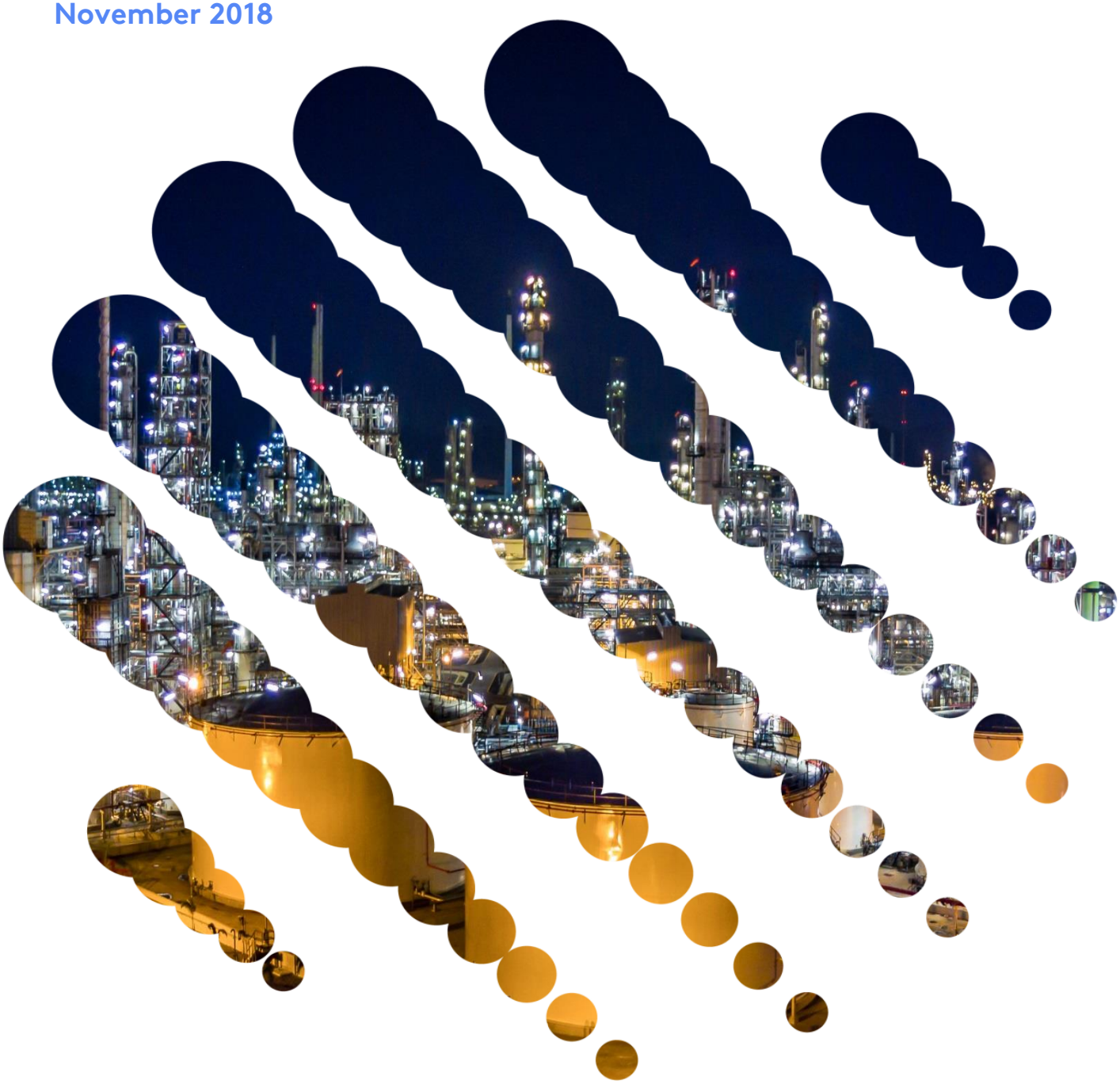
Carbon Performance Assessment in Oil and Gas Discussion Paper

November 2018



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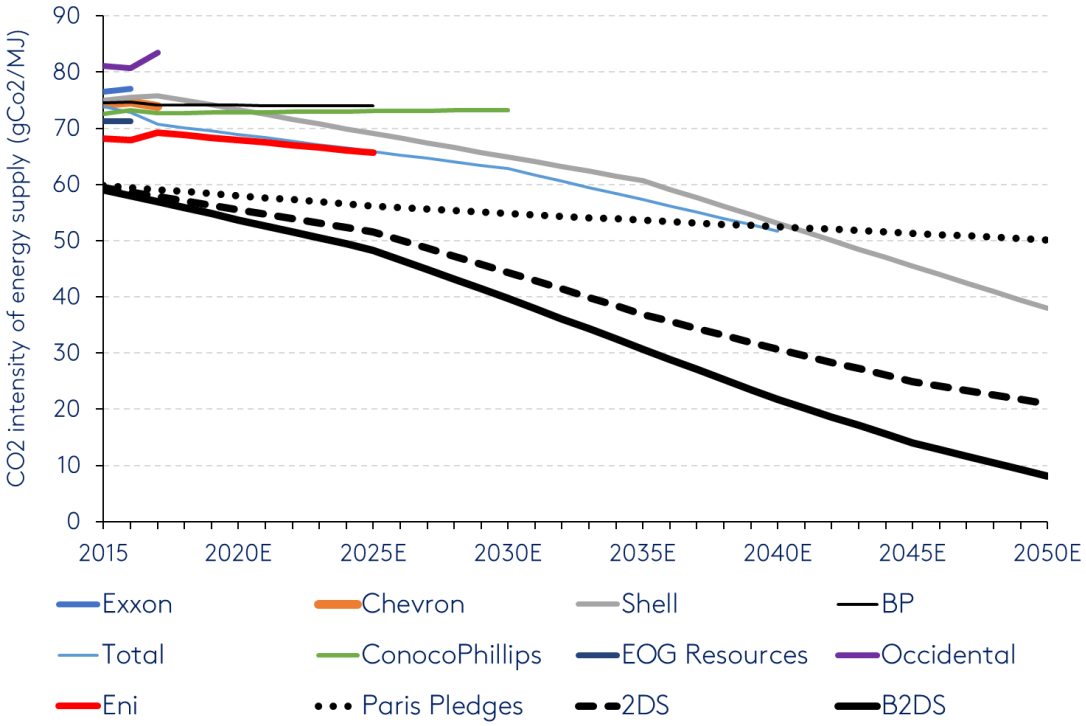
Executive Summary

This discussion paper updates the methodology developed by TPI in March 2018 [1] to assess the Carbon Performance of oil and gas producers, and applies it to the ten largest publicly listed oil and gas producers globally, as measured by market capitalisation.

The update to the methodology includes, principally, a more comprehensive approach to estimating emissions from companies' all-important use of sold products (Scope 3). We have engaged extensively with the industry in developing this methodology and many of the companies provided detailed feedback on their assessments.

We calculate companies' carbon emissions intensity and benchmark it against international climate commitments made as part of the 2015 UN Paris Agreement (Figure ES1). The benchmarks are based on scenarios of the carbon intensity of energy supply developed by the International Energy Agency (IEA).

Figure ES1. Carbon intensity pathways (Scope 1 and 2 emissions plus Scope 3 emissions from use of sold products) for nine of the top ten oil and gas companies, versus low-carbon benchmarks



We find that:

- It is possible to meaningfully benchmark the current Carbon Performance of nine out of the world's top ten oil and gas companies, using publicly disclosed data on their operational (i.e. Scope 1 and 2) CO_2 emissions, as well as their sales of energy products. Only Reliance cannot be benchmarked at present, because it does not disclose its operational CO_2 emissions. Data on sales of energy products can be used to consistently estimate companies' Scope 3 emissions from use of sold products, which is by far the largest share of oil and gas producers' lifecycle emissions.
- Our methodology seeks to make the best of the current state of disclosure. While a lot of relevant data are available, at present the leading players do not provide consistent, consolidated disclosures of emissions and energy production that cover all key sources. Our disclosure expectations, which have clear implications for those engaging with the sector, are set out in Box ES1.

- All of the oil and gas companies assessed have a carbon intensity that is well above the benchmarks currently. Companies' carbon intensity ranges from Eni's 68 grams of CO_2 per megajoule to Occidental's 82 gCO_2/MJ (15% and 37% above the benchmarks respectively). This reflects what is a comparison between oil and gas companies, who currently supply energy almost exclusively from high-carbon sources, and the average of companies across the whole energy sector, including supplies from both high-carbon and low-carbon sources. In the long term, if dangerous climate change is to be avoided, only low-carbon sources can be used.
- Given that companies' current emissions intensities are similar, and that limitations in company disclosures make it unlikely that the data are completely accurate, we urge investors not to over-interpret companies' relative positions today. More significant, in our view, is the status of companies' *future* ambitions/targets.
- Five of the ten––– companies have set some form of quantitative emissions ambition/target, enabling TPI to benchmark their future Carbon Performance. Three of these companies, BP, ConocoPhillips and Eni, have set targets relating to their operational emissions. Two companies, Shell and Total, have expressed ambitions to reduce not only their operational emissions, but also emissions from their value chains, including from use of sold products.
- The ambitions of Shell and Total would see them aligned with the least stringent Paris Pledges benchmark by 2040. The remaining companies never come into alignment with any of the benchmarks. The operational emissions targets of Eni and especially BP and ConocoPhillips do little to reduce their future carbon intensity. This reflects the fact that these targets tend to be limited in ambition/scope. In particular, significant long-term reductions in companies' carbon intensity cannot be achieved through reducing operational emissions alone.
- No company has proposed to reduce its carbon intensity sufficiently to be aligned with a 2 Degrees or Below 2 Degrees benchmark by 2050. No company is on track to achieve net zero emissions by 2050.

Box ES1. Disclosure expectations for oil and gas companies

Many investors perceive the emissions generated by burning fossil fuels as the key long-term risk facing the sector. Only by improving companies' public disclosure can they accurately assess this risk. This requires:

- **Consistent emissions disclosure:**
  - Direct and indirect (Scope 1 and 2) emissions covering all activities (only seven of the ten companies assessed provided this);
  - Scope 3 use of sold products emissions, stated on the same boundary as Scope 1 and 2 and covering all externally sold energy (no company currently provides this);
- **Energy disclosure (on a boundary consistent with emissions):**
  - The total value (in MJ) of all externally sold energy products segmented by energy source/type (no company currently provides this);
  - The proportion of externally sold products destined for non-energy uses;
- **Long-term emissions reduction targets, including Scope 3 use of sold products emissions and stated on a boundary consistent with emissions and energy disclosure:**
  - Emissions intensity targets (only Shell and Total currently provide this, in the form of ambitions);
  - Or absolute reduction targets (no company currently provides this)
  - The planned contribution of negative emissions technologies such as CCS (Carbon Capture and Storage) or reforestation to long-term targets.

1. Introduction

1.1. The Transition Pathway Initiative

The Transition Pathway Initiative (TPI) is a global initiative led by asset owners and supported by asset managers. Established in January 2017, TPI investors now collectively represent over UK£7/US$9.3 trillion of assets under management.[1]

On an annual basis, TPI assesses how companies are preparing for the transition to a low-carbon economy in terms of their:

- Management Quality – all companies are assessed on the quality of their governance/management of greenhouse gas emissions and of risks and opportunities related to the low-carbon transition.
- Carbon Performance – in selected sectors, TPI quantitatively benchmarks companies' carbon emissions against the international targets and national pledges made as part of the 2015 UN Paris Agreement.

TPI publishes the results of its analysis through an open access online tool hosted by the Grantham Research Institute on Climate Change and the Environment at the London School of Economics (LSE): http://www.transitionpathwayinitiative.org.

Investors are encouraged to use the data, indicators and online tool to inform their investment research, decision making, engagement with companies, proxy voting and dialogue with fund managers and policy makers, bearing in mind the Disclaimer that can be found on the inner front cover of this report. Further details of how investors can use TPI assessments can be found on our website.

1.2. About this report

This discussion paper continues the development of a methodology for assessing the Carbon Performance of oil and gas producers. It builds on a first draft published by TPI in March 2018.[1] Since March, we have consulted widely on our approach, including presentations to IPIECA and the Oil and Gas Climate Initiative (OGCI). Many of the companies analysed have provided detailed feedback on their assessments (see Box 1).

The structure of the report is as follows:

- Section 2 explains how TPI has assessed Carbon Performance in other sectors, i.e. automotive, cement, electricity, paper and steel.
- Section 3 then shows how the TPI methodology can be applied to assessing Carbon Performance in the oil and gas sector.
- Section 4 presents the results from applying the methodology to the ten largest oil and gas companies.
- Section 5 provides a summary of our results and a discussion of the limitations of the approach, including disclosure.
- Section 6 highlights the broader implications for investors of this method of assessment of oil and gas producers' Carbon Performance.

[1] As of 5th June 2018.

Box 1. The company assessment process and quality assurance

In preparing the data for this report, we have followed TPI's standard assessment and quality assurance procedures, which include seeking company feedback on our preliminary estimates. The procedures are as follows:

- **Initial data collection and review**. An analyst collects emissions and energy sales data from company disclosures and conducts a detailed review to confirm that the data are complete and consistent.
- **Initial findings review**. Following the application of the methodology to the data, a different analyst reviews each company's assessment in detail, and we look at overall trends across companies with a view to identifying outliers and unusual patterns.
- **Company review**. Once we have completed the company assessments, we write to each of the companies with its draft assessment, requesting that the companies review their assessments and confirm the accuracy of the underlying data.
- **Final assessment**. We review company responses and either amend their assessments, or provide a justification for why the assessment should not change.

Further details can be found in our latest *Methodology and Indicators Report*. [8]

2. TPI's Carbon Performance assessment

TPI's Carbon Performance assessment is based on the Sectoral Decarbonization Approach (SDA).[2] The SDA translates greenhouse gas emissions targets made at the international level (e.g. under the 2015 Paris Agreement to the UN Framework Convention on Climate Change) into appropriate benchmarks, against which the performance of individual companies can be compared.

The SDA is built on the principle of recognising that different sectors of the economy (e.g. oil and gas production, electricity generation and automobile manufacturing) face different challenges arising from the low-carbon transition, including where emissions are concentrated in the value chain, and how costly it is to reduce emissions. Other approaches to translating international emissions targets into company benchmarks have applied the same decarbonization pathway to all sectors, regardless of these differences.[3]

Therefore the SDA takes a sector-by-sector approach, comparing companies within each sector against each other and against sector-specific benchmarks, which establish the performance of an average company aligned with international emissions targets.

Applying the SDA can be broken down into the following steps:

- A global carbon budget is established, which is consistent with international emissions targets, for example keeping global warming below 2°C. To do this rigorously, some input from a climate model is required.
- The global carbon budget is allocated across time and to different regions and industrial sectors. This typically requires an integrated economy-energy model, and these models usually allocate emissions reductions by region and by sector according to where it is cheapest to reduce emissions and when (i.e. the allocation is cost-effective). Cost-effectiveness is, however, subject to some constraints, such as political and public preferences, and the availability of capital. This step is therefore driven primarily by economic and engineering considerations, but with some awareness of political and social factors.
- In order to compare companies of different sizes, sectoral emissions are normalised by a relevant measure of sectoral activity (e.g. physical production, economic activity). This results in a benchmark path for emissions intensity in each sector:

  $$\text{Emissions intensity} = \frac{\text{Emissions}}{\text{Activity}}$$

  Assumptions about sectoral activity need to be consistent with the emissions modelled and therefore should be taken from the same economy-energy modelling, where possible.
- Companies' recent and current emissions intensity is calculated and their future emissions intensity can be estimated based on emissions targets they have set (i.e. this assumes companies exactly meet their targets).[2] Together these establish emissions intensity paths for companies.
- Companies' emissions intensity paths are compared with each other and with the relevant sectoral benchmark pathway.

TPI now uses three sectoral benchmark pathways/scenarios:

1) *Paris Pledges*, consistent with the emissions reductions pledged by countries as part of the Paris Agreement in the form of Nationally Determined Contributions or NDCs.

[2] Alternatively, future emissions intensity could be calculated based on other data provided by companies on their business strategy and capital expenditure plans.

2) *2 Degrees*, consistent with the overall aim of the Paris Agreement to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels", albeit at the low end of the range of ambition.

3) *Below 2 Degrees*, consistent with a more ambitious interpretation of the Paris Agreement's overall aim.

The source of data for these scenarios is usually the modelling of the International Energy Agency (IEA), via its biennial *Energy Technology Perspectives* report.[4] An exception is the automobile manufacturing sector, where TPI has used the modelling of the International Council on Clean Transportation (ICCT).

In line with TPI's philosophy, companies' emissions intensity paths are derived from public disclosures (including responses to the annual CDP questionnaire, as well as companies' own reports, e.g. sustainability reports) as far as possible.

Another initiative that is also using the SDA is the Science Based Targets Initiative (http://sciencebasedtargets.org/), though, unlike this initiative, TPI's Carbon Performance assessment is used to evaluate all the companies in a sector, whether they have 'opted in' to setting science-based targets or not. There are also some other differences in the detail of how the SDA is applied by the two initiatives. Nonetheless, in principle, a company that has set a science-based target under the Science Based Targets Initiative should be in alignment with the 2 Degrees scenario and therefore with the Paris Pledges scenario.

Further details of how the Carbon Performance methodology is applied in specific sectors can be found in TPI's sectoral Methodology Notes.

3. Applying the method to the oil and gas sector

3.1. Benchmarking oil and gas producers against the carbon intensity of energy supply

In applying the SDA to the oil and gas sector, a key consideration is that the vast majority of the sector's lifecycle emissions stem from use of sold products, i.e. burning oil and gas for energy in buildings, electricity, industry and transport. For example, Shell's disclosed breakdown of its 2017 emissions indicates that use of sold products accounts for 86% of its value-chain or Scope 3 emissions and 77% of all its emissions [5]. Therefore any assessment of Carbon Performance should include emissions from use of sold products[3] in our view. To assess overall emissions this is added to direct and indirect operational emissions (i.e. Scope 1 and 2) generated by activities including the extraction and refining of oil and gas, flaring and fugitive methane emissions.

Oil and gas companies are primarily engaged in the supply of energy. This mainly involves the sale of hydrocarbons (i.e. oil and gas), both those the company has extracted itself, and those purchased from other oil and gas companies. Fossil or hydrocarbon energy can be supplied in its raw form (i.e. crude oil or natural gas), as a refined product (e.g. diesel oil and kerosene), or sold directly to the end user as a finished product. A small, but growing, proportion of the energy supplied by oil and gas companies is in the form of electrical energy, generated from both renewables (solar, wind and biofuels) and fossil fuels, and in the form of biofuels. Therefore an appropriate measure of activity in the oil and gas sector is the aggregate or overall supply of energy products. This measure excludes the sale of hydrocarbons for plastic and petrochemical production (explained in more detail below).

Dividing a company's emissions from Scope 1, Scope 2 and Scope 3 use of sold products by its supply of energy products creates our Carbon Performance metric in the oil and gas sector, i.e. the *carbon intensity of energy supply*.[4]

Energy supply can be defined as the total net calorific energy supply from all energy sources, including hydrocarbons, biomass and waste used for energy generation, and energy supplied as electricity generated from fossil fuels, nuclear or renewables. Together with associated CO_2 emissions, (primary) energy supply is modelled in the IEA's ETP scenarios,[5] allowing us to calculate the carbon intensity of global energy supply in a Paris Pledges scenario, a 2 Degrees scenario and a Below 2 Degrees scenario.

Like other modelling groups, IEA foresees a low-carbon transition, where decreasing volumes of oil and gas (and coal) are extracted and are replaced by a steadily rising share of zero-carbon sources of energy (Figure 1). Thus companies can reduce their emissions intensity (

Figure 2) by, among other things, diversifying away from fossil fuels and producing more energy from other sources (e.g. biofuels and renewables).

[3] Also known as Scope 3 Category 11 emissions according to the GHG Protocol.
[4] The Science Based Targets Initiative has also indicated that it plans to assess oil and gas producers in this way (https://www.greenbiz.com/article/how-oil-and-gas-companies-can-prepare-low-carbon-world).
[5] See the ETP2017 Scenario Summary spreadsheet, World worksheet; data on Total primary energy demand by energy source, and Direct CO2 emissions.

Figure 1. Global primary energy mix 2014-2050 in different scenarios, based on data from IEA ETP2017

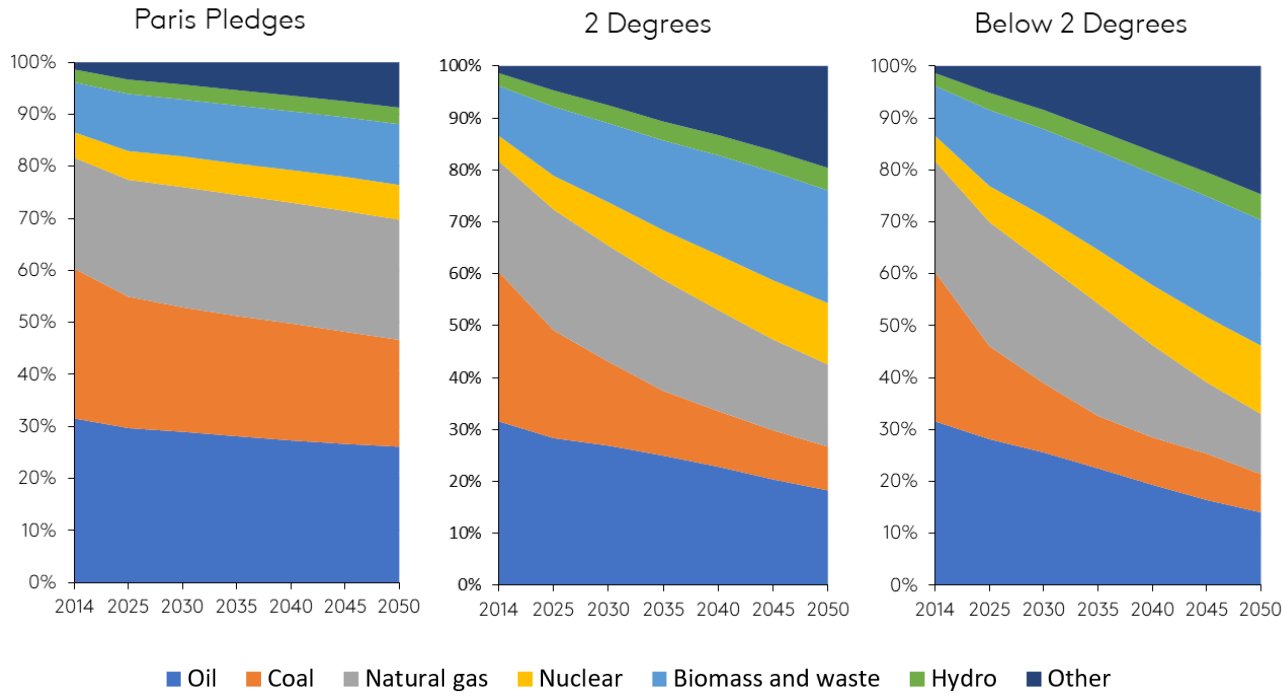
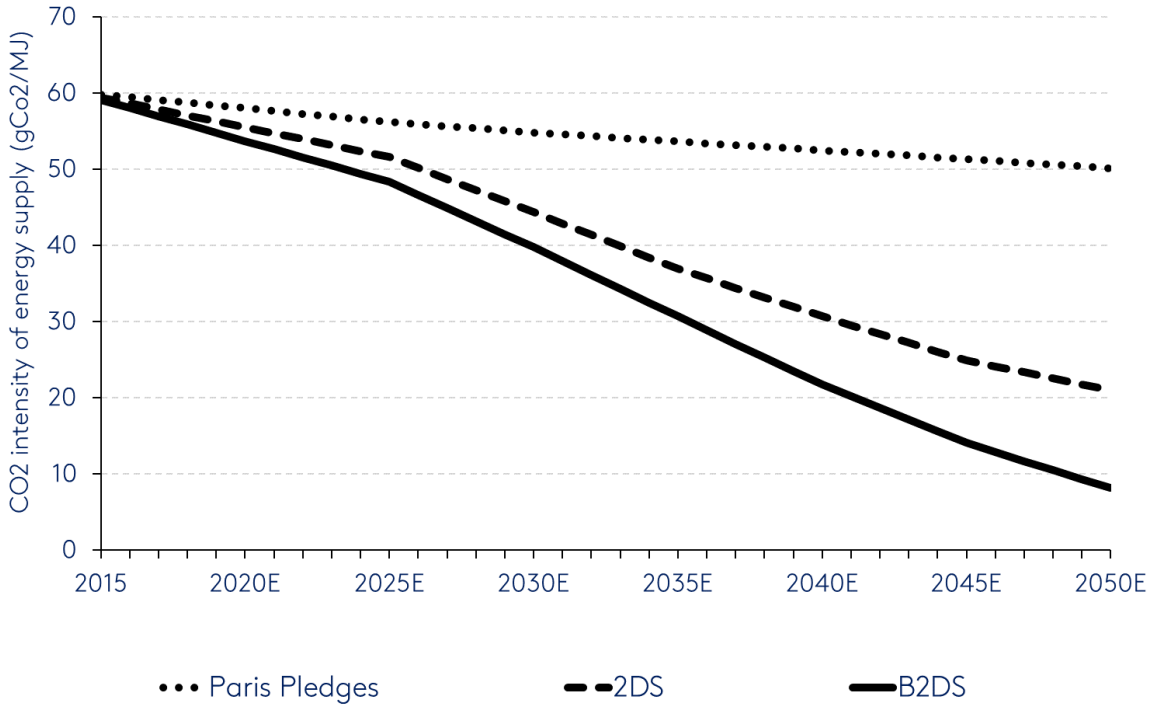


Figure 2. IEA ETP Resulting carbon intensity of primary energy mix 2015-2050 in different scenarios



3.2. Estimating companies' carbon intensity of energy supply

Choice of companies to profile

In this paper, we apply the methodology to the world's ten largest publicly listed oil and gas companies, as measured by market capitalisation (free float). This list includes both Exploration and Production (E&P) players, as well as integrated players with significant downstream activities:

- BP
- Chevron
- ConocoPhillips
- Eni
- EOG Resources
- Exxon Mobil
- Occidental
- Reliance
- Shell
- Total

Boundary of assessment: all energy products sold externally

Our previous discussion paper [1] only measured emissions from the sale of unrefined, primary energy products extracted by the company itself. However, for integrated oil and gas companies such as BP and Shell, downstream refining and retailing activities sell significantly (two to three times) more oil and gas than they extract upstream. We believe an assessment that more accurately reflects the full extent of a companies' activities is more useful to investors.

This paper therefore expands the boundary of the assessment to cover *all energy products sold externally*. This holistic definition is explicitly designed to include all upstream and downstream products, as well as the supply of any electricity and heat. We segment energy products sold externally by oil and gas companies into five categories (see Figure 3) and the relative importance of these categories varies widely according to company structure:

1) Sales of primary, 'unrefined' products. Three of the top ten companies (ConocoPhillips, EOG Resources and Occidental) are E&P players that exclusively sell unrefined primary energy products, principally crude oil and NGLs[6] (collectively known as liquids), and natural gas. For the remaining companies, we assume all of their liquids production is consumed internally by their downstream refinery businesses, so that only natural gas production is sold externally.

2) Sales of refined products. Seven of the ten companies have large refinery businesses, which consume liquids that have been both internally produced and purchased. Only Chevron and Reliance are deemed to actually sell this refined product externally. The remaining five companies distribute all their refinery products internally to a downstream finished-products business.

3) Sales of finished products. Refined products, either internally produced or purchased from external suppliers, are distributed as fuel to end-customers (i.e. at petrol stations). For five of the companies assessed in this paper, the sale of finished products constitutes the majority of energy products sold externally.

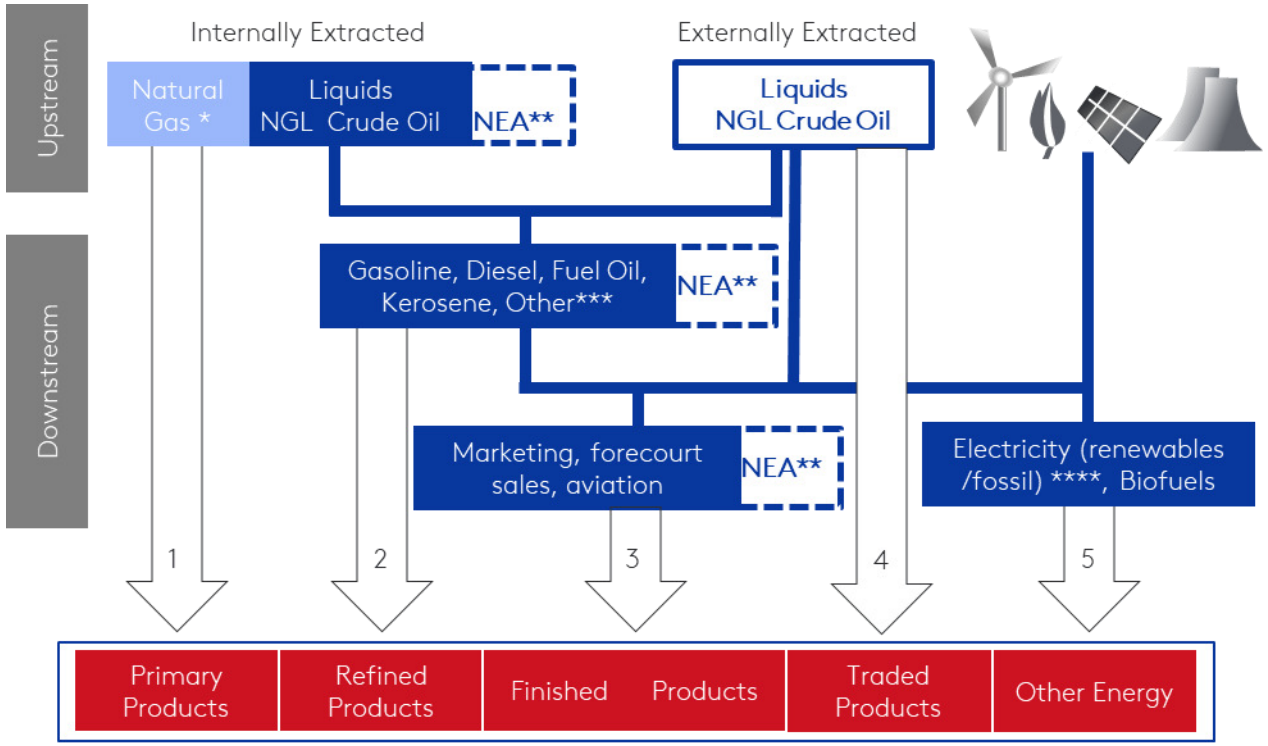
4) Sales of physically traded products. Some integrated oil and gas companies sell primary energy products (natural gas and liquids) extracted by third parties. We understand this activity is fairly widespread amongst integrated companies, but is currently only fully disclosed by BP, Total and Eni.

5) Sales of other energy products. BP, Eni and Total disclose electricity and heat generated from fossil fuels and low-carbon sources, including biofuels, solar and wind. While just a small proportion of their energy mix today, these businesses are expected to grow.

[6] See glossary.

In addition, an adjustment is made to reflect the portion of liquid hydrocarbon output destined for non-energy uses in the plastic and petrochemical industry. As petrochemicals are not typically burnt, they do not directly release CO_2 into the atmosphere. The total of energy products sold externally by each company, through all channels and adjusted for non-energy uses, is called its *'Assessed Product'*.

Figure 3. Calculating "Assessed Product": all energy products sold externally



All energy products sold externally

1. Primary products
2. Refined products
3. Finished products
4. Traded products
5. Other Energy

* Natural Gas is shown as an example of a primary product. TPI factors downstream natural gas into its assessment (where disclosure allows) but the supply chain is omitted here to simplify the chart

** NEA = Non-Energy Adjustment

*** Product basket (50% Naphtha/LPGs)

**** Energy only. Electricity emissions accounted for within scope 1 & 2 disclosure

Data availability: disclosure of historical emissions intensity

TPI is a disclosure-based framework and our aim is that companies themselves disclose their consolidated emissions intensity of energy sold externally, including all significant sources of emissions, and do so on a consistent basis.

Unfortunately, company disclosures do not meet this ideal at present. While six of the ten companies disclose Scope 3 emissions from use of sold products, these figures do not include sales of finished products, and therefore they are inconsistent with the boundary we use to assess Carbon Performance. In addition, none of the ten companies currently publishes aggregate data on total energy sold externally, or any breakdown thereof.

In the absence of suitable, consolidated disclosures of companies' emissions intensity, we have developed a methodology for making use of existing emissions and energy sales disclosures. To assess a company requires a minimum of two pieces of information:

1) *Scope 1 and 2 CO_2 emissions*. Seven of the ten companies disclose this information in full. Reliance has not yet provided any Scope 1 or 2 emissions data (although it has publicly stated that it intends to do so), Total only provides Scope 1 and 2 emissions related to its primary production activities, while EOG Resources does not provide information on its Scope 2 emissions. For Reliance, the lack of data means we are unable to provide an assessment of Carbon Performance at this time. For Total, we have increased disclosed Scope 1 and 2 emissions by 74% to reflect the size of Assessed Product relative to the company's primary production activities. In the case of EOG Resources, we can estimate Scope 2 emissions for 2016 on the basis of the ratio between Scope 1 and 2 emissions across the other E&P companies.
2) *A measure of all energy products sold externally, segmented by category*. This enables both Scope 3 emissions from use of sold products and the total energy sold to be calculated. All ten companies disclose data here to some extent, although Reliance does not provide finished sales data or a breakdown of refinery sales. Typically liquids sold are measured in barrels (Eni uses tonnes) and natural gas sales are measured in cubic feet or meters. The E&P companies – ConocoPhillips, EOG Resources and Occidental – tend to disclose natural gas, crude oil and NGL sales (ConocoPhillips also discloses bitumen sales). Integrated oil and gas companies typically disclose sales of natural gas, plus four named, refined oil products and an 'other' category. BP, Eni and Total also disclose electricity production from renewable energy sources.

Nine out of the ten companies provide sufficient information on these metrics to make an assessment. Nevertheless assumptions are still required in two key areas:

1) *Non-energy products*. Currently no company explicitly discloses the total proportion of its externally sold product volumes destined for non-energy uses. Shell indicates that 80% of its "Other" refined product is naphtha, which is therefore excluded from its Net Carbon Footprint calculation. We use this number for Shell (it implies 17% of overall liquids), but elsewhere we have to use a standard factor. Based on global data from IEA [6], we assume that at least 9.7% of liquid sales are non-energy products and all products disclosed as bitumen, naphtha, lubricants, solvents and refinery feedstocks are destined for non-energy use. Where a company discloses sales of non-energy products greater than 9.7% (ConocoPhillips discloses bitumen sales of 15%), the higher figure is used. The proportion of sales destined for non-energy uses is likely to vary widely by company.
2) *Trading businesses*. Neither BP nor Total provides a product breakdown for their oil trading businesses, which account for 44% and 37% of Assessed Product respectively. We have assumed these businesses sell crude oil.

Data availability: targets

Five of the ten companies have published ambitions or targets to reduce emissions, which can be converted into an estimate of the future carbon intensity of energy supplied.

BP, ConocoPhillips and Eni have set targets relating to operational emissions (either Scope 1 or Scope 1 and 2). As these targets only cover part of total emissions, assumptions are required to calculate how emissions outside the scope of the target evolve. We apply the approach used by TPI in other sectors, namely assuming the emissions intensity of activities outside the scope of the target remains constant. BP's absolute emissions target requires us to make an assumption about the future growth of energy supplied by the company. This is achieved by assuming its energy sold externally grows in line with IEA global forecasts, again following the approach adopted by TPI in other sectors. Our detailed approach to each target is as follows:

- BP targets Scope 1 emissions of 51 $MtCO_2$ in 2025, which is the same as the 2015 level. To convert this into an emissions intensity target, we assume that the intensity of the company's Scope 2 emissions, plus Scope 3 emissions from use of sold products, remains constant over the same period. To calculate the company's 2025 Scope 1 intensity, we divide absolute emissions of 51 $MtCO_2$ by a projection of the company's energy supply in 2025. This projection is made by assuming BP's energy supply grows in line with the IEA's projections for the sector over the forecast period, i.e. 1.12% per year. The resulting Scope 1 emissions intensity is then added to the Scope 2 and 3 intensity calculated for 2017 and which is assumed to be unchanged in 2025.
- ConocoPhillips targets a 5-15% reduction in its Scope 1 and 2 emissions intensity by 2030, relative to 2016. Given the target is quoted as a range, we assume a mid-point 10% reduction in the company's Scope 1 and 2 emissions intensity and add this to an unchanged emissions intensity from Scope 3 use of sold products.
- Eni sets four emissions reduction targets. The first two are absolute reduction targets, which aim to cut Scope 1 emissions by nearly 8 $MtCo_2e$ from the 2014 level by 2025, through reducing flaring and methane losses. The third targets a 43% reduction in "GHG emissions / gross hydrocarbon production 100% operated (E&P)" from the 2017 level by 2025. This emissions intensity target covers 52.6% of Scope 1 emissions in 2017, or 22.2 $MtCO_2$. These targets are assumed to supersede the (fourth) 2021 emissions intensity target and the remainder of the company's emissions intensity (Scope 3 emissions from use of sold products, Scope 2 emissions and other Scope 1 emissions) is assumed to be unchanged.

Shell and Total have published emissions intensity ambitions that include both operational emissions (Scope 1 and 2) and Scope 3 emissions from use of sold products:

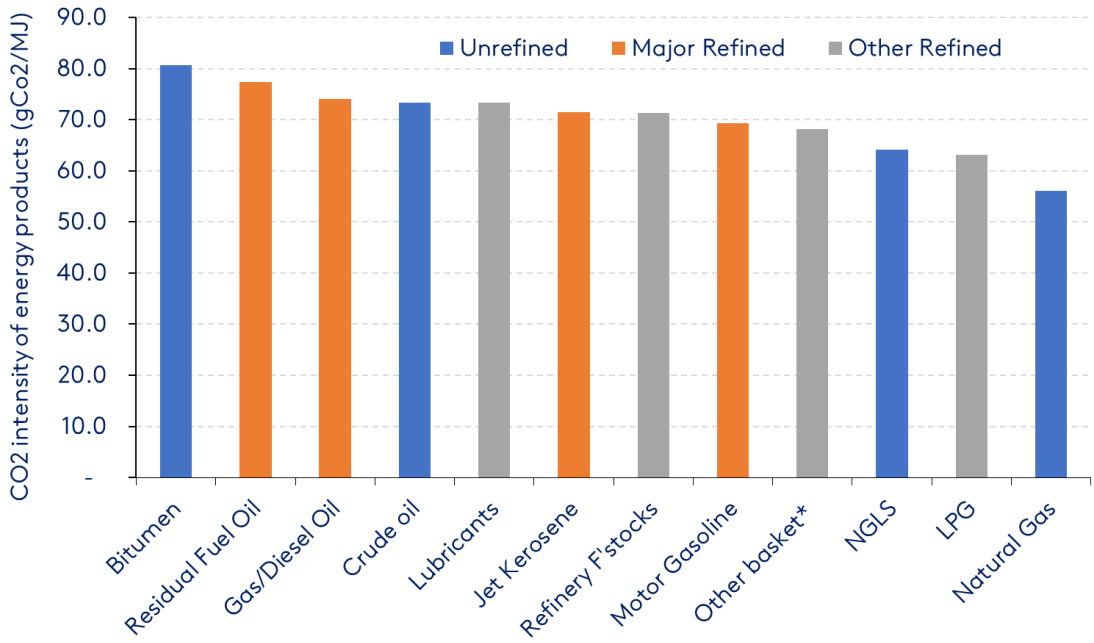
- Shell aims to reduce its "net carbon footprint" by 20% below the base year value by 2035, and by 50% by 2050.[7] The company's net carbon footprint comprises the lifecycle emissions of energy supplied. While this measure does not exactly correspond with our calculation, it is close, so we assume it covers all relevant emissions and is comparable to the IEA's ETP carbon intensity of energy supply.
- Total aims to reduce its emissions intensity (measured in tCO_2 / tonne of oil equivalent) from the 2015 level by 15% by 2030 and 25-35% by 2040. We take the mid-point of the 2040 range and assume this metric applies to all emissions relevant to our calculation.

Calculating energy supplied and Scope 3 emissions from use of sold products

The emissions and energy content of fossil fuels varies by product (see Figure 4). Our analysis uses product CO2 emissions factors from the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories [7].

[7] Shell Management Day Presentation, 23rd-25th November 2017. See http://go.shell.com/2nSSAk5

Figure 4. The CO_2 intensity of disclosed energy products



** Other basket is 50% naphtha and 50% LPGs based on IEA analysis of residual fuels (see text)*

The first step in this methodology is assigning the product categories disclosed by companies to IPCC categories (see Table 1). This is relatively straightforward in most cases. BP, Chevron, Exxon Mobil and Shell disclose four categories of refined oil product that account for between 83% and 94% of liquid volumes and broadly correspond with IPCC categories, as well as the major product categories identified by IEA (i.e. motor gasoline, gas/diesel oil, fuel oil and jet kerosene). Where there is some ambiguity, we reference IEA's model of global consumption of oil by category [1] to determine the most appropriate classification.[8]

For the residual 'Other' category, comprising 6-17% of liquid volumes, we assume a split of 50% Naphtha and 50% LPG. This is based on IEA data, which indicates that Naphtha and LPG account for 15% of consumption globally (7.6% and 7.4% respectively).

After assigning a product to an IPCC category, the second step is to apply the relevant emission and energy factors (see Table 2). As IPCC factors are given on a weight basis and most energy production is given in barrels of oil or, in the case of natural gas, a volume measurement, unit conversions are required.[9] The resulting variation of emissions intensity of the range of products assessed is shown in Figure 4.

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[8] Thus the 41% of Exxon Mobil's refined product sales disclosed as "gasoline, naphthas" is categorised as "Motor Gasoline", based on IEA's estimate of naphtha accounting for just 8% of global consumption, compared with Motor Gasoline accounting for 30%. Equally Exxon Mobil's and BP's "Aviation fuel" category, Shell's "Kerosene" and Total's "Avgas and Jet Fuel" are all categorised as "Jet Kerosene", on the basis that Jet Kerosene accounts for 8% of global consumption, while IPCC categories such as "Other Kerosene" and "Aviation Gasoline" account for just 1% and less than 1% respectively. Eni and Total additionally disclose volumes of products like LPG and lubricants, which can be directly matched to IPCC categories.

[9] Product weight is converted into barrels using BP data [7], supplemented by additional information for some of the lower volume fuels. Natural gas, typically disclosed in cubic feet (cf), is converted to barrels of oil equivalent (boe) based on the volume needed to generate the same energy. There are 5.6 cf in a barrel of oil, but as the energy content of gas varies, the conversion rate used ranges from 5.5 (Eni) to 6.0 (ConocoPhillips). Company conversion rates also vary slightly over time. Where no specific conversion figure is given, we have used a conversion rate of.8 cf of natural gas per boe. This figure is widely used, including in Shell's Annual Reports.

Table 1. Assigning reported unrefined and refined energy products to IPCC category

	Unrefined products				Major Refined/Finished Products				Other Refined / Finished Products			
IPCC Product Category	Crude Oil	Natural Gas Liquids	Natural Gas	Bitumen	Motor Gasoline	Gas/ Diesel Oil	Jet Kerosene	Residual Fuel Oil	Other Basket (LPG + Naphtha)	Liquified Pet. Gases	Lubricants	Refinery F'Stocks
Exxon					Gasoline, napthas	Heating oils, kerosene,	Aviation fuels	Heavy fuels	Speciality			
Chevron					Gasoline	Diesel/Gas Oil	Jet Fuel	Residual Fuel Oil	Other Petroleum Products			
Shell				Bitumen	Gasolines	Gas/diesel oils	Kerosines	Fuel oil	Other products			
BP					Gasolines	Middle distillates	Aviation fuels	Fuel oil	Other products			
Total				Bitumen	Motor gasoline	Diesel fuel and heating oils	Avgas and jet fuel	Fuel oils	Other products	LPG	Lubricants. Solvents	
ConocoPhillips	Crude Oil	NGL	Natural Gas	Bitumen								
EOG Resources	Crude oil and Condensate	Natural Gas Liquids	Natural Gas									
Occidental	Oil	Natural Gas Liquids	Natural gas									
Eni					Gasoline	Gasoil	Jet fuel / Kerosene	Fuel oil	Others	LPG	Lubricants	P'chemical feedstock
Reliance	Oil	Condensate	Gas									
Consumption of total global liquids produced (%)					**29.8**	**34.8**	**8.3**	**7.7**	**15.0**	**7.4**	**NA**	**NA**

* See [6]

Table 2. Conversion of IPCC Emission and Energy Factors into per barrel equivalent

IPCC product category	Emissions per Barrel Equivalent				Energy per Barrel Equivalent				Emission intensity
	Default carbon content			CO_2 per	Net Calorific Value		Weight	Net Cal. Val.	
	Carbon kg / GJ	CO_2 factor	CO_2 kg / GJ	barrel grams	TJ / Gg	TJ / Tonne	tonnes / barrel	MJ / barrel	gCO_2 / MJ
Unrefined products									
Crude oil	20.0	3.67	73.3	**423,113**	42.3	42,300	0.136	**5,770**	**73.3**
Natural Gas Liquids *	17.5	3.67	64.2	**229,548**	44.2	44,200	0.081	**3,577**	**64.2**
Natural Gas **	15.3	3.67	56.1	**308,401**				**5,497**	**56.1**
Bitumen *	22.0	3.67	80.7	**515,605**	40.2	40,200	0.159	**6,392**	**80.7**
Major Refined products									
Motor Gasoline	18.9	3.67	69.3	**368,399**	44.3	44,300	0.120	**5,316**	**69.3**
Gas/Diesel Oil	20.2	3.67	74.1	**426,772**	43.0	43,000	0.134	**5,762**	**74.1**
Jet Kerosene	19.5	3.67	71.5	**400,450**	44.1	44,100	0.127	**5,601**	**71.5**
Residual Fuel Oil	21.1	3.67	77.4	**490,721**	40.4	40,400	0.157	**6,343**	**77.4**
Other Refined products									
Other basket (LPG and Naphtha) *	18.6	3.67	68.2	**346,337**	45.8	45,750	0.111	**5,078**	**68.2**
Liquified Petroleum Gases	17.2	3.67	63.1	**256,543**	47.3	47,300	0.086	**4,068**	**63.1**
Lubricants *	20.0	3.67	73.3	**441,077**	40.2	40,200	0.150	**6,015**	**73.3**
Refinery Feedstocks *	19.5	3.67	71.3	**376,641**	42.3	42,250	0.125	**5,281**	**71.3**

** Weight per barrel conversion factors: Natural Gas Liquids and Naphtha* [2] *Lubricants* [3] *and bitumen* [4], [2] *** Natural Gas is assumed to have energy of 5.5GJ per barrel of oil equivalent based on* [5] *(pg. 182)*

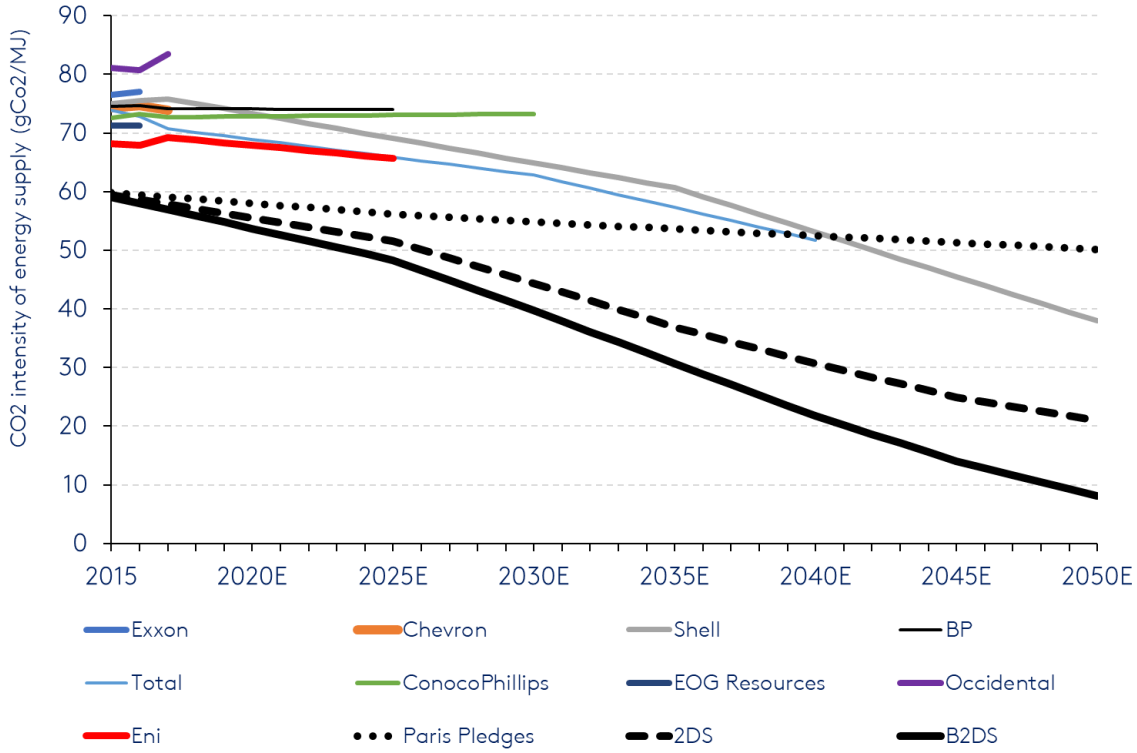
4. Results

4.1. Benchmarking oil and gas producers against the carbon intensity of energy supply

Figure 5 plots the carbon intensity of energy supply for nine of the world's top ten oil and gas companies (Reliance is excluded due to insufficient disclosures) and compares it with the benchmarks. We find that all nine companies have a historical carbon intensity (i.e. averaged over 2015-17) that is well above the benchmarks. The least carbon-intensive company is Eni, but at 68 gCO_2/MJ it is still 15% above the least stringent Paris Pledges benchmark. The most carbon-intensive company is Occidental at 82 gCO_2/MJ; 37% above the Paris Pledges benchmark. The fact that all nine companies begin well above the benchmarks reflects what is, in essence, a comparison between relatively high-carbon energy suppliers (oil and gas companies) and the average energy supplier across all sources, whether low or high in carbon.

Five of the nine companies assessed provide ambitions or targets to reduce their emissions, which we have been able to use to assess alignment with the benchmarks in future. We find that targets focused only on reducing operational emissions (Scope 1 and 2) have little impact on overall emissions intensity. This is due to the overwhelming importance of emissions from Scope 3 use of sold products. Consequently BP and ConocoPhillips will in fact be further away from alignment by their target years. Eni closes the gap between its carbon intensity and the benchmarks fractionally, but remains out of alignment by its target year.

Figure 5. Carbon intensity pathways for the top ten oil and gas companies versus low-carbon benchmarks



Shell and Total have set out emissions reduction ambitions including Scope 3 use of sold products. We find that both Shell and Total become aligned with the Paris Pledges benchmark by 2040. Shell's more aggressive rate of decarbonisation post 2035 puts it on a path to potentially align with 2 Degrees in the second half of the century. Nonetheless it is clear that none of the nine companies aligns with either the 2 Degrees benchmark or the Below 2 Degrees benchmark at any point before 2050. No companies currently plan for their emissions to reach net-zero before mid-century.

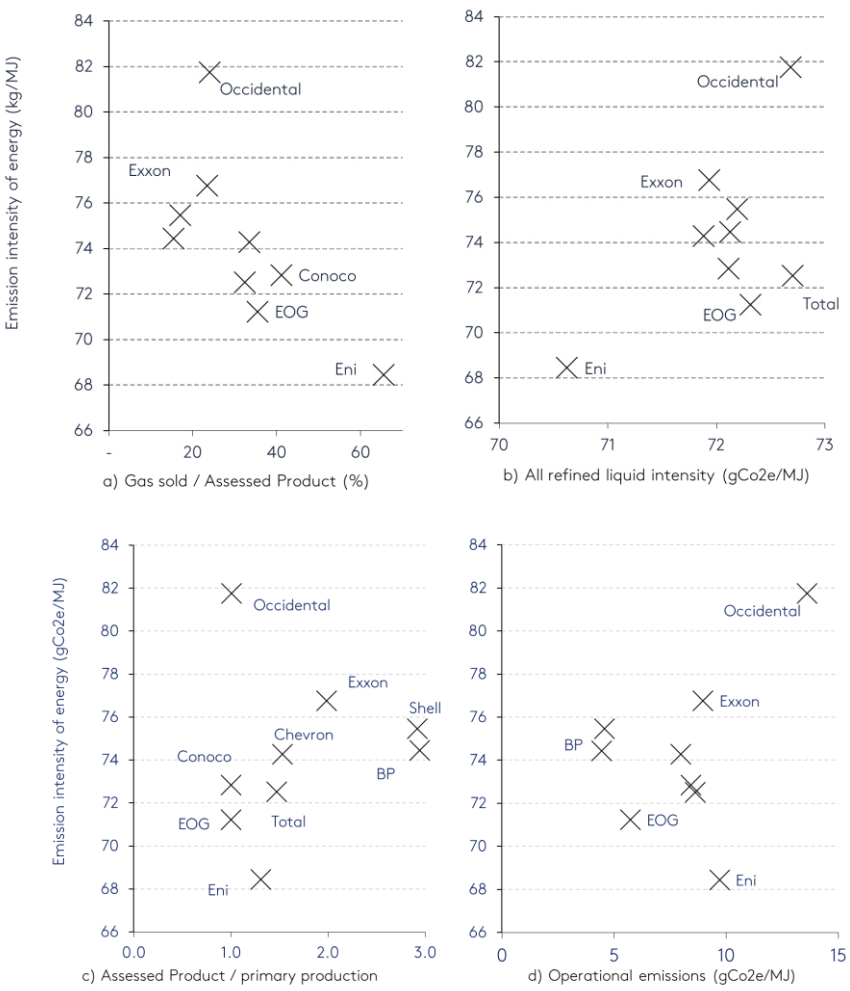
4.2. Variation in companies' carbon intensity of energy supply

The current average carbon intensity (over 2015-17) of the largest oil and gas companies is tightly clustered between 68 gCO_2/MJ and 82 gCO_2/MJ. Four factors were assessed with a view to explaining company differences within this range:

1) The proportion of natural gas in the mix;
2) Variation in the emissions intensity of liquid products;
3) The extent of downstream activity; and
4) The level of operational emissions (Scope 1 and 2).

The results presented in Figure 6 suggest none of the factors assessed exerts a dominant influence on the results. As expected, emissions intensity falls with the share of gas sold in Assessed Product (Figure 6a) and rises with the average emissions intensity of refined liquid products (Figure 6b), but similar product mixes result in different emissions intensities. Interestingly, there is no clear evidence that emissions intensity is determined by business model, i.e. by a systematic difference between E&P and integrated companies (Figure 6c). This suggests it is possible to compare E&P and integrated companies directly. There is no clear relationship between operational emissions and overall emissions intensity, consistent with the small share of overall emissions accounted for by operational emissions (Figure 6d).

Figure 6. Overall carbon intensity vs a) the proportion of natural gas in the mix, b) variation in the emissions intensity of liquid products, c) the extent of downstream activity and d) the level of operational emissions



The analysis does suggest that Eni's low emissions intensity reflects both the high proportion of natural gas in its Assessed Product (at 65% it is more than double the average) and the low emissions intensity of its liquid products. Eni classifies 43% of refined liquid fuels as 'Other', a category to which we ascribe a relatively low (68 gCO_2/MJ) emissions intensity.

Occidental's high emissions intensity reflects combination of the relatively low proportion of natural gas in its product mix (24%), a high liquid emissions intensity (73 gCO_2/MJ) and high operational emissions.

4.3. Comparing the results with companies' published data

As no oil and gas company currently publishes directly comparable figures, it is not possible to test the accuracy of our emissions intensity results. Shell's disclosed emissions intensity figure of 83 gCO_2/MJ [5] (versus our estimate of 75) uses a "net carbon footprint" lifecycle methodology that, amongst other differences, includes upstream emissions from externally acquired products. Total recently disclosed [6] a "Carbon Intensity" of 71 gCO_2/MJ in 2015 (vs. our estimate of 72), but the methodology was not precisely defined.

It is possible to test the emissions calculation method by narrowing the boundary of Assessed Product to match the Scope 3 use of products data where it is currently disclosed (Table 3). The results suggest our approach can be reasonably accurate, with an average discrepancy of -1% and estimates for four of the six companies falling within 5% of the disclosed figure. However, due to insufficient disclosure, it is not always clear that the boundary used in our modelling (consolidation method, approach to non-energy products, and scope of activities) exactly matches that used by the company when producing its disclosed data. These issues are highlighted in the notes to Table 3 and are discussed in more detail in Section 5.2.

Table 3. Disclosed Scope 3 use of sold products data vs TPI calculations

			Emissions (mT)		Variation
Company	Product boundary used by company	Year	Compan	TPI	(%)
Chevron	Unrefined production only	2017	376	358	(4.8)
Shell *	Natural gas + refined production. Adjusted for non-energy	2016	600	598	(0.3)
BP **	Natural gas, NGLs & refined production on equity basis	2017	412	379	(8.0)
Total	Natural gas + refined production	2017	400	403	0.8
ConocoPhillips **	Natural gas, NGLs & refined production on equity basis	2017	164	179	9.0
Eni **	Unrefined production only on an equity basis	2017	229	230	0.4
Total			**2,181**	**2,146**	**(1.6)**

* Shell's Scope 3 use of products disclosure explicitly breaks out the proportion of emissions generated by energy products and therefore we use this adjusted figure.
** BP, ConocoPhillips and Eni publish Scope 3 emissions on an equity basis that is not necessarily consistent with the operational data the TPI uses to estimate emissions.

5. Discussion

5.1. Summary of results

This discussion paper has updated the methodology developed by TPI in March 2018 [1] to assess the Carbon Performance of oil and gas producers, and it has applied this updated methodology to the ten largest publicly listed oil and gas producers globally, as measured by market capitalisation. We have found that:

- It is possible to assess the Carbon Performance of these companies using their publicly disclosed data, on the basis of the carbon intensity of energy supply. Nine companies provide both operational (Scope 1 and 2) CO_2 emissions data and an adequate breakdown of externally sold energy volumes. By applying IPCC factors to these energy volumes, we can estimate current Scope 3 emissions from use of sold products, the key emissions category for oil and gas companies, as well as total energy sold externally. Taking total emissions and dividing by energy sold externally enables us to compare companies' carbon intensity with benchmarks derived from IEA modelling of primary energy supply.
- The carbon intensity of all nine oil and gas companies assessed exceeds the benchmarks currently. It ranges from Eni's 68 gCO_2/MJ to Occidental's 82 gCO_2/MJ (15% and 37% above the least stringent Paris Pledges benchmark respectively). This reflects what is a comparison between oil and gas companies, who currently supply energy almost exclusively from high-carbon sources, and the average of companies across the whole energy sector, including supplies from both high-carbon and low-carbon sources. In the long term, if dangerous climate change is to be avoided, only low-carbon sources can be used.
- The differences in carbon intensity between the companies are modest overall and appear to reflect a combination of the share of natural gas in the product mix, the emissions intensity of their liquid product and the intensity of operational emissions. However, none of these factors appears to exert a dominant role. Eni's low carbon intensity reflects a product mix with a high proportion of natural gas and a less emissions-intensive liquid portfolio; Occidental's high carbon intensity appears to reflect high operational emissions, a carbon-intensive liquid portfolio and a low proportion of natural gas. There appears to be no systematic difference in carbon intensity between E&P and integrated companies.
- As no company currently discloses Scope 3 emissions from all sold energy products, we cannot directly compare our overall estimates of carbon intensity of energy supply with companies' own published data. However, narrowing the product boundary to match companies' current Scope 3 disclosures suggests that our methodology is capable of reproducing companies' own emissions data. The average discrepancy across the six companies that disclose Scope 3 emissions from use of sold products is -1%, with four of the six estimates falling within 5% of the disclosed figure.
- The narrow range of company carbon intensities and the potential errors in estimating Scope 3 emissions from use of sold products suggest that investors should not attribute too much weight to the relative position of oil and gas companies today. Greater disclosure, particularly of the energy content of products sold and emissions from downstream refining and marketing activities, would improve the accuracy of the assessment and could substantially impact the ranking.
- Five of the ten companies have set some form of quantitative emissions ambition/target, enabling TPI to benchmark their future Carbon Performance. Three of these companies, BP, ConocoPhillips and Eni, have set targets relating to their operational emissions. Two companies, Shell and Total, have expressed ambitions to reduce not only their operational emissions, but also emissions from their value chains, including from use of sold products, which is the major source of emissions for all oil and gas producers.

- The ambitions of Total and Shell would see them become aligned with the least stringent Paris Pledges benchmark by 2040. The remaining companies never come into alignment with any of the benchmarks. This illustrates the importance of setting ambitions or targets relating to emissions from use of sold products.
- No company has proposed to reduce its carbon intensity sufficiently to be aligned with a 2 Degrees or Below 2 Degrees benchmark by 2050. No company currently plans to achieve net-zero emissions by 2050.

5.2. Future evolution of the methodology

This paper demonstrates it is possible to estimate the carbon intensity of most of the largest listed oil and gas companies using publicly disclosed information. Nevertheless we believe improved disclosure would improve the accuracy of the assessment. As Table 4 highlights, no company discloses either emissions, targets or energy product sales in a consistent way.

This inconsistency can be clearly seen in the approach to disclosing Scope 3 emissions. Currently no integrated oil and gas company discloses emissions related to all of its external energy sales: Exxon does not disclose any Scope 3 emissions, Chevron only discloses Scope 3 emissions related to its primary products, while Shell, BP and Total disclose Scope 3 emissions on the basis of primary and refined production. Even here variation can be found. BP's disclosure is on an equity share basis, unlike the approach adopted by Shell and Total.

This approach to Scope 3 disclosure appears to contradict both the stated principles of relevance, completeness and consistency established by IPIECA and the net volume accounting method it outlines.[9] Company feedback suggests the current IPIECA guidelines only oblige Scope 3 emissions relating to the "most relevant" segment be disclosed. Whether it is the guidelines or their interpretation that is the cause, we see this inconsistency as a big problem for investors. It is currently very difficult for investors to understand the full environmental impact of oil and gas companies, or compare their impact.

Table 4. Current emissions, energy and target disclosure for the ten largest oil and gas companies

	Emissions disclosure *			Energy Disclosure (total/breakdown) **					NEA	Target	Notes
	Scope 1	Scope 2	Scope 3	Primary	Refined	Marketing	Trading	Other	Non-Energy Adjustmen	Ambition/ Target****	
Exxon	●	●		●●	●	●●			●		Not a very granular split of sales of refined products. No indication of trading sales or refinery products
Chevron	●	●	●	●●	●●				●		boundary of scope 3 disclosure appears to be production (5% error)
Shell	●	●	●●●	●●	●●	●●	●○	X○	●●	●●●	1% error on sc3 calc. Sc.3 disc. on all sold products expected. Target based on "lifecycle emissions": incl. Sc1&2 for acq. energy but excl. 1&2 associated w/plastic
BP[1]	●	●	○○	●●	●●	●●	●	●○	●	●	wind disclosure. No solar disclosure
Total[2]	○	○	●●	●●	●●	●●	●●	XX	●	●●●	TPI adj. Sc.3 est 12%< disc. Target given in co2 per toe. TPI uses **all emissions** /Energy from **all sold products.** Converts to toe (30%>Total est) and cuts applied to this #
ConocoPhillips[1]	●	●	○	●●					●●	●●	E&P company. Breakout of NGLs. Adjusted for disclosed bitumen production. Target to reduce Scope 1&2 by 10% by 2030
EOG Resources	●			●●					●		E&P company. Breakout of NGLs. But emissions (scope 1 only) disclosed via CDP. No adjustment made for plastic
Occidental	●	●		●●					●		Straightfoward E&P company. Breakout of NGLs. No adjustment made for plastic
Eni[1]	●	●	○	●●	●●	●●	●●	●○	●	●●●	The future of O&G? Gas orientated, target by y/e'18 and already breaks out other energy products. <2% error vs TPI Scope 3 calc. Breakdown of all sold products inc. trading?
Reliance	●	●		●●	●	X			●		Potentially problematic. Scope 1&2 disclosure expected soon but RIL is a conglomerate with broader activities. A refinery business but no breakdown of refinery products

Key: ● = disclosure expected, ○ = inconsistent or incomplete disclosure, X = insufficient disclosure to include

* Scope 3 emissions: ● = primary product only, ●● primary + refined only, ●●● all sold product

** Energy disclosure: ● = total number given, ●● = total plus breakdown

*** Non-energy Adjustment: ● = Adjustment based on disclosure ●● = Adjustment based on IEA (9.7% of liquid s

**** Target: ● = scope 1 based only, ●● = scope 1&2 ●●● = scope 3

1 BP, ConocoPhillips and Eni disclose Scope 1 and 2 on an operational basis and Scope 3 on an equity basis

2 Total only discloses Scope 1 and 2 related to production

**** Target: ● = scope 1 based only, ●● = scope 1&2 ●●● = scope 3

We calculate Scope 3 emissions independently based on companies' energy sales data. Nonetheless inconsistent disclosures do affect our assessments in a number of ways:

- Operational emissions and product volumes are disclosed using different reporting boundaries. ConocoPhillips and Eni disclose operational emissions (Scope 1 and 2) on the basis of 100% operational control, but their disclosure of product volumes (used by TPI to estimate emissions from use of sold products and energy supplied) is on an equity share basis. TPI accepts both operational control and equity share boundaries in its assessments, but inconsistency between the scope of disclosed operational emissions and product volumes makes it inaccurate to add Scope 3 use of sold products emissions to operational emissions. For these companies, TPI has attempted to adjust for this by scaling operational emissions using the ratio between production stated on an equity basis and on a 100% operational control basis.

- Inconsistent disclosure of traded products. BP and Total disclose large crude oil trading businesses, while Eni sells gas extracted by third parties. Even after attempting to adjust for energy that is not physically traded, these activities account for a relatively large proportion of their assessed product (44%, 37% and 23% respectively). We believe this activity is widespread amongst other integrated players, but may not be fully disclosed. Without disclosure of an oil trading business for example, the proportion of oil-based products in the mix is lowered, flattering emissions intensity results.
- Inconsistent disclosure of low-carbon initiatives. Shell, BP, Total and Eni all highlight initiatives to diversify into lower-carbon energy sources, such as biofuels, solar and wind power generation, within published investor materials. However, as the energy produced by these initiatives is a small proportion of the total currently, it is rarely systematically disclosed.
- Limited disclosure of non-energy products. Currently no company explicitly discloses the total proportion of sales destined for non-energy uses. Shell provides some guidance and ConocoPhillips discloses that 15% of liquid production is bitumen. In the absence of this disclosure, we are forced to assume 9.7% of liquid sales volume is non-energy across the rest of the sector. In reality the proportion of sales destined for non-energy uses is likely to vary widely by company
- Limited and inconsistent targets. Only five companies currently publish ambitions or targets that enable investors to assess the alignment of long-term strategic plans with international climate goals. In every case the metric deployed is different. The question of how binding "ambitions" will ultimately prove to be, is an area of uncertainty for investors.

We believe that these issues, in isolation, do not impact the emissions intensity results sufficiently to undermine the analysis. For example, as operational emissions are a small proportion of oil and gas companies' total emissions, restating them on an equity share basis (to match Scope 3 calculations) would have a modest impact on overall intensity.

Even with consistent and full disclosure of product volumes, there are further, inherent limits to the accuracy of the methodology. Issues include:

- Application of the appropriate IPCC category. Even with much more granular product disclosure, it may not be possible to match IPCC categories exactly. Exxon Mobil's composite categories "Gasolines, naphthas" and "Heating oils, kerosene, diesel oils" illustrate the issue, but all major categories are likely to contain some subsidiary products. Applying a standard product basket (50% naphtha / 50% LPGs) to all "other" categories is also problematic, particularly for Eni and Total, which separately breakout LPGs, and because "other" accounts for 43% of Eni's refined liquid production.
- The emissions and energy generated by energy products are inherently variable. The IPPC emission factors for unrefined products (e.g. crude oil) can range ± 5%.

6. Implications for investors

There are several strategies available to oil and gas companies to reduce their emissions:

1) Reduce operational (Scope 1 and 2) emissions.
2) Reduce the carbon intensity of their products by diversifying into low-carbon energy sources.
3) Shift hydrocarbon sales away from energy markets into plastics and petrochemicals.
4) Cut investment in new hydrocarbon production assets, exploit existing production assets and return profits to shareholders, perhaps eventually winding up the business.

BP, ConocoPhillips and Eni appear to be following strategy (1) at present. Our assessment highlights that this strategy does little to reduce their overall carbon intensity and the risks they therefore face from the low-carbon transition. In part this reflects relatively small targeted emissions reductions (i.e. by BP and ConocoPhillips). But it also reflects the fact that operational emissions are a small share of the lifecycle carbon footprint of oil and gas producers.

Strategy (2) is being adopted by two of the top ten oil and gas companies, Shell and Total, as well as other companies outside the top ten (e.g. Repsol). Our methodology enables these companies' long-term ambitions to decarbonise to be independently assessed and benchmarked. The results suggest that Shell and Total will substantially reduce their carbon intensity if they meet their long-term ambitions. But our results also show that they need to increase their long-term ambitions in order to be aligned with the most ambitious international climate commitments.

Our current methodology has limited ability to assess companies responding via strategies (3) or (4). Strategy (3) would reduce absolute emissions without reducing emissions intensity, as non-energy products are stripped out of the emissions intensity calculation. Likewise, in strategy (4), falling production levels would effectively reduce the absolute volume of CO2 released, but the emissions intensity of energy production may remain constant.

Given no company has articulated their intention to adopt either strategy (3) or (4), we believe our approach captures existing responses adequately. We could expand our methodology to encompass these other strategies, should it be required, and it may also be desirable for investors to use TPI's assessment alongside other, complementary forms of assessment. For example, Carbon Tracker's 2 Degrees of Separation classifies companies according to the competitiveness of their oil and gas reserves and explores their exposure to a carbon constraint imposed to limit global warming to well below 2°C.[10].

We urge investors not to over-interpret companies' relative positions today. Companies' current emissions intensities are similar and inconsistencies and limitations in disclosures (see below) create potential inaccuracies, which could have a big impact on how they rank. More significant, in our view, is the status of companies' future ambitions/targets.

By articulating long-term ambitions including Scope 3 emissions from use of sold products, companies such as Shell and Total are signalling that they are establishing business strategies today that will enable them to transition to a low-carbon future. Those that have either yet to set an ambition/target, or are still focusing exclusively on reducing operational emissions, are signalling to investors that they are not intending to make such a transition.

While this analysis demonstrates it is possible to benchmark Carbon Performance in the oil and gas sector using publicly disclosed data, improvements in disclosure would substantially improve the accuracy of our assessments. Box 2 outlines what we believe is needed and contrasts it with the current status of disclosure. Only six of the companies analysed in this report disclose Scope 3 emissions data and the chosen boundary is inconsistent in nearly every case. Industry reporting guidelines that enable oil and gas

companies to only disclose emissions at the boundary that is most relevant to them mean investors are unable to assess their full carbon footprint.

We believe investors should put further pressure on companies to provide additional disclosure and improve the consistency of existing data. Many investors perceive the emissions associated with use of sold products as the key long-term risk for the sector. This view reflects the threat of both dramatic demand shifts and increasingly stringent energy-related policy and regulation. Only by improving disclosure can they both accurately assess this risk and reliably monitor company progress against long term targets.

Box 2. Disclosure expectations for oil and gas companies versus current status

Many investors perceive the emissions generated from burning fossil fuels as the key long-term risk facing the sector. Yet current disclosure is patchy at best and even where available it is often inconsistent both internally and across the sector. Only by improving companies' public disclosure across the sector can investors accurately assess transition risk.

Disclosure expectations	Current Status
• Consistent emissions disclosure: o Direct and indirect (Scope 1 and 2) emissions covering all activities; o Scope 3 use of sold products emissions, stated on the same boundary as Scope 1 and 2 and covering all externally sold energy;	**7/10.** Total, EOG and Reliance do not disclose **0/10.** Shell has stated it intends to provide this, but has not set a date
• Energy disclosure (on a boundary consistent with emissions) o The total value (in MJ) of all externally sold energy products segmented by energy source/type; o The proportion of externally sold products destined for non-energy uses.	**0/10** **0/10**
• Long-term emissions reduction targets including Scope 3 use of sold products emissions and stated on a boundary consistent with emissions and energy disclosure: o Emissions intensity targets; o Or absolute reduction targets; o The planned contribution of negative emissions technologies such as CCS (Carbon Capture and Storage) or reforestation to long-term targets.	**2/10.** Shell + Total ambitions **0/10** **0/10.** Shell has set out a "potential illustrative strategy"

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Glossary

Downstream: a generic term that covers a range of activities such as refining and marketing, primarily undertaken by integrated oil and gas companies; distinct from "upstream" activities, which are the focus of E&P companies (see below).

E&P (Exploration and Production): a segment of the oil and gas industry focused exclusively on the location and extraction of primary energy products (see below); distinct from integrated oil and gas companies, which also undertake downstream activities such as refining and marketing of energy products to consumers.

LNG (Liquified Natural Gas): to make natural gas convenient to transport, it can be cooled to -162°C, shrinking it in volume by 600 times and turning it into a non-flammable liquid.

LPG (Liquified Petroleum Gas): crude oil refining or natural gas processing can extract butane and propane gas, collectively known as LPG. These two gases liquify under pressure and are therefore suitable as a portable energy source.

Naphtha: a generic term for refined or partially refined oil product that can be blended into motor and jet fuel and used as a petrochemical input ("feedstock").

NGL (Natural Gas Liquids): the liquid products separated from natural gas during processing are called NGLs. These include ethane (used in petrochemicals), propane and butane (see LPGs above) and condensate.

Primary Products: raw, unrefined energy products such as crude oil and natural gas are collectively referred to as primary energy products.

SDA (Sectoral Decarbonisation Approach): the SDA translates greenhouse gas emissions targets made at the international level into appropriate benchmarks, against which the performance of individual companies can be compared. See reference [2].

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