the other end, if this low-estimate falls below its *allocated carbon budget*, it cannot help state where the future cumulated emissions will fall.

B. Calculation of alignment indicators:

Short-term, medium-term, and long-term alignment:

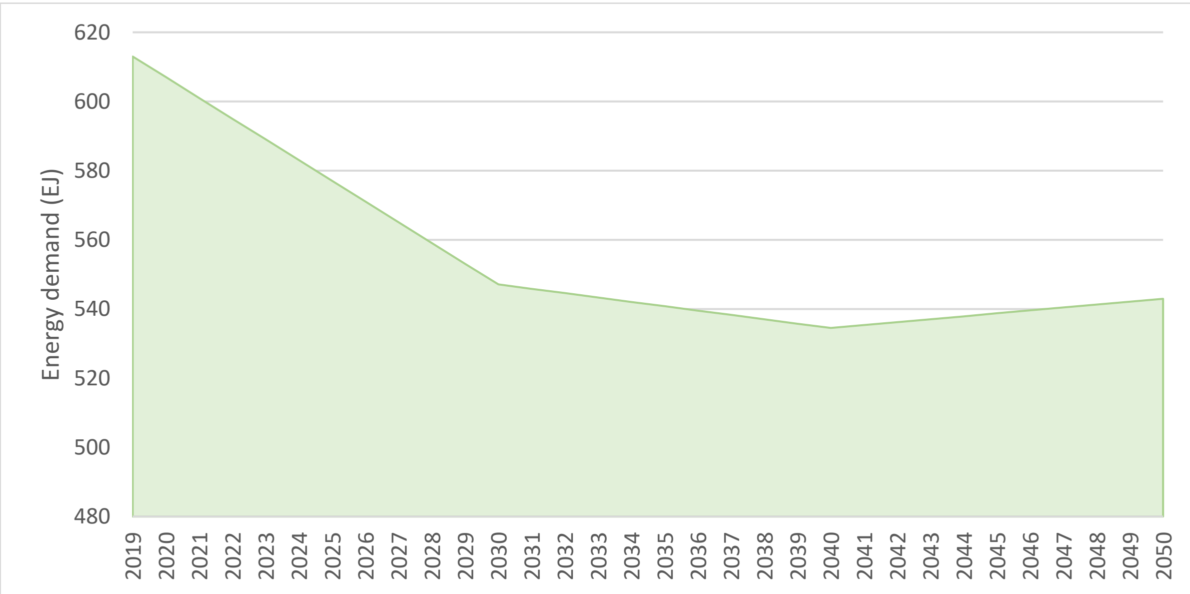
To be aligned on a scenario on a specific timeframe it takes a company to keep its absolute emissions within the budget it is allocated by the scenario.

Yearly absolute emissions of a company are given by the product of its carbon intensity and its production. Hence, the cumulative absolute emissions of the company are given by:

$$\sum_{i=2021}^{End\ Year} Companies' pledged\ carbon\ intensity\ (i)\ \times Companies\ pledged\ \ production\ (i)$$

Because companies do not accurately disclose their production plans for the years to come, we took the conservative hypothesis[7] that their production will evolve following the same trend as the IEA's Net Zero scenario, starting from their 2019 production level. This is equivalent to say companies would keep a constant market share in a world where global primary energy demand evolves as prescribed by the scenario.

Graph 2. World primary energy demand forecast in the IEA Net Zero scenario



[7] This hypothesis is conservative as none of the oil and gas companies covered in this analysis are reducing their production as needed. In fact, most of them are still planning on growing hydrocarbon production, and more broadly on growing energy production.

As such, we have:

- The companies' low-estimate cumulated emissions given as a function of the end year*:*

$$LECE\ (End\ Year) = \ Low - estimate\ cumulated\ emissions\ (End\ Year) = \sum_{i=2021}^{End\ Year} Companies'\ pledged\ carbon\ intensity\ (i)\ \times 1.5°C\ Ref\ Scenario - aligned\ \ production\ (i)$$

- The companies 1.5°C carbon budget given as a function of the end year:

$$Carbon\ budget\ (End\ Year) = \sum_{i=2021}^{End\ Year} 1.5°C\ Ref\ Scenario\ carbon\ intensity\ (i)\ \times 1.5°C\ Ref\ Scenario - aligned\ \ production\ (i)$$

We declare a company not aligned on a given timeframe (e.g. over short-term which refers to the period 2021 – 2025) if its *Low-estimate cumulated emissions* exceeds its *Carbon budget*. Consequently, a company is not aligned:

- Over short-term (2021 – 2025) if *LECE (2025) > Carbon budget (2025)*
- Over medium-term (2021 – 2035) if *LECE (2035) > Carbon budget (2035)*
- Over long-term (2021 – 2050) if LECE *(2050) > Carbon budget (2050)*

Short-term, medium-term, and long-term overshoot:

The overshoot is defined as the exceeding emissions of a company's *Low-estimate cumulated emissions* compared to its *Carbon budget* over the same time period. Reusing the functions defined previously, overshoots are defined:

- In absolute terms: *LECE (End year) – Carbon budget (End year)*
- In relative terms: $\frac{LECE\ (End\ year) - Carbon\ budget\ (End\ Year)}{Carbon\ budget\ (End\ Year)}$

A company not aligning will emit in excess and have a positive overshoot: the higher, the more misaligned.

Year of overshoot:

Because companies all have pledged carbon intensities consistently above the reference scenario carbon intensity pathway, they all build up emissions overshoots year on year. This leads to companies' emissions reaching the *Carbon budget (2050)*¸ or *Long term carbon budget*¸ far before 2050. The earlier a company consumes its *Long term carbon budget*¸ the more its short- and medium- term emission targets are misaligned.

This is translate through the *Year of overshoot*, defined as the minimum year for which

$$LECE\ (year) > Long\ term\ carbon\ budget$$

Share of Long term carbon budget consumed by 2030 :

It appears that most of companies' long-term overshoot actually builds up over short- and medium-term, due to a higher gap on carbon intensity. To reflect this, we calculated the share of the Long term carbon budget already consumed by 2030, defined as:

$$\frac{LECE\ (2030)}{Long\ term\ carbon\ budget}$$

For all companies covered in this analysis, more than 70% of their Long term carbon budget is consumed before 2030, highlighting the urgent need to reduce greenhouse gas emissions immediately to keep within climate requirements.

Medium-term carbon intensity excess:

As stressed in the two previous indicators, most of companies' Long term carbon budget is consumed over short- and medium- term. This can be due to excessive carbon intensity, or excessive production, as compared to our reference scenario. However, given the lack of data regarding companies' future production plan, this analysis only assesses the gap in between companies' pledged carbon intensity pathway and the 1.5°C reference scenario carbon intensity pathway. To reflect this gap, we defined the medium-term carbon intensity excess:

- In absolute terms:

$$\left[\underset{over\ 2021-2035}{average\begin{pmatrix}company\ pledged\\ carbon\ intensity\end{pmatrix}}\right]-\left[\underset{over\ 2021-2035}{average\begin{pmatrix}1.5°C\ reference\ scenario\\ carbon\ intensity\end{pmatrix}}\right]$$

- In relative terms:

$$\frac{\left[\underset{over\ 2021-2035}{average\begin{pmatrix}company\ pledged\\ carbon\ intensity\end{pmatrix}}\right]-\left[\underset{over\ 2021-2035}{average\begin{pmatrix}1.5°C\ reference\ scenario\\ carbon\ intensity\end{pmatrix}}\right]}{\underset{over\ 2021-2035}{average\begin{pmatrix}1.5°C\ reference\ scenario\\ carbon\ intensity\end{pmatrix}}}$$

N°2. Reliance on Offset mechanisms

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

Step 1. Company's pledged reliance on offset

This indicator aims to measure to what extend a company relies on offsets to meet its decarbonization targets.

- 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 offset to meet decarbonization targets, in percentages. This calculation has been conducted separately for Carbon Capture, Use and Storage (CCUS) and Nature-Based Solutions, two popular but problematic ways of offsetting emissions.

Step 2. Forecasted use of offset in 2050

For companies using offsets to meet intermediate decarbonization targets, but without any pledged target for 2050, we estimate how much offset they would need by 2050. This estimation is based on the *Company's pledged reliance on offset*, calculated previously, and assuming the company's reliance on offset does not change.

Given the emissions reduction the company needs to achieve by 2050 the *Forecasted need of offset in 2050* is given by:

$$Company's\ pledged\ reliance\ on\ offset\ \times Needed\ emissions\ reduction\ by\ 2050$$

For instance, let us consider a company relying on offset to achieve 10% of its 300MtCO2e emissions reduction in 2030. If 2030 is the latest year for which the company set an offset target, we assume the company will keep relying that much on offset in the future. Consequently, if the company need to reduce its emissions of 500 MtCO2e by 2050, our calculations forecast a use of offset equivalent to 50 MtCO2e.

This indicator shows that companies are relying too heavily on offset to meet they decarbonization target, and that it cannot be a sustainable way to reduce emissions. This calculation has been conducted separately for Carbon Capture, Use and Storage (CCUS) and Nature-Based Solutions, two popular but problematic ways of offsetting emissions.

Step 3. 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 2050* as follow:

- CCUS: today, there exists 28 CCUS centers of average capture capacity of 1.5 $MtCO_2e$ per year[8]. 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 1.16$kgCO_2e/m^2$/year. This coefficient is the result of a peer-reviewed study. [9]

N°3. Expansion plans of companies

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 they energy production as per the reference scenario. To that purpose, expansion should stop immediately, as stress by the IEA in its Net Zero scenario.

Companies' assets[10] fall into four main categories:

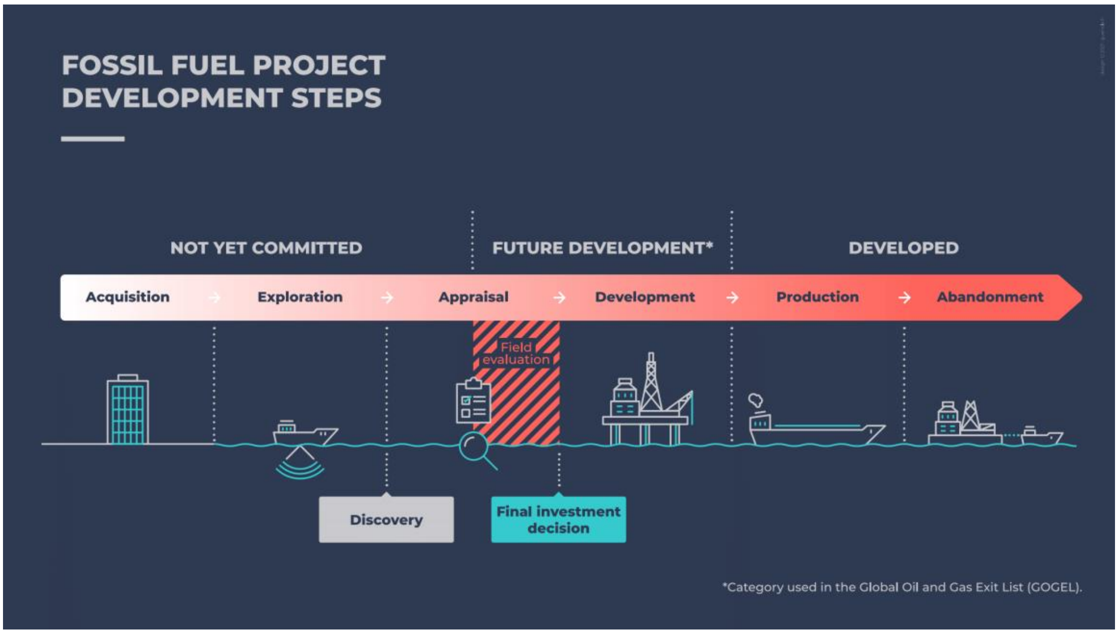
- Undiscovered: these assets relate to geological formation that may contain oil and gas, but that have not been explored yet.
- Not yet committed, or discovered: these assets relate to oil and gas fields that have been subject to a preliminary assessment, but for which no significant development investment has been made. These assets could eventually be developed, but no strategic or financial commitment has been made yet.
- Future Development, or 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, or producing: these assets relate to oil and gas fields that have already been developed, and are currently producing.

[8] https://carbontracker.org/reports/adapt-to-survive/

[9] 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.

[10] Resources, expressed in millions of barrels of oil equivalent, are a metric similar to 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.

Graph 3. Fossil fuel projects development steps



Despite calls to end new oil and gas developments, companies are still engaging in expansion and exploration activities. This is reflected in our analysis through a set of indicators presented below.

<u>Exploration CAPEX:</u>

This is the Capital Expenditure of a company for 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. At a time where no new projects should be sanctioned for development, new exploration does not make sense.

This indicator is taken from the Global Oil and Gas Exit List, and is the 3-years average of companies over 2019 – 2021.

<u>Discovered resources:</u>

Companies holds portfolios of discovered assets that could eventually be developed. This provides an indication of how much more resources companies could aim to exploit if their hunger for expansion does not stop.

This data is extracted from Rystad Energy UCube.

<u>Expansion resources:</u>

This is the total amount of hydrocarbon resources that are either under development or ongoing field evaluation. These assets are highly likely to enter production in a near future.

This data is taken from the Global Oil and Gas Exit List's[11] field "Resources under development / field evaluation in 2021".

[11] https://gogel.org/

Producing resources:

To help assess how significant are companies' expansion plans, given this analysis covers companies of different sizes, the latter are discussed in front of companies' current producing resources. That is total resources still in the ground of assets that are producing as of today.

This data is extracted from Rystad Energy UCube.

Recent production levels:

Oil and gas need to be phased out over the next decades. To assess how unnecessary are the new resources that oil and gas companies are developing, we then aim to represent how many years these companies could keep producing at recent levels, given their current producing reserves, and how many more years they could produce with the assets they are developing.[12]

We consequently compared producing resources and expansion resources to recent production levels. To ease the covid effect, the recent production level has been defined as the average production over the 2019 – 2021 period.

Recent production level through this analysis then refers to the average of production levels over 2019 – 2021, sourced from Rystad Energy UCube[13].

Unconventional activities

The oil and gas industry is increasingly developing unconventional oil and gas.[14] Unconventional sources of oil and gas are particularly harmful for the environment and the climate. These activities include fracking, tar sands, coalbed methane, extra heavy oil, and ultra deepwater. For more information about these activities, see the methodology note of the Global Oil and Gas Exit List.[15]

The share of companies' production and expansion plan across these different activities has been sourced from Urgewald analyses based on data from Rystad Energy.[16]

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[12] We acknowledge that this estimation does not take into account the natural decline of currently producing assets' output. This phenomenon causes production to eventually decrease, independently of the amount of resources in the ground, and keeps companies from maintaining their production to recent levels. This, however, is not deemed to be an issue given that oil and gas production needs to decrease immediately, respectively by 4% and 3% a year according to the Production Gap Report.

[13] 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.

[14] https://cdn.sei.org/wp-content/uploads/2021/04/trends-in-fossil-fuel-extraction.pdf

[15] https://gogel.org/

[16] https://urgewald.org/english

N°4. Growth in oil and gas production

As stated previously, oil and gas companies should start decreasing their production immediately. Three indicators have been set to represent companies' trend in oil and gas production. Note that following announcement from BP, Shell, and Equinor related to the Ukrainian situation, production contribution coming from exited Russian assets and minority interests have been removed.

<u>Historical production growth:</u>

This indicator gives the growth of production since 2016, just after the Paris Agreement has been signed, to *Recent production levels*. This is defined as:

$$\frac{Recent\ Production\ Levels - Production\ (2016)}{Production\ (2016)}$$

All the data used for this calculation is sourced from Rystad Energy UCube[17].

<u>Forecasted short-term production growth:</u>

This indicator gives the growth of production between *Recent production levels* and 2024, according to Rystad Energy UCube forecasts.[18]

While Rystad Energy builds its forecasts solely on assets characteristics, it does not take into account companies' strategy that could willingly include the development or non-development of particular assets. Consequently, we decided to only include in this forecast **assets that are already in field evaluation or under development, or producing**, as the levels of investments they have been subject to gives a high level of certainty of exploitation.

This indicator is then defined as per:

$$\frac{2024\ Forecasted\ Production - Recent\ Production\ Levels}{Recent\ Production\ Levels}$$

All the data used for this calculation is sourced from Rystad Energy UCube[19].

<u>Potential mid-term production growth:</u>

This indicator gives the growth of production between *Recent production levels* and 2030, according to Rystad Energy UCube forecasts.

For this indicator, we don't filter assets based on their life cycle stage, as assets that could be developed by 2030 may still be at the discovered stage as of now. Consequently, this indicator provides a lesser level of certainty as compared to the *Forecasted short-term production growth.* Indeed, a company could make the strategic choice not to develop a discovered asset, while Rystad Energy would have

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[17] 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.

[18] 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.

[19] 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.

predicted a development. Hence, this indicator does not aim to predict what will happen, but what could happen if companies keep developing new oil and gas fields.

It is defined as per:

$$\frac{2030\ Potential\ Production - Recent\ Production\ Levels}{Recent\ Production\ Levels}$$

All the data used for this calculation is sourced from Rystad Energy UCube[20].

N°5. Forecasted energy production for 2030

CAPEX

The first indicator we collected to assess to what extend companies are changing their energy mix is their short-term CAPEX. CAPEX allocation of a company is indicative of activities it aims to develop. Too low CAPEX allocations for renewable 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.

This indicator comes directly from companies' public documents.

Ratio of renewable and fossil energy production in 2030, and share of renewable in the energy mix in 2030

The second indicator we looked at is the future energy mix. To that purpose, we looked through companies' document to retrieve plans of fossil fuel production by 2030, as well as development plans for renewable. This data has then been processed 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 the majors plans for fossil fuel production in 2030

We look at companies plans of oil and gas production. Calculations can be found in our data set, available for download on www.reclaimfinance.org/majorfailure. See below the approach adopted for each company in our scope.

TotalEnergies. The company aims to "increase its energy production from 17PJ/d to 23PJ/d to meet growing demand, this growth coming half from electricity, mainly renewable with a target of around 100GW of gross capacity by 2030, and half from LNG growth, while oil production at that date is expected to be stable of below 2019 levels".[21] The expected level of production of fossil fuels in 2030 is then calculated as the level of fossil fuels production in 2019, plus half of the 6 PJ/d expected growth coming from LNG.

Shell. The company announced it passed its oil production peak in 2019, and expects it to decline 1-2% per annum by 2030. In the same time, it anticipated its gas share of hydrocarbon production to

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[20] 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.

[21] avis_convocation2021_fr_bd.pdf (totalenergies.com)

reach 55% by 2030.[22] This enables us to calculated 2030 level of oil production, then to access the 2030 level of gas production using the ratio 45%/55%.

BP. The company announced it expects its "hydrocarbon business to be 40% lower in terms of production by 2030, compared to 2019".[23] However, according to BP spokesman David Nicholas, "The 40% production cut does not include BP's 20% stake in Rosneft". Accessing BP's equity level of production in 2019, as well as Rosneft's contribution to this figure, we could calculate the targeted level of production of hydrocarbons for 2030.

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."

ENI. The company declared its upstream production will grow up to 2025[24], then plateau from 2025 at around 2 000 kboe/d. Without any further indication, this plateau is assumed to last up to 2030.

Repsol. The company announced a "flexible production level of around 650 kboe/d over 2021 – 2025"[25], but also stated it is "confident that it can maintain its upstream production at current levels of about [650 kboe/d], not only in 2021-25 but in the following five years as well".[26]

Step 2. Estimating companies' plan of renewable production

TotalEnergies. The company announced that 15% of its energy production as of 2030 should come from electricity, mainly from renewable.[27]

Shell. The company announced it aims to serve 50 millions of households with renewable energy by 2030.[28] Given that the renewable uptake is happening faster in more developed countries, we considered the average annual consumption of an Australian household.[29]

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[22] 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
[23] https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/sustainability/group-reports/bp-sustainability-report-2020.pdf
[24] https://www.eni.com/en-IT/media/press-release/2020/02/long-term-strategic-plan-to-2050-and-action-plan-2020-2023.html
[25] https://www.repsol.com/content/dam/repsol-corporate/en_gb/accionistas-e-inversores/pdfs/investor-update-0221_tcm14-211014.pdf
[26] https://www.argusmedia.com/en/news/2163764-repsol-to-cut-upstream-investment-in-202125-update
[27] https://totalenergies.com/system/files/documents/2021-05/avis_convocation2021_fr_bd.pdf
[28] https://www.shell.com/energy-and-innovation/the-energy-future/our-climate-target/_jcr_content/par/relatedtopics.stream/1635426463090/54e9db7e3118ac2c9f4bc1c06d36051a5dc1a982/our-climate-target.pdf
[29] https://www.aer.gov.au/system/files/Residential%20energy%20consumption%20benchmarks%20-%209%20December%202020_0.pdf

BP. The company announced a target of 50 GW of renewable capacity by 2030.[30] Assuming an average capacity factor of 25%[31], 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.

Equinor. The company announced a target of 12 to 16 GW of renewable capacity by 2030.[32] Assuming an average capacity factor of 25%[33], we calculated the average annual electricity generation for a renewable capacity of 14 GW. 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.[34] Assuming an average capacity factor of 25%,[35] we calculated the average annual electricity generation for a renewable capacity of 14 GW. 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 20 GW of renewable capacity by 2030.[36] Assuming an average capacity factor of 25%,[37] we calculated the average annual electricity generation for a renewable capacity of 14 GW. 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.

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[30] https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/sustainability/group-reports/bp-sustainability-report-2020.pdf

[31] 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

[32] https://www.equinor.com/content/dam/statoil/documents/quarterly-reports/2021/cmd-2021/cmd-transcript-2021-06-15-equinor.pdf

[33] 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

[34] https://www.eni.com/en-IT/investors/long-term-plan.html

[35] 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

[36] http://www.repsol.com/en/press-room/press-releases/2021/repsol-increases-its-targets-for-renewable-generation-and-emission-reductions/index.cshtml

[37] 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

How to estimate average renewable generation from renewable capacity?

Renewable energy does not always produce energy, as their output can depend on weather or network conditions. However, 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.[38]

Short of knowing which technology companies will choose to meet their renewable targets, we calculated an average capacity factor. To that purpose, we referred to IEA[39] to estimate the relative importance of different renewable technologies across this sector, and calculated the capacity-weighted average capacity factor, that is:

$$\sum\nolimits_{technologies} Capacity\ Factor\ \times Total\ Capacity \Big/ \sum\nolimits_{technologies} Total\ Capacity$$

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

$$Avg\ Renewable\ Generation = Avg\ Capacity\ Factor\ \times Renewable\ Capacity\ \times 24\ \times 364$$

Step 3. Comparing fossil fuel production and renewable production

Non-combustible renewable energy[40] consists in final energy, which is energy consumed directly by the final user. Each MWh produced and sent onto the grid is consumed on the other end by a client.

On the other hand, oil and gas products consists in primary energy: they need to undergo combustion to deliver energy for the final user, or client. This process of combustion comes with efficiency losses. Hence, when consumed, primary energy of oil and gas products leads to energy losses and final 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[41] : energy produced from non-combustible renewable sources 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, and we referred to BP's Statistical Review of World Energy to conduct our calculations.[42]

In the end, the primary energy equivalent of renewable generation is given by

$$Renewable\ primary\ energy\ equivalent = \frac{Avg\ Renewable\ Generation}{Lastest\ Thermal\ efficiency\ factor}$$

[38] IEA Average annual capacity factors by technology, 2018

[39] IEA Renewable 2020 Data Explorer

[40] These renewable energies make the bulk of today's renewable energy as per IEA Renewable 2020 Data Explorer

[41] https://www.eia.gov/todayinenergy/detail.php?id=41013

[42] https://www.connaissancedesenergies.org/sites/default/files/pdf-actualites/bp-stats-review-2021-full-report.pdf

Step 4. Ratio of renewable production to fossil fuel production

The ratio between renewable production and fossil fuel production is finally calculated based on the fossil fuel equivalent of companies' forecasted renewable production, and on the companies' fossil fuel production plans, as follow:

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

Step 5. Maximum share of renewable in the energy mix in 2050

The share of renewable in the energy mix in 2030 is given by :

$$Renewable\ share = \frac{Renewable\ primary\ energy\ equivalent}{Total\ primary\ energy\ production}$$

Our analysis considers only fossil fuel and renewable production levels by 2030, regardless of other energy production means. Would a company resorts to other energy production means, such as biofuels or hydrogen, its 2030 total primary energy production would exceed the aggregate of its renewable primary energy equivalent and fossil fuel production.

Consequently, the sum of fossil fuel production and renewable primary energy equivalent leads to a low estimate of 2030 total primary energy production, and using it to compute the renewable share in 2030 gives a high estimate of the renewable share in the energy mix in 2050 :

$$Max\ renewable\ share = \frac{Renewable\ primary\ energy\ equivalent}{Renewable\ primary\ energy\ equivalent + Fossil\ fuel\ production}$$