Consultation version of 10th of August 2020

Guidance on setting science-based targets for Oil, Gas and Integrated Energy companies

This document is a work-in-progress representing the views of its authors and perspectives conveyed by the Technical Working Group of this project. It is not meant to represent a definite position of the Science Based Targets initiative, nor the official position of any of the SBTi partner organisations. Because this document is a work-in-progress, it may still change, perhaps profoundly.

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This guidance also benefited early on from the work developed for the ACT – Assessing Low-Carbon Transition initiative, namely the TWG discussions and in particular the work developed by the team from iCare who led and wrote the ACT Oil&Gas methodology. Last, but not the least, this guidance also reflects multiple conversations one to one with all the members of the TWG as well as the TWG discussions and the written feedback to discussion papers on several of the topics this guidance addresses.

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Executive Summary

Section 1:

Setting GHG Science-Based Targets in the Oil & Gas Sector

Chapter 1: Scope and Boundaries

This chapter presents and defines the scope and boundaries considered in developing methodologies for science-based targets (SBT) setting of Oil, Gas and Integrated energy companies. For the purpose of this guidance we have considered an “Integrated Energy sector”, composed of Oil and Gas (O&G) companies, as well as Energy companies with oil and gas activities – but are no longer strictly just Oil and Gas and so can be considered as companies that are already in transition[1].

Oil and Gas energy companies vary widely in their core activities ((Tordo, 2011) and (Melton et al., 2015)). However, the industry is usually divided into three main segments (IPIECA, 2014):

1. Upstream: comprising exploration, drilling, production, and O&G field services;
2. Midstream: comprising pipelines, terminals, marine transportation, storage, and midstream services;
3. Downstream: comprising refineries, retail outlets, natural gas distribution, and petrochemicals.

Figure 1 - Activities in the O&G value chain

Proposed Scope

By scope, we mean the parts of the value chain addressed in methodology development, as well as the types of companies that can apply the methodologies for GHG target-setting purposes. Wells often produce both oil and gas, but for clarity we differentiate their value chains.

The proposed scope relies on the following agreed assumptions:

1) Oil and Gas companies may choose to address the challenges of the energy transition by pursuing the following strategic options[1]:
   a) Wider energy provision (instead of oil and gas provision), which encompasses a wider variety of energy products and services, including the electricity value chain, the biomass, hydrogen and ammonia value chains, energy efficiency services, etc.
   b) Moving into a circular carbon company, with the provision of carbon capture, usage and storage services or products related with carbon;
   c) Continue to focus on oil and gas production while managing its decline.
   d) Completely reinvent its business model, operating in another sector (not addressed here).
2) The focus is on energy products. While we recognize that non-energy uses provide pathways with limited associated emissions for fossil hydrocarbons, this is a different sector to the O&G sector that will see separate methodological developments under the Science Based Targets initiative (SBTi). Accounting for hydrocarbon flows to non-energy uses will be dealt with later in this document when addressing operational boundaries.

Some activities that occur in this expanded Oil and value chain (see point 1 above, what we are designating as Oil, Gas and Integrated energy value chain) were not considered sufficiently distinct or significant in terms of carbon emissions to be prioritized for their own SBT methodology at this stage:

[1] Please see chapter 7 for details of the different transition modes considered.

1. O&G services and logistics: although these players have a critical role in discovering resources, they are not the ultimate decision-makers on the investments needed to convert resources into reserves. They are not a high priority for an SBT methodology;

2. O&G transportation and storage: pure players of pipelines, vessels, or storage facilities are excluded. The considerable lock-in effect and continuous efforts for expanding the transportation infrastructure make it an unlikely candidate for an SBT. Furthermore, this stage is also responsible for a small percentage of overall emissions from the O&G sector (~1%[2]) and is a low priority for the SBTi[3];

3. Trading: is not seen as a strong lever for change among players in Oil, Gas and Integrated Energy sector;

4. O&G and electricity equipment manufacturing: these activities are excluded as they fall within a different sector (manufacturing) and considered too upstream from energy supply activities.

Figure 2 and Figure 3 show the activities in the O&G value chains considered for coverage by the methodologies and those activities that were excluded.

Figure 2 – Activities in the oil value chain and exclusions to scope (red boxes)

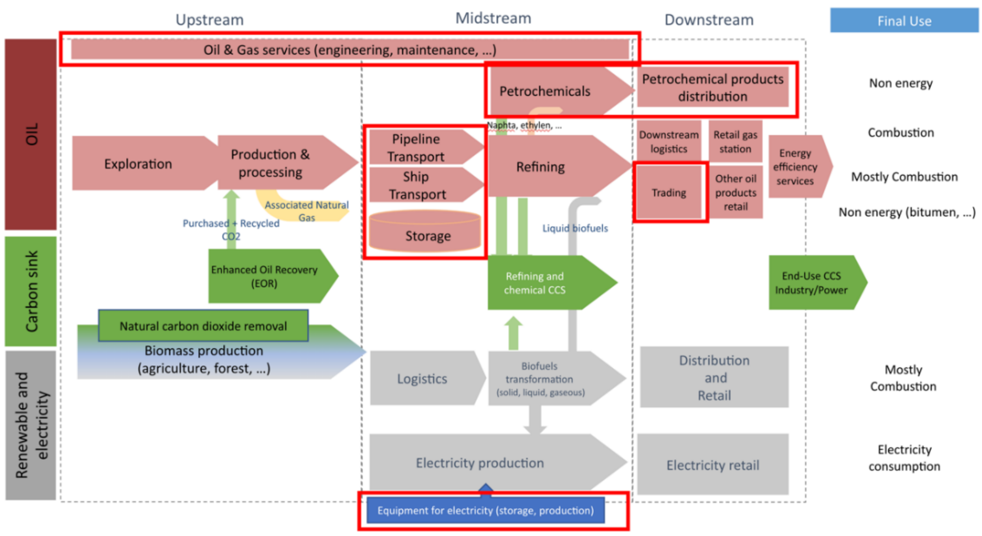
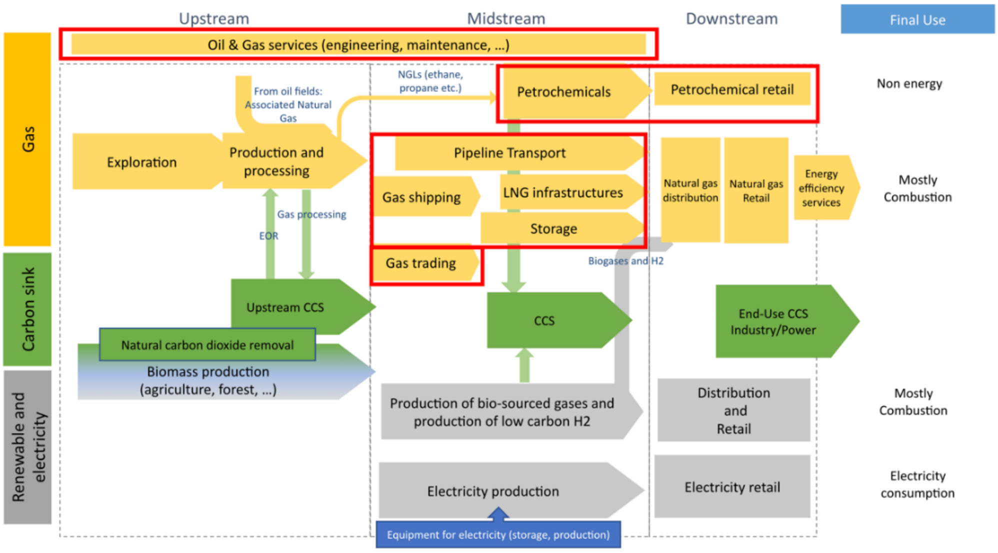


Figure 3 – Activities in the gas value chain and exclusions to scope (red boxes)

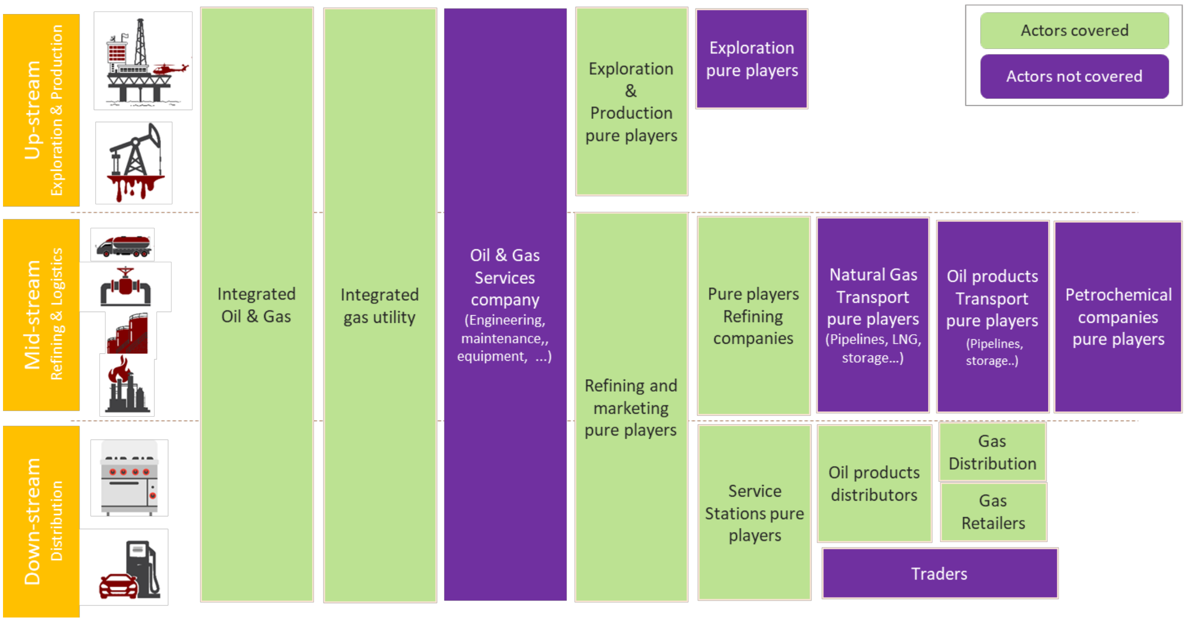
[2] According to data from https://oci.carnegieendowment.org/.
[3] The SBTi also considers that the enabling role of the O&G transportation infrastructure and the continuing trend in construction of this type of infrastructure are relevant, however, at this stage it is not seen how an SBT method focused on emissions can help with this challenge.



Gas distribution and retail are both within scope. Gas distribution is the final step in delivering natural gas to consumers. While large industrial or commercial customers can receive natural gas directly from the transmission network, most other users receive natural gas from their local distribution company that operates and manages low-pressure distribution networks.

The following common types of companies in the O&G value chain are covered by this Guidance as shown in Figure 4.

Figure 4 – Companies in the O&G value chain covered by the SBT O&G guidance



Proposed Boundaries

This section defines what organizational and operational boundaries shall be considered by the companies that fall in scope (as defined in the previous section). By boundaries, we mean the set of activities that companies shall consider in setting SBT.

Organizational boundaries

The SBTi expects companies to follow the GHG Protocol and consolidate their emissions according to one of the three approaches it defines (operational control, financial control or equity share)[4]. The O&G sector is known for its complex ownership arrangements for operating assets - for example, joint ventures in which multiple companies have an equity share in an asset are common within the sector. This may be overlaid by contracts/sub-contracts for a third party to operate the asset.

For practical reasons, the approach taken differentiates organizational boundary requirements in the setting of SBT's in the following manner:

1. companies shall follow an equity share approach in consolidating Scope 3 emissions, namely Purchased Goods and Services and Use of Sold Products categories;
2. companies should follow an equity share approach in consolidating Scope 1&2 emissions but may follow an operational control approach.

Operational boundary

Operational boundary requirements set which GHG emission sources (and sinks) should be considered for SBT setting purposes. These are set for key segments below.

Table 1 - Upstream (production & gas processing)

Scope	Sources	Emissions	Consolidation approach
1	Mobile and stationary, including flaring	Shall account for Direct emissions: CO_2 from combustion May account for Direct emissions: N_2O and CH_4 from combustion	Should consolidate on Equity share basis May consolidate on operational control basis
	Venting, flaring, and fugitives	Shall account for Direct emissions: CH_4 May account for Direct emissions: CO_2	
2	Electricity, heat and steam	Shall account for Indirect emissions: CO_2 May account for Indirect emissions: N_2O and CH_4 from combustion	
3	Use of sold products (crude oil, natural gas)	Shall account for Indirect emissions: CO_2 May account for Indirect emissions: N_2O and CH_4 from combustion	Shall consolidate on Equity share basis
	Purchase goods and services (crude oil, natural gas)	Shall account for Indirect emissions: CO_2 and CH_4 (non-combustion) May account for Indirect emissions: N_2O and CH_4 from combustion	
	The Scope 3, Use of sold products category will refer to oil and gas (and associated products) production by the company and shall be consolidated on an Equity basis as usually found in financial reports. Emissions related to the use of crude oil and gas in non-energy products are not included within the Scope 3, Use of Sold Products category. See Annex A for details.		

Table 2 - Oil midstream (Refinery)

Scope	Sources	Emissions	Consolidation approach
1	Mobile and stationary, including flaring	Shall account for Direct emissions: CO_2 from combustion May account for Direct emissions: N_2O and CH_4 from combustion	Should consolidate on Equity share basis May consolidate on operational control basis
	Venting, flaring, and fugitives	Shall account for Direct emissions: CH_4 May account for Direct emissions: CO_2	
2	Electricity, heat and steam	Shall account for Indirect emissions: CO_2 May account for Indirect emissions: N_2O and CH_4 from combustion	

[4] Of the 96 O&G companies that reported their organizational boundaries in 2019 to CDP, 85 reported using operational control, nine financial control and two equity share.

3	Use of sold products (crude oil, natural gas)	Shall account for Indirect emissions: CO_2 May account for Indirect emissions: N_2O and CH_4 from combustion	Shall consolidate on Equity share basis
	Purchase goods and services (crude oil, natural gas)	Shall account for Indirect emissions: CO_2 and CH_4 (non-combustion) May account for Indirect emissions: N_2O and CH_4 from combustion	
	Scope 3, Use of sold products category will refer to volumes of finished oil and gas products, ready to be commercialized or inject into transmission grids and that the company effectively sells to other for further distribution (physical sales). Emissions related to the use of refined non-energy products (lubricants, waxes, etc) sold are not included within the Scope 3, Use of Sold Products category. See Annex A for details.		

Table 3 - Oil downstream (service stations and oil distributors)

Scope	Sources	Emissions	Consolidation approach
2	Electricity, heat and steam	Shall account for Indirect emissions: CO_2 May account for Indirect emissions: N_2O and CH_4 from combustion	Shall consolidate on Equity share basis
1	Road transportation	Shall account for Indirect emissions CO_2 May account for Direct emissions: N_2O and CH_4	
3	Use of sold products (Refined products)	Shall account for Indirect emissions CO_2 May account for Direct emissions: N_2O and CH_4	
	Scope 3, Use of sold products category will refer to volumes of energy products ready to be used by a final consumer and that the company effectively sells to a final user through its retail and petrol distribution stations. Emissions related to the use of refined non-energy products (lubricants, waxes, etc) sold are not included within the Scope 3, Use of Sold Products category. See Annex A for details.		

Table 4 - Gas downstream (gas distribution and gas retail)

Scope	Sources	Emissions	Consolidation approach
1	Fugitive emissions	Shall account for Direct emissions CH4	Shall consolidate on Equity share basis
	Mobile and stationary combustion	Shall account for Direct emissions CO_2 May account for Direct emissions: N_2O and CH_4	
2	Electricity, heat and steam	Shall account for Indirect emissions CO_2 May account for Indirect emissions: N_2O and CH_4 from combustion	
3	Use of sold products (Gas products)	Shall account for Indirect emissions CO_2 May account for Indirect emissions: N_2O and CH_4 from combustion	
	Scope 3, Use of sold products category will refer to volumes of gas products sold to a final consumer, household or industrial.		

Scope 3 volume counting for Integrated Oil and Gas companies: Net Value Chain approach

Oil, Gas and Integrated energy companies trade energy products at multiple points of their value chains. The goal is to assess all energy products sold by a company, which includes material produced and processed by the company and materials produced and processed by others. This approach considers the sum of all volumes managed at each step of the value chain for each product, considering imports and exports and netting internal exchanges of products to avoid double counting. As per above, the company shall follow an equity share approach to the consolidation of these flows. A Net Value Chain method to account for products destined for energy use[5] is defined in *Equation 1*.

[5] This means, as per the Scope and Boundary chapter, that at production stage discount factors can be applied for products destined for non-energy use, such as petrochemical feedstock, lubricants, etc.

Equation 1 - Net Value Chain volumes

$$Net\ Value\ Chain = \max_{i=1\ to\ 3}(Volume\ in\ stage\ i),$$

where 1 = production; 2 = refining and 3 = marketing

Three examples are provided in Figure 1 to

Figure 3 where flows at each stage of the value chain – upstream, midstream and downstream - are exemplified, including both flows produced by company and those imported from external entities and exported (sold) to third parties. The examples are provided for Oil but can be generalized for other energy products. The analysis on Net Value Chain volumes should be done at global level but may also be done at regional level.

Figure 1 – Mainly E&P

(1) E&P		(2) Refining		(3) Marketing	
Imports	-	Imports of crude (Ic)	0	Imports of gas. (Ig)	20
Production	200	Refines	60	Sells	30
Export crude (Ec)	140	Export gas. (Eg)	50	Exports	-
Transfer 1/2	60	Transfer 2/3	10	Transfer	-

Total value chain = 220 Net value chain = 200

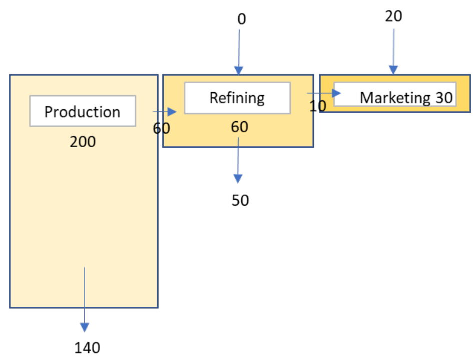


Figure 2 – Mainly refining

(1) E&P		(2) Refining		(3) Marketing	
Imports	-	Imports of crude (Ic)	180	Imports of gas. (Ig)	0
Production	100	Refines	190	Sells	90
Export crude (Ec)	90	Export gas. (Eg)	100	Exports	-
Transfer 1/2	10	Transfer 2/3	90	Transfer	-

Total value chain = 280 Net value chain = 190

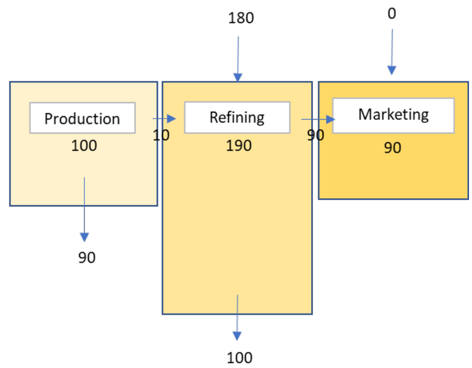
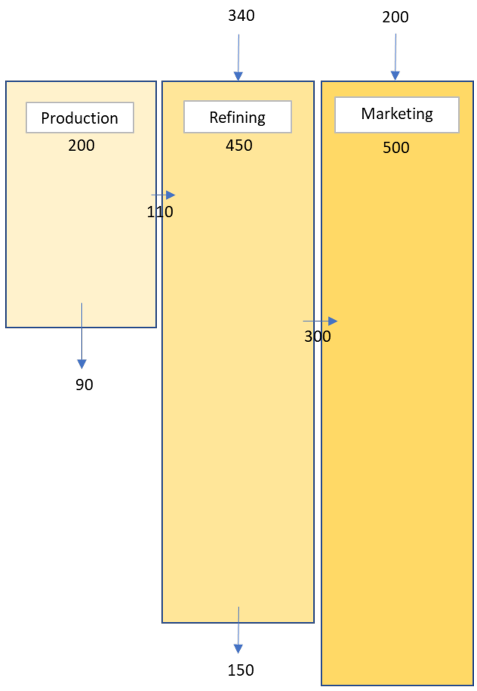


Figure 3 – Mainly marketing

(1) E&P		(2) Refining		(3) Marketing	
Imports	-	Imports of crude (Ic)	340	Imports of gas. (Ig)	200
Production	200	Refines	450	Sells	500
Export crude (Ec)	90	Export gas. (Eg)	150	Exports	-
Transfer 1/2	110	Transfer 2/3	300	Transfer	-

Total value chain = 740 Net value chain = 500



Exclusions to the methodology

Integrated energy companies will have activities considered "out-of-scope" of this methodology and companies should follow the approaches here defined for two notable cases:

1. Scope 1&2 emissions from petrochemical feedstock fluxes, namely emissions from the Fluid Catalytic Cracker (FCC) in refineries. Petrochemical activities often co-exist with activities related with the energy value chain in highly integrated industrial processes, notably in refineries and petro-chemical complexes. For this methodology, FCC emissions should be considered (default option) but companies may decide to exclude 100% of the FCC emissions if they find that is mainly serving petrochemical feedstock purposes. The boundary between energy and petrochemical is set at the refinery Fluid Catalytic Cracker and so, necessarily, this constitutes an area where flexibility is provided, but exclusions of FCC emissions as part of the Oil and Gas activities – with inclusion as petro-chemical activities - shall be noted and justified. Annex B presents data and a brief explanation on the rationale for this approach.
2. Scope 3 emissions: as specified above, there should be no consideration of non-energy products (asphalt, lubricants, waxes, white-spirits and other distillates, olefins, petrochemical feedstock) for Scope 3 purposes;

Companies might also have smaller auxiliary processes (e.g. linked to the non-energy purposes), which represent *de minimis* sources of emissions. Companies should continue to report the GHG emissions from these activities, but may:

A. Exclude these emissions, provided they fall below a 5% threshold of total scope 1 + 2 + (3, Use of Sold products);
   Use a simplified, non-sector specific methodology (e.g. absolute contraction or GHG emissions per unit of value added) to set an SBT for those sources.

Chapter 2: Criteria and recommendation for target setting

In this section the requirements for Oil, Gas and Integrated energy companies to set targets and for their validation by the SBT initiative are defined, considering the following aspects:

1. Type of company, e.g. integrated, upstream, midstream or downstream company;
2. Ambition level;
3. Emission Scopes, e.g. 1, 2 or 3;
4. Time horizon, e.g. short, mid and long-term target setting;
5. Target type, e.g. absolute or intensity targets;
6. Base year.

Oil, Gas and Integrated energy companies wishing to set a science-based target and validated it by the SBTi should also read the generic "SBTi Criteria and recommendation" (at the time of writing in its version 4.1 of April 2020). Where this Oil, Gas and Integrated energy company guidance deviates from the general SBTi criteria in its current version, this guidance takes precedence. The SBTi will continue to update its requirements and recommendations and might refine or modify it in the future, including the specific criteria and recommendations applicable to Oil, Gas and Integrated energy companies.

Some of the basic requirements for science-based target setting to be validated by the SBTi are:

- Base year: For Oil, Gas and Integrated energy companies, the SBTi requires targets to be set with a base year within the 5 previous years when the target is being set, or as an average of the past 5-years. The reasons for a given choice of a base-year shall be given. The SBTi recommends choosing the most recent year for which data are available as the target base year[6].
- Target year: Specific target year requirements are set below per target and company type, but generically targets that cover more than 15 years from the date of submission are considered long-term targets. Companies are encouraged to develop such long-term targets up to 2050.
- Level of Ambition: At a minimum, targets must be consistent with the level of decarbonization required to keep global temperature increase to well-below 2°C compared to pre-industrial temperatures, though companies are encouraged to pursue greater efforts towards a 1.5°C trajectory. Both the target timeframe ambition (base year to target year) and the forward-looking ambition (most recent year to target year) must meet this ambition criteria. The criteria associated with a classification of WB2C or 1.5C are set in Table 1.

Table 1 – Conditions associated with a WB2C and 1.5C scenario, using the SBTi criteria

	Temperature (ºC)	**Overshoot**	**Likelihood**
WB2C	~1.8	Low	>66%
1.5C	1.5	Low	>66%

[6] A common concern form companies in setting old base years is that they want to see their early action recognized. The target setting methodology recognizes the starting point of each company – namely if it is above or below the sector average – and adjust the pathways and targets on that basis.

Integrated Companies

Integrated companies operate across more than one segment of the value chain. Integrated companies shall have targets that:

A. Reflect changes in the demand, either on an absolute or intensity basis;
B. Reflect changes in supply, including limitations on continuing investment in fossil fuel production;
C. Explicitly address upstream and midstream methane emissions.

The following table illustrates the criteria ("shall" requirements), recommendations ("should" requirements) and options ("may" requirements) for these targets. All requirements are "shall" except where explicitly indicated. Repeated lines in table represent options for same requirements. The column "segment" reflects not a requirement, but the segment (point in the value chain) which the target mainly applies to.

	Target type	Timeframe	Consolidation	Methodology	Segment
A	S1+2+3 or S3 (USP). Intensity or Absolute	5 years to 15 years May: long-term; interim; net-zero	Equity share	May: WTW, SDA S3, SDA S1, SDA S2	Marketing
B	Should: Absolute	5 to 15 years May: 3-5 years	Equity share	Should: Least-cost; SDA S3	Upstream
	May: Commitment to only sanction projects with high likelihood of being competitive in 1.5 or WB2C budget	Minimum next 15 years	Equity share	May: Least-cost	Upstream
C	Absolute	5 to 15 years May: long-term	Should: equity share May: Operational control	SDA CH4	Upstream & Midstream

WTW – Well-to-wheel; SDA – Sectoral Decarbonization Approach

Upstream Companies

Upstream companies operate primarily in the initial production stages (e.g. extraction from natural environments) of energy products. These companies shall have targets that:

A. Reflect changes in supply, reflecting limitations on continuing investment in fossil fuel production;
B. Address upstream methane emissions.

Upstream companies may have targets that:

C. Reflect changes in demand, either on an absolute or intensity basis;
D. Address S1&2 upstream emissions, either on an absolute or intensity targets[7].

The following table illustrates the criteria for these targets. All requirements are "shall" except where explicitly indicated. Repeated lines in table represent options for same requirements.

	Target type	Timeframe	Consolidation	Methodology
A	S1+2+3 or S3 (USP), Absolute	5 to 15 years May: 3-5 years	Equity share	May: Least-cost, SDA S3, WTW
	May: Commitment to only sanction projects with high likelihood of being competitive in 1.5 or WB2C budget	Minimum next 15 years	Equity share	Least-cost
B	S1 CH_4, Absolute	5 to 15 years	Should: equity share	SDA CH4

[7] It might seem strange that this is a "May" requirement. The reason for this is that, to this date, it has not been possible to determine an authoritative SBT method for upstream CO_2 emissions. Companies can set a S1&2 target by setting a S1+2+3 target using a method like the WTW (this would satisfy both requirements C and D); or set their own S1&2 targets using some other methods, which they might want to develop, but will need to be approved by the SBTi.

		May: long-term	May: Operational control	
C	May: S1+2+3; Intensity	5 to 15 years May: long-term	Should: equity share	WTW
D	May: S1 and/or S2; Absolute or intensity	5 to 15 years May: long-term	Should: equity share May: Operational control	SDA S2[8]

Midstream Companies

Midstream companies shall have targets that:

A. Reflect changes in the demand, either on absolute or intensity basis;
B. Address direct methane emissions.

Midstream companies may have targets that:

C. Address S1&2 upstream emissions, either on an absolute or intensity targets.

The following table illustrates the criteria for these targets. All requirements are "shall" except where explicitly indicated. Repeated lines in table represent options for same requirements.

	Target type	**Timeframe**	**Consolidation**	**Methodology**
A	S1+2+3 or S3 (USP), Absolute or intensity	5 to 15 years May: long-term	Should: equity share	May: WTW, SDA S3
B	CH**4** Absolute or intensity	5 to 15 years May: long-term	Should: equity share May: Operational control	SDA CH4
B	May: S1 and/or S2; Absolute or intensity	5 to 15 years May: long-term	Should: equity share May: Operational control	SDA S2[9]

Downstream Companies – Petrol Stations

Downstream Fuel Distribution/Petrol station companies shall have targets that:

A. Reflect changes in demand, either in absolute or intensity basis;
B. Address Scope 1 & 2 of operations.

The following table illustrates the criteria for these targets. All requirements are "shall" except where explicitly indicated. Repeated lines in table represent options for same requirements.

	Target type	**Timeframe**	**Consolidation**	**Methodology**
A	Absolute or Intensity	5 to 15 years May: 3 years	Equity share	SDA S3, WTW
B	Absolute or Intensity	5 to 15 years May: 3 years	Equity share Operational control	Scope 1: SDA Transport
B	Absolute	5 to 15 years May: long-term	Equity share Operational control	Scope 2: SDA

Downstream companies – Gas distribution and/or retail

Downstream Gas Distribution and/or Gas retail station companies shall have targets that:

A. Reflect changes in the demand, either in absolute or intensity basis;
B. Address Scope 1 (CO_2 transport), Scope 1 methane (leakage) & Scope 2 of operations.

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[8] Please note that it was not possible to developed so far a Scope 1 SBTi methodology for upstream companies.
[9] Please note that it was not possible to developed so far a Scope 1 SBTi methodology for midstream companies.

The following table illustrates the criteria for these targets. All requirements are "shall" except where explicitly indicated. Repeated lines in table represent options for same requirements.

	Target type	Timeframe	Consolidation	Methodology
A	Absolute or Intensity	5 to 15 years May: 3 years	Equity share	SDA S3, WTW
B	Absolute or Intensity	5 to 15 years May: 3 years	Equity share Operational control	Scope 1: SDA Transport
B	Absolute	5 to 15 years May: long-term	Equity share Operational control	Scope 2: SDA

Other requirements

Other requirements are set in relation to data inputs, calculation methods and other features specific to the application of SBT methods and are presented in the respective sections explaining those methods.

The following requirements are also applicable for companies wishing to have their target validated by the SBTi:

A. Companies shall publish and make publicly available their methodologies, base year data, reasons for selecting a base year and justify and document with detail any deviation from this guidance. These materials may be used by the SBTi to validate their targets.
B. In the same document, companies shall explain, with detail, how the indicator used at company level to measure progress towards a science-based target is aligned with the scenario indicator used to define the sector pathway aligned with WB2C or 1.5C, and explain with detail any deviation and an estimate of its impact.

The SBTi also strongly recommends that companies publish on a yearly basis - in their financial or sustainability reports, as well as in their disclosures to CDP - their progress towards their targets and for the data, calculations and final figures used in the demonstration of progress towards targets to be externally verified/audited by a third party. Companies are also welcome to complement their intensity targets with absolute targets or commitments to staying within certain carbon budgets.

Chapter 3: Scenarios for Oil & Gas SBT setting

GHG mitigation scenarios are a key parameter in target setting methodologies and influence the outcomes of a target setting exercise as well as the validation of those targets. This section presents key choices on the use of scenarios for science-based target setting; provides criteria on scenario selection for target setting, both for 1.5ºC and WB2C[10]; and guidance on how to use scenarios for setting SBT's to Oil, Gas and Integrated Energy companies.

The following principles were taken into consideration when analysing which scenarios should be used for SBT setting:

- Precautionary approach[11]: as per where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.
- Shared responsibility[12]: whereby both the suppliers and consumers recognize that they share responsibility for actions to address the emissions resulting from the use of oil and gas products.
- Stewardship[13]: acknowledges that the energy system will need to transition in order to be sustainable and all agents within that system have a role in that transition.

These principles apply to challenges that emerge in SBT setting for the Oil and Gas sector, namely: 1) role and volume of Carbon Capture and Storage (CCS) and carbon dioxide removals (CDR) in the transition scenarios; 2) role of Oil and Gas players in CCS and CDR vs. other sectors and players; 3) early action vs. delayed action in a context of uncertain technology developments.

Oil, Gas and integrated energy companies SBT reference scenario set

Given the set of scenarios currently available[14], the recommendation is to use:

the IEA WEO SDS 2019 as a reference scenario to assess if a target is a WB2C target[15];

A. the AIM/CGE 2.0-SSP1-19 as reference scenario to assess if a target is a 1.5ºC target[16].

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[10] WB2C will be used to refer to the well-bellow 2ºC temperature objective, referring to scenarios have at least a 66% likelihood of staying under 2ºC, no overshoot, or 50% likelihood 1.7ºC limited overshoot (SBTi, 2019).

[11] As stated in the Rio Declaration (1992), see for example https://www.cbd.int/marine/precautionary.shtml

[12] Concrete definitions of "shared responsibility" are scarce. We have not attempted to define it, rather this is based on the work of André Nollkaemper and Dov Jacobs (2013). Please note that "shared" responsibility, while still individual and informing moral responsibility judgements, does not equate with accountability or with civil, criminal or other types of legal responsibility in this discussion.

[13] See Chapin *et al.*, 2009, page 6, who also quotes (Leopold, 1949). The stewardship principle recognizes the intervenients in a system as an integral component of that system and implies a sense of responsibility for the state of the system of which we are part.

[14] For this work only the scenarios from Hupman et al., IAMC 1.5°C Scenario Explorer and Data hosted by IIASA as well as scenarios from the IEA (WEO and ETP) were analysed.

[15] This recommendation is based on the fact that it is a well-known and well-recognized scenario by the marketplace, and with good granularity in describing the energy system transition.

[16] There is a very limited number of scenarios that comply with the SBTi criteria and meeting 1.5ºC temperature target. The SSP1-19 has a clearer storyline (Rihai et al., 2017) aligning with the aims of the SBTi on sustainability and it is also used to illustrate a sustainability-oriented scenario, or P2 scenario archetype (IPCC, 2018).

However, companies may choose other scenarios besides the two listed above, provided they (shall) meet the following criteria:

1) Scenarios that comply with the “Foundations of Science-based Target Setting” document (SBTi, 2019), which applies a four-step filtering process[17] to define SBTi scenario sets, namely:
    a) scenarios with no overshoot and low overshoot:
        i) this is 1.5˚C scenarios with at least a 50% probability of limiting warming in 2100 to 1.5˚C, as well as a 50% chance of limiting peak warming to 1.5˚C;
        ii) and WB2C scenarios with at least a 50% probability of limiting warming in 2100 to ~1.7˚C where warming cannot temporarily overshoot 2˚C (i.e. pathway class Lower 2˚C).
    b) removing scenarios that predicted a peak earlier than 2020;
    c) removing scenarios that have an annual linear reduction (2020-2035) that is less ambitious than the 20th percentile of the scenario set. This filter detects pathways characterized by delayed action or unlikely historic and near-term emissions.
2) physical criteria related to:
    a) bioenergy limit: a limitation in the provision of bioenergy of ~ 135 EJ/year by 2050 and in second half of the century.

For reference, analysis was conducted on the Integrated Assessment Modelling Consortium (IAMC) database[18] and IEA WEO 2019 and ETP 2017 scenarios[19]. The scenarios meeting the criteria above are the ones in Table 2.

Table 2 –Key features of scenarios meeting the criteria for scenario selection from the scenario set analysed.

	Scenario run	Carbon budget (Gt)		CCS	BECCS	LU CDR	BECCS Gt/year	Bioenergy EJ/year
		2020-2050	2020-2100	2020-2050 (Gt)			(by 2050)	(by 2050)
WB2C	POLES EMF33_EMF33_ Med2C_limbio	740	1136	63	31	-	4.1	112
	REMIND-MAgPIE 1.7-3.0_EMF33_WB2C_none	560	677	37	0	-	0	134
	REMIND-MAgPIE 1.7-3.0_EMF33_WB2C_limbio	695	708	137	71	-	5.8	118
	REMIND-MAgPIE 1.7-3.0_PEP_2C_red_eff	605	595	85	36	77	3.7	106
	REMIND-MAgPIE 1.7-3.0_PEP_2C_red_netzero	714	592	82	34	58	4.4	111
	IEA WEO SDS 2019	625*	NA	40	4	NA	0.25	~80
1.5C	AIM/CGE 2.0-SSP1-19	468	308	67	12	29	1.3	67.1
	POLES EMF33-EMF33_ 1.5C_limbio	279	42	19	13	-	1.8	105
	REMIND-MAgPIE 1.7-3.0-PEP_1p5C_red_eff	302	-4	149	98	137	6.0	117

* Energy emissions only

For further information on scenario selection please “Foundations of Science-based Target Setting” paper and Annex C.

[17] As a result of this filtering process, from an initial set of 177 scenarios used as input to 25 models, the SBTi identified a final set of twenty (20) 1.5˚C scenario runs and twenty-eight (28) WB2C scenario runs.
[18] Hupman et al., IAMC 1.5°C Scenario Explorer and Data hosted by IIASA
[19] The forthcoming IEA ETP 2020 publication might also contain scenarios that fit these criteria and we hope to analyse them as potential additional candidates for the scenario set.

Key questions related to the use of scenarios

Gross and Net emissions

A common output of scenario runs is net CO_2 emissions and data on the primary energy supplied by key fuels. Very few scenarios provide data on net CO_2 emissions by fuel and no scenario provides gross emissions by fuel. The key determinant between net and gross emissions of fuels are the amounts of Carbon Capture and Storage of fossil CO_2 deployed per fuel. Likewise, the amount of net emissions is determined by the pace of deployment of carbon free energy and how much Negative Emission Technologies (NETs) are deployed in the scenario. The main NETs in the scenarios are Afforestation/Reforestation (linked to Land Use Change sector, a distinct sector from energy, with its own set of requirements in terms of mitigation) and BECCS – at the interface of Land Use and energy sectors.

Setting an SBT with reference to gross emissions would reflect all the extractable carbon allowed in scenarios – but not its dependence on future (and uncertain) CCS and NETs. This effect is mitigated by the scenario selection criteria, which minimizes both CCS and NETs (BECCS). Gross emission scenarios would have to be derived from fuel emission factors, in the absence of quantities captured and stored permanently per fossil fuel.

Net emissions scenarios by fuel, on the other hand, already account for all CCS allocated by the model to that fuel – even if those quantities are not made explicit. CCS is a key activity in the emerging extended value chain of a new Integrated Energy sector or as a Carbon management sector, in which Oil and Gas companies are likely to play an important role. This embedded CCS is reflected in the overall carbon intensity of energy provided derived from scenarios using net emission figures. When setting and monitoring their targets, Oil, Gas and Integrated Energy companies should be allowed to count for it – even if at the moment, the ways of doing that accounting are not clear.

On the other hand, land-based activities like afforestation and re-forestation, are less likely to be an extension of the activity of Integrated Energy companies. Most important, land-based removals compensate for higher net emissions (and thus, overshoot), but is unclear to what sector these negative emissions should be attributed to. Unless land-use removals are explicitly allocated to the Energy sector - which does not occur in any scenario, in fact several scenarios focus exclusively on the energy and industrial emissions sectors - land removals, namely from afforestation and reforestation activities, should not be accounted for an Oil, Gas and Integrated energy company meeting its SBT.

In all cases, the one requirement to be met is that there shall be consistency between scenario variables and variables used in the indicator to set SBT at company level.

Scope 3 accounting

Companies may account for carbon transfers in their value-chain, related to the use of carbon capture and storage at their client side.

To date Scope 3, Use of Sold Products accounting is done by accounting for the carbon content in fuels and its transformation into CO_2 - relating to gross emission pathways. The current practice on Scope 3 calculation has no consideration of CCS applied to coal, gas or oil, while scenarios usually provide net emission pathways that consider it. So, there is a potential inconsistency between scenarios and company level indicator. For this reason, a term called "Carbon transfers" has been introduced to refer to carbon of fossil origin that is captured and permanently stored and that can be accounted for in a "Downstream Indirect Emissions" category by companies. This proposal has the advantage of giving full visibility of amounts captured by clients and that might be claimed by fossil fuel providers has their "Scope 3, Use of sold products" emission reductions.

How these relationships between energy providers and their clients is to not yet fully established and is a matter for future development of the accounting frameworks. Namely, this issue might be addressed by the on-going work on Removals accounting being done by the GHG Protocol team at WRI.

The approach on Scope 3 is distinct of the Scope 1 emissions, where the Scope 1 figure is to be already a net figure, this is, considering the amounts of CO_2 that have been captured and stored permanently[20].

Direct and Indirect Removals accounting

Direct CO_2 removals from atmosphere that occur within energy sector activities may be accounted, while indirect removals of CO_2 shall not be accounted.

Besides CCS, removals are another area which needs to be explicitly addressed in the coherence between scenario and company level indicator. How removals should translate into corporate GHG accounting is an issue currently under discussion and it is not clear who should be credited for the removal, namely: 1) if it should be the company that operates the asset with removal equipment; 2) or the company operating/owning/financing removal equipment; 3) or the company that effectively stores, monitors and holds the liability for long-term storage of CO_2; 4) all the three options, but clearly distinguishing between direct and indirect removals between participants in the removal and storage value chain. Thus, even if participation of the Oil and Gas companies in a CCS sector - which can also deliver removals when done on sustainably sourced biomass - seems one likely transition mode for companies, it is not possible at the moment to clearly attribute the credit for removals along this value chain.

However, BECCS occurs within the energy sector and within the Oil and Gas value chain (e.g. BECCS as part of a biorefinery process) and the scenario selection process already minimizes the use of BECCS. Because of this, BECCS does not play a significant role in decreasing the carbon intensity of energy in those scenarios and even less in the first decades. The expected contribution of BECCS to reduce the carbon intensity of energy is small in the scenarios (due to the limits imposed to bioenergy) and is expected to be also small in the real economy in next decade. However, it is important to recognize and give credit for early effort and for these reasons it is proposed that Direct Removals may be taken into consideration in a company energy carbon intensity indicator.

Electricity consumption scenarios for Oil and Gas activities

Companies shall provide their own scenarios for electricity consumption, when setting Scope 2 targets.

Scope 2 emissions represent the smallest fraction of all emissions in the Oil and Gas value chain. However, they can be significant for certain parts of the value chain (e.g. retail) and represent large volumes (order of millions of t CO_2).

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[20] Note on EOR

Scope 2 emissions will typically be dominated by the grid decarbonization. However, aspects related with increases of activity are also relevant, namely: 1) electrification of drill rigs and other upstream equipment can reduce emissions, noise, and costs and can be powered through connection to the grid or mini-grids with renewable power, and 2) that the utilization of renewable powered electric motors to power natural gas compressor stations can be an effective means to increase renewable integration in midstream transportation, and 3) electrification might also play a role in the decarbonization of refineries, namely in integration of CCS.

Although electrification can lead to overall reduction of emissions, it will lead to increased electricity consumption and can lead to increases of Scope 2 emissions. We have no known electricity consumption scenarios for upstream or midstream activities. For this reason, it is proposed that companies shall provide their own scenarios in terms of electricity consumption increases while decarbonizing production. Scope 2 emissions are usually dominated by the rate of decarbonization of the grid.

Chapter 4: Methodologies

The allocation method, or mechanism, is the means by which the emissions budget of an environmental scenario is divided up and allocated to companies. The allocation method functions independently of the scenario, but not all scenarios may be suitable for use with an allocation method. The emissions budget is the sum of annual absolute emissions over a specified number of years. A target may be certified as a Science Based Target only if it leads to an outcome in which the allocated emissions budget is not exceeded. This describes the first of three guiding principles that inform the design and approval of allocation methods for oil and gas companies:

1. **The budget aggregation principle**: The sum of allocated emissions budgets from all companies making up a sector is equal to the scenario's emissions budget for the sector.

2. **The sectoral boundary principle**: Only emissions from inside the sector and its value chain are included in the construction of emission pathways. Emission reductions or removals occurring outside of the specified sector boundary cannot be considered for setting an SBT.

3. **The attribution principle**: Only emissions directly attributable to the company's defined operational scope of responsibility are relevant. This excludes avoided emissions (Scope 4) derived from consequential accounting methods.

Allocation methods available for the oil and gas sector are listed in Table 3. The method available depends of the indicator that can be built for each emission scope and the availability of scenarios that are compatible with that indicator.

Table 3. Allocation methods for each operational boundary along different segments of the oil, gas and integrated energy value chain

Stage	Operational boundary	Allocation mechanism
Integrated	S1+2+3	WTW SDA Convergence
	S1+2+3	Least-cost
Upstream	Scope 1 - CH4	SDA Convergence
	Scope 2	SDA Contraction
	Scope 3, USP	SDA Convergence
Midstream	Scope 1	SDA Contraction
	Scope 2	SDA Contraction
	Scope 3, USP	SDA Contraction
Downstream	Scope 1	SDA Benchmark
	Scope 2	SDA Contraction
	Scope 3, USP	SDA Convergence

It is recommended that companies only focus on subsections covering the stages in which they operate. The Scope 2 method is the same for all stages and is presented at the end, in section X. Companies operating in multiple stages can refer to all relevant subsections and combine their emission targets or can decide to use one of the integrated methods.

Integrated Well-to-wheel method

The application of this method shall cover all the energy products[21] managed by an integrated company and shall consider their impacts on a well-to-wheel basis[22], considering both direct and indirect emissions from companies associated with their energy products businesses. The methodology can be applied by integrated companies, as well as non-integrated companies.

Indicator

The indicator being proposed for the setting of SBT for Integrated Oil & Gas companies is essentially the same as the one being used by Shell[23] and ENI[24] and other companies, with a few deviations which will be detailed here[25]. The indicator is a Scope 1+2+3 emissions intensity indicator, which takes into consideration, not the full value-chain emissions, but the “well-to-wheel emissions”, this is, the value chain emissions related to the production, processing and delivery of energy to the final consumer and is defined in *Equation 2 - Well-to-wheel indicator*.

Oil, Gas and Integrated energy companies trade energy products at multiple points of their value chains. The goal is to assess all energy products sold by a company, which includes material produced and processed by the company and materials produced and processed by others. This approach considers the sum of all volumes managed at each step of the value chain for each product, considering imports and exports and netting internal exchanges of products to avoid double counting. As per the boundary considerations in Chapter 2, the company shall follow an equity share approach to the consolidation of these flows. The values to be considered are Net Value Chain values for products destined for energy use[26], defined in Equation 1.

Products and their emissions

This part specifies the numerator part of Equation (2). The products to be considered by companies when setting their GHG carbon intensity target shall include all energy products in the portfolio and consider the full GHG emissions across the value chain. The company shall consider all products in Figure 4 that it produces, refines or markets – independently of when they have entered its value chain, see previous section - and all steps of the value chain that are highlighted (per product) in the blue light boxes. The company should also include the GHG emissions arising from the other non-highlighted steps in the value chain (e.g. transportation and distribution). Annex D specifies in further detail the application of Equation (2) to each product as well as emission factors to be used for these calculations.

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[21] As per boundary requirements and recommendations presented in Chapter 1.
[22] In practice this is not truly a “tank-to-wheel” analysis, but it is most approximated to one. Deviations are explained in Annex E.
[23] Please see https://tinyurl.com/y86ghpxo
[24] Please see https://tinyurl.com/y8nctvaf
[25] Some of this deviations can be observed in how the companies are applying the same principles differently between them.
[26] This means, as per the Scope and Boundary chapter, that at production stage discount factors can be applied for products destined for non-energy use, such as petrochemical feedstock, lubricants, etc.

Equation 2 - Well-to-wheel indicator

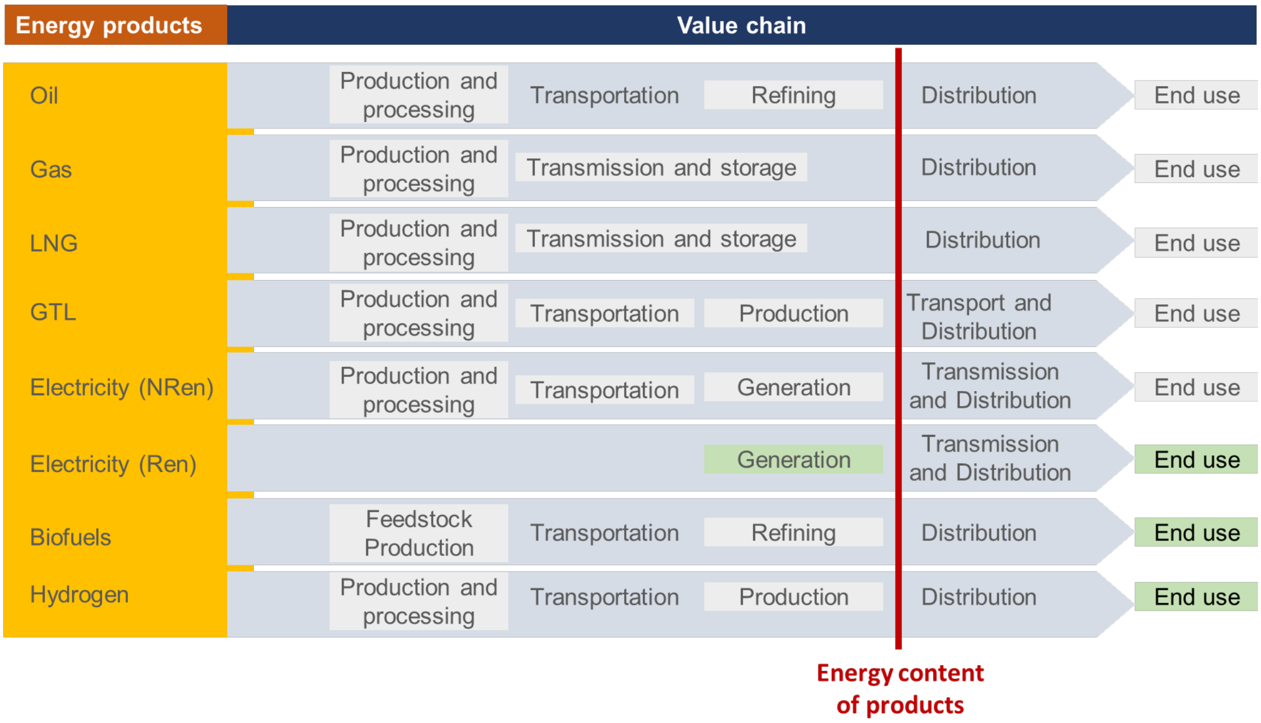
$$CI(WTW)_y^P = \frac{[Scope\ 3\ (PGS)_y^{P,bought}]_{Indirect,upstream} + [(S1+S2)_y^{P,sold} - Removals\ from\ Atmosphere]_{Direct} + [Scope\ 3\ (USP)_y^{P,sold} - C\ Transfers]_{Indirect,downstream}}{Energy\ in\ products_y^{P,sold}}$$

$CI(WTW)^P_b$	Company product GHG intensity in mass CO_2e per energy sold, calculated on a well to wheel basis.
P, sold	Energy product sold in given year.
Y	Year y.
Scope 3 $(PGS)_y^{P,bought}$	Scope 3, Purchase Goods and Services: are indirect emissions from the production of raw materials for production of energy products or energy products, acquired by the company in year y, accounted on a cradle to gate boundary.
$(S1+S2)_y^{P,sold}$	Scope 1 + Scope 2 emissions from the production of products sold.
S1	Scope 1 emissions, or direct emissions from operations already take into consideration any CO_2 amounts captured and permanently stored; biogenic carbon that is captured and permanently stored, would be considered as a removal and accounted in that category.
Removals from atmosphere	Removals generally respect to carbon removed from the atmosphere or oceans pools into another reservoir. In this case, it respects to any direct removals from biorefinery processes only. Indirect removal accounting is not allowed as it is currently unclear and is also unlikely to play a significant role in decreasing the carbon intensity of energy supplied until the 2040's.
Scope 3 $(USP)_y^{P,sold}$	Scope 3, Use of sold products: are indirect emissions resulting from the use of the energy products sold in given year y. 1. It is a gross emission from fossil energy products sold, calculated by multiplying activity levels by a CO2 emission factor that reflects the carbon content of the fuel and has no consideration of carbon capture and storage within value chain.
C transfers	Transfers of fossil carbon from its natural reservoirs into controlled reservoirs or products, where Carbon that would have otherwise been emitted is now permanently stored. The accounting of Carbon transfers in the downstream part of the value chain is currently unclear and so this parcel is not allowed at this stage and is also unlikely to play a significant role in decreasing the carbon intensity of energy supplied until the 2040's.
Energy in $products_y^{P,sold}$	Energy in the products sold in given year y

Products and their energy content

This part specified the denominator part of *Equation (2)*. Figure 4 shows the point at which the energy content delivered should be measured – e.g. after refinery gates for oil or before grid injection for electricity, which will equate to “secondary energy”[27]. Annex D specifies in further detail the application of Equation *(2)* to each product as well as the details of how each product should be converted into secondary energy.

Figure 4 – Energy products and their emissions in the value-chain



On the calculation of the secondary energy content, it is particularly relevant the assumptions related to electricity calculations, which require particular care and have significant impact on the calculation of the indicator and the scenario pathway. Please see the section relative to electricity in Annex D for more on this point.

Construction of the scenario pathway

For the application of this method the Energy measurement used in the construction of the indicator needs to be consistent with Energy measurement used in the scenario. As per above, companies should measure “Secondary Energy” (or oil products “after refinery gates”, or electricity before injection into the grid). This indicator is compared to a carbon intensity of

[27] Secondary energy products, as per UN definition, “ is the manufacture of energy products through the process of transformation of primary fuels or energy”, where primary is defined as “the capture or extraction of fuels or energy from natural energy flows, the biosphere and natural reserves of fossil fuels within the national territory in a form suitable for use.. The resulting products are referred to as “primary” products”. According to this definition, several types of energy at this stage will still be “primary energy”, such as natural gas and some forms of renewable electricity.

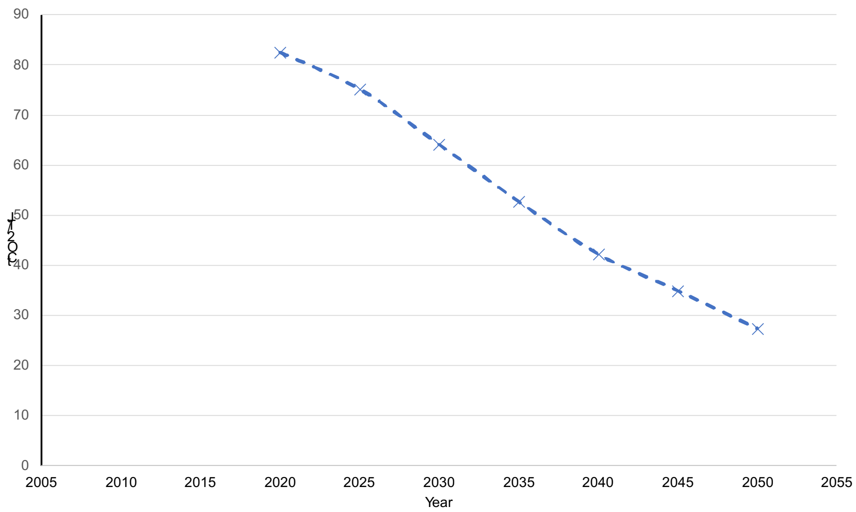
secondary energy calculated in the same way as the indicator, from either a primary energy supply scenario, a secondary energy supply scenario or a final energy demand scenario. Depending on which information is available for each scenario, different transformations of the scenario might need to be used.

In this method a company shall use a “Secondary Energy carbon intensity pathway” scenario, calculated to fit to the maximum extent possible the indicator in Equation 2) and it should be built based on scenario data from the WB2C or 1.5C scenario data sets identified in Chapter 3. If a company is using a different scenario than the ones identified in Chapter 3, the scenario shall comply with the criteria set there and the company shall document it comprehensively as well as how the scenario has been transformed to match the indicator.

Annex E contains an example of transforming scenario data output into a “Secondary Energy carbon intensity pathway” that is in line with the proposed indicator and its calculation rules per fuel (as per Annex D).

Text box 1 – Full emissions intensity of Final Energy demand, using the IEA WEO 2019 SDS

Using the procedure in Annex E it is possible to construct a global carbon intensity of secondary energy pathway, considering both CO_2 and CH_4 emissions, which can be used to set a WTW target, using the SDA convergence allocation mechanism.



Application

To determine a science-based target using this method the company should calculate its WTW Carbon Intensity value for the base year and then apply the same principle as used in the Sectoral Decarbonization Approach (SDA) converge allocation formula, this is, convergence to the sector average by 2050. In this case, the sector is the “integrated energy” sector, which encompasses the overall provision of energy to the economy, as represented by the pathway calculated in the previous section.

To apply the SDA convergence allocation Equation 3 shall be used.

Equation 3 – SDA convergence allocation formula

$$CI_y = d * p_y + SI_{2050}$$

where,

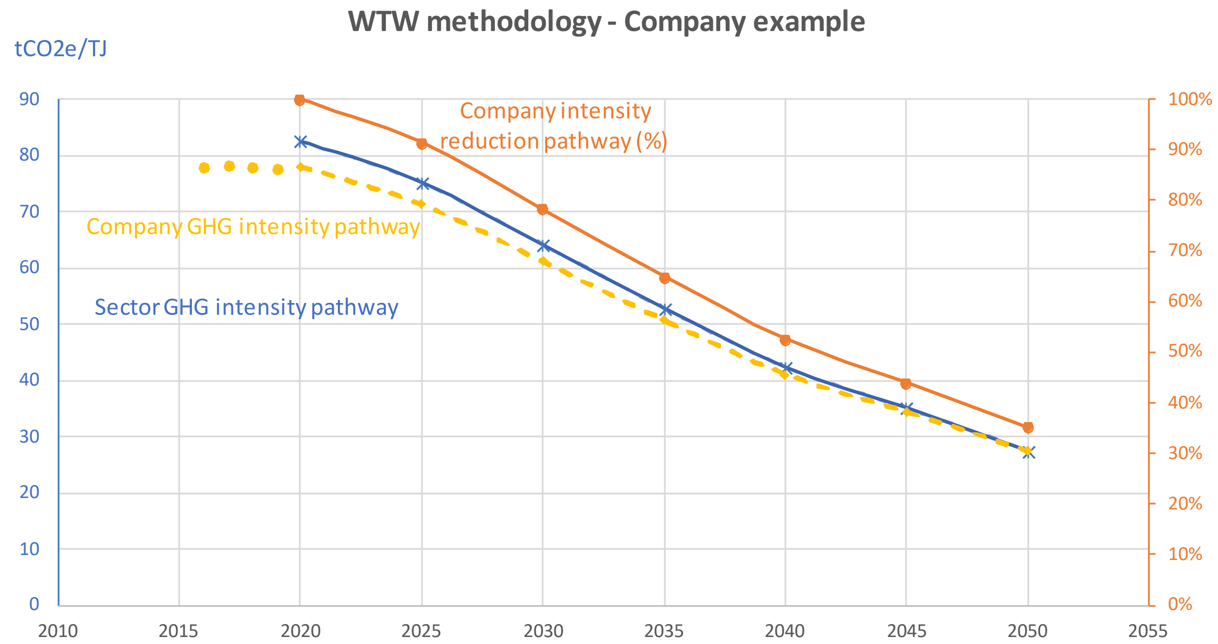
$$d = CI_b - SI_{2050}$$

$$p_y = (SI_y - SI_{2050}) \ / \ (SI_b - SI_{2050})$$

d	Difference in emissions intensity between company in base year and sector in 2050
CI_b	(tCO_2/TJ)
SI_{2050}	Company emissions intensity in base year (tCO_2/TJ)
p_y	Sector emissions intensity in convergence year 2050 (tCO_2/TJ), given by the scenario
SI_y	Convergence index of the sector in year y
SI_b	Sector emissions intensity in year y (tCO_2/TJ), given by the scenario
CI_y	Sector emissions intensity in base year b (tCO_2/TJ), given by the scenario
	Company emissions intensity in year y (tCO_2/TJ)

Text box 2 – An example of target setting for a fictious Oil and Gas company using the WTW SDA methodology

Using the SDA convergence allocation mechanism, a company GHG intensity pathway (tCO2e/TJ) can be produced (yellow line) which converges to the sector emissions intensity of secondary energy by 2050. This curve can be used to set WB2C SBT targets according to the WTW method. The target can be expressed as a specified intensity (~32 tCO2e/TJ, in this example) or as a % reduction from a base year.



In this example the base year was set at 2020, as the average of the previous 4 years.

In applying the WTW methodology an Oil, Gas and Integrated energy company shall:

1. Choose a recent base year which is representative of its recent trends OR choose an average of previous 3 to 5 years;

2. Converge to the scenario sector benchmark in 2050;

3. Set a short-term target within a time frame of 5 to 15 years.

The WTW method can be applied by Integrated companies, as well as by companies operating at any segment of the Oil&Gas value chain, as per this guidance.

Least-cost methodology

The LCM is a forward-looking method that allocates potential future production according to an economic rationale of assuming that demand is met by the lowest cost projects available. This methodology offers a simplified model of how markets might rationally allocate supply in the face of dwindling demand and, similarly, how extractives companies might consider a competing set of potential investments.

The approach is based on the economic logic that in a competitive market, the higher-cost projects will be outcompeted by those that can supply the market at lower cost. The approach therefore matches the aggregate demand level derived from any given low-carbon transition pathway scenario to the lowest cost project set that might supply it.

The LCM assumes that projects which are already producing or under development continue to produce, and therefore anticipated production from these sources is netted off the total required demand level. It then turns, in sequence, to the cheapest available sources of potential future production to supply the residual demand until the given level of demand is satisfied. The basis for comparing projects in the LCM is unit level production costs and breakeven prices are used for this purpose[28].

Indicator

The indicator used by the LCM is a carbon budget (tCO_2) allocated for each company for a given time period. This carbon budget can be divided into two parts: the committed carbon budget; and the investable carbon budget. The committed carbon budget is the estimate of the carbon budget already committed in existing assets; the investable carbon budget is the portion that, considering the assets owned by the company and the LCM, might fit under a given temperature target budget. This carbon can then be distributed during that time period in different ways – the method proposes it is done linearly – providing an extractable carbon allocation per year.

Scenarios

Comparing supply to demand for a given climate outcome requires translating an ultimate associated global warming, defined by a carbon budget, into separate demand pathways/levels for the energy sources under review. These demand levels are then used as the basis of the analysis. A number of different organisations produce modelled demand scenarios for given climate outcomes.

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[28] Breakeven prices calculated for an IRR of 15% is what the Carbon Tracker Initiative has used in their published analysis using this methodology.

To date the method has already been applied to the IEA WEO SDS 2019; the IEA Energy Technology Perspectives (ETP) Beyond 2 Degrees Scenario (B2DS); scenarios from the IAMC 1.5°C Scenario Explorer database29 consistent with the P1 and P2 scenario archetypes (used in the IPCC Special Report on Global Warming of 1.5 Degrees); and as a reference baseline case the IEA WEO Stated Energy Policies Scenario (IEA WEO STEPS 2019, previously known as the New Policies Scenario). For more information on scenario selection for SBT setting purposes, please see Chapter 3.

Application

The method follows these steps:

1. Select a scenario to use with an associated climate outcome;
2. Identify a demand profile in that scenario for each fossil fuel commodity regionally and over time under that scenario;
3. Identify an internally consistent set of supply data with associated supply costs (preferably from an external database) that estimates break-even costs for potential projects and establish a merit order of such projects based on costs (a "cost curve");
4. Deduct future production from existing projects from the demand profile to establish residual demand to fill with future project options;
5. Fill residual demand with available potential production from future project options on a least-cost basis, yielding a list of projects that are "inside" and "outside" the specified scenario demand;
6. Calculate aggregate carbon emissions for the scenario period for each company based on their project set that fits inside the demand level;
7. Optional: Adjust that budget based on emissions intensity of the company's portfolio;
8. Define a pathway for future company emissions using the company's calculated carbon budget, it's known starting point (today's production/emissions) and the assumption of a linear trajectory.

The method has been applied successfully by Carbon Tracker namely in their report *Breaking the Habit*. More information can be found in Annex F, where a detailed description of the method can be found.

Upstream: Scope 3, USP (SDA, convergence)

Indicator

The indicator being proposed for the setting of SBT for Scope 3, Use of Sold Products emissions for upstream operations is the total Scope 3, Use of Sold Products carbon emissions intensity of energy produced by the company, where the carbon emissions intensity are calculated as per the Production Method defined in the "CDP Technical Note: Guidance methodology for estimation of Scope 3 category 11 emissions for oil and gas companies".

Equation 4 – Scope 3, Use of sold products carbon intensity of sold products

$$CI(S3, USP)_y^P = \frac{NP^P * EF^P - C\ Transfers}{Energy\ in\ products_y^{P,sold}}$$

or

[29] https://data.ene.iiasa.ac.at/iamc-1.5c-explorer/#/login?redirect=%2Fworkspaces

$$CI(S3, USP)_y^P = \frac{NP^P * HV^P * EF_{ce}^P - C\ Transfers}{Energy\ in\ products_y^{P,sold}}$$

$CI(S3,USP)^P{}_y$	Company product GHG intensity in mass CO_2e per energy sold, calculated on a well to wheel basis.
P, sold	Energy product sold in given year.
Y	Year y.
NPP	Net production (in t, mmbbl, mbpd, boe, boed, bcf, mmcm, etc)
EFP	Full combustion emission factor (in tCO2/t, tCO2/mcm, tCO2/mmBtu, etc)
HVP	Heating value (in GJ/kg, TJ/Gg, toe/m3 , boe/gal., Btu/cf, etc.)
EFPce	Full combustion energy emission factor (in tCO2/TJ, tCO2/boe, etc)
C transfers	Transfers of fossil carbon from its natural reservoirs into controlled reservoirs or products, where Carbon that would have otherwise been emitted is now permanently stored. The accounting of Carbon transfers in the downstream part of the value chain is currently unclear and so this parcel is not allowed at this stage and is also unlikely to play a significant role in decreasing the carbon intensity of energy supplied until the 2040's. Please note that the C Transfer respects only to CCS applied in the downstream part of value chain and so, direct emissions captured and stored should not be counted here.
Energy in productsy^{P,sold}	Primary Energy in upstream products sold in given year y

Products and their emissions

For the counting of emissions, similar considerations as in the WTW methodology apply. See Annex D.

Products and their energy content

For the counting of energy, similar considerations as in the WTW methodology apply, but instead of using secondary energy, primary energy is used. See Annex G.

Construction of the scenario pathway

For the application of this method a Primary Energy carbon intensity pathway for each main fuel type is built, based on scenario data from the WB2C or 1.5C scenario data sets complying with the criteria set in Chapter 3. For the construction of a pathway that can be compared with the S3, USP indicator specified above, the following variables are needed[30]:

1. "Emissions|CO2|" for each fuel type (coal, oil and gas) which would comprise the "CO_2 emissions from energy use on supply and demand side" for that particular fuel. Please

[30] Please note that Methane emissions not included here. The reason for this is that CH_4 emissions happen mainly outside the product use phase and so, the scenario would not be consistent with the indicator. For this reason, the indicator is also constructed only has CO_2 and not CO_2e.

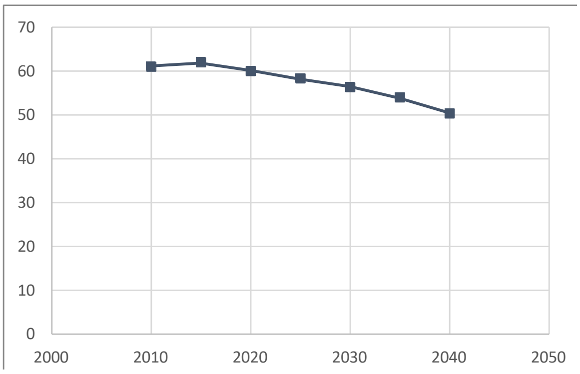
note that these variables do not exist in the IAM database and are derived from data existent in the WEO 2019[31];

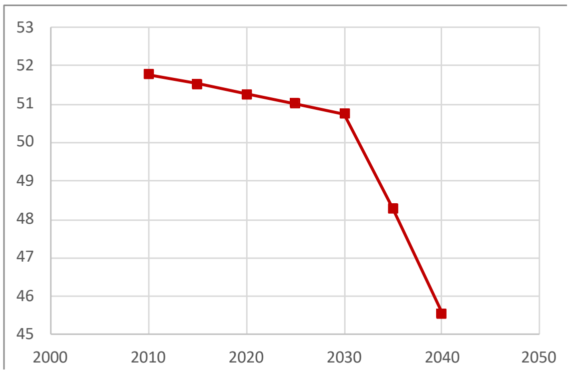
2. "Primary Energy" content of each fuel also taken from the same source;

The same notes on use of scenario variable categories apply as in section 3.1.2.

Text box 3 – Emissions intensity of Primary Energy, using the IEA WEO 2019 SDS

Using the procedure highlighted above it is possible to use the IEA WEO 2019 SDS scenario to construct fuel specific pathways for their carbon intensity of delivered primary energy. These consider only CO_2 (the CO2 embodied in the energy products), which can be used to set a S3, USP target, using the SDA convergence allocation mechanism. The graphics below represent (1) Carbon intensity of oil (CO_2/TJ primary energy); and (2) Carbon intensity of Gas (CO_2/TJ primary energy) [Y axis = carbon intensity in tCO2/TJ primary energy; X axis = year].



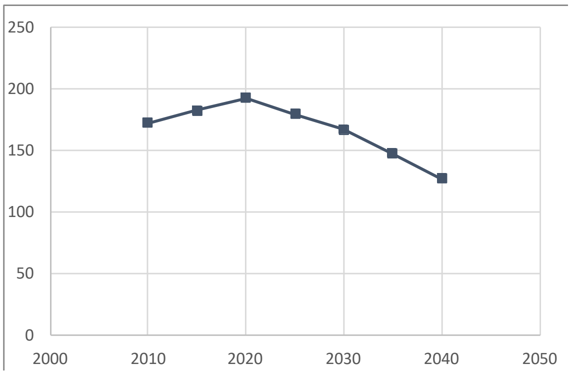


In this method use is made also of the activity projections for each fuel, so pathways are used also for the amounts of Oil and Gas allowed in the scenarios.

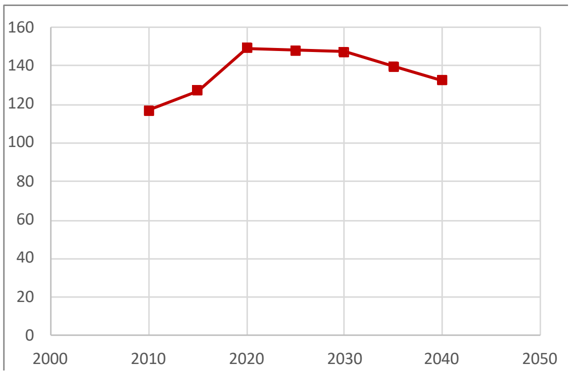
[31] Data can be found in "Table A.3: Electricity and CO2 emissions – World2, page 681, table at bottom of the page with total CO_2 per main fuel, representing net emissions per fuel. Primary energy values of each fuel are taken from Table A3: Energy demand – World, page 679.

Text box 4 – Sector activity scenario for Oil and Gas, according to IEA WEO 2019 SDS

The graphics below represent the activity scenario for oil (1) and Gas (2) [Y axis = carbon intensity in EJ primary energy; X axis = year].



(1)



(2)

Application

The Scope 3, Use of sold products (S3, USP) emissions budget for the upstream stage is calculated using the SDA Convergence allocation method. The SDA convergence allocation method is based on the principle that a company's emissions intensity should converge to its sector's emissions intensity (defined by the scenario) in the long-term. Once the intensity convergence path is established, it may be used to calculate the company's absolute emissions pathway. The emissions budget can then be known and is the cumulative of absolute emissions over the target period.

For upstream S3, USP, emissions intensity relates to the primary energy product during its use phase, measured for each product on an energy basis (metric tons CO_2 per TJ). The measure of activity is net production, or production available for sale, i.e. gross production minus the company's own consumption. An S3, USP budget is calculated for each primary energy product before being aggregated to the company level.

A series of six calculation steps is followed:

Step 1 is to calculate the weighted average emissions intensity of each primary energy product. At the product inventory level, each primary energy product may represent a grouping of products. For example, the 'oil' product includes all upstream liquids: crude oil, condensate, synthetic oil, bitumen, natural gas liquids, etc. As expressed by Equation 5, the weighted average emissions intensity of the product is the sum of all sub-product use phase emissions, deducting for where sub-product carbon is sequestered, divided by the aggregate product energy. Sequestration occurs in many oil product applications, such as when bitumen is used for road surfacing – see the boundary chapter and provisions on applying discount factors for non-energy oil products. Under some scenarios, sequestration will also occur in the future where Carbon Capture and Storage (CCS) technology is deployed in the power sector.

Equation 5 – Carbon intensity of primary energy

$$CI_b^p = \frac{\sum_{sp} CI_b^{sp} * \left(1 - seq_b^{sp}\right) * CA_b^{sp}}{\sum_{sp} CA_b^{sp}}$$

CI^p_b Company emissions intensity of the primary energy product p (e.g. oil) in base year b (tCO_2/TJ)
CI^{sp}_b Company emissions intensity of sub-product sp (e.g. crude oil, condensate, etc.) in base year b (tCO_2/TJ)
CA^{sp}_b Company activity (production) of sub-product sp in base year b (TJ)
seq^{sp}_b Fraction of carbon sequestered during the lifetime of sub-product sp

Step 2 is to calculate the use phase emissions intensity pathway of each primary energy product. Each pathway converges to the sector average in the long-term and is calculated using the SDA convergence Equation 3.

Equation 3 – SDA convergence allocation formula

$$CI_y^p = d^p * p_y^p + SI_{2050}^p$$

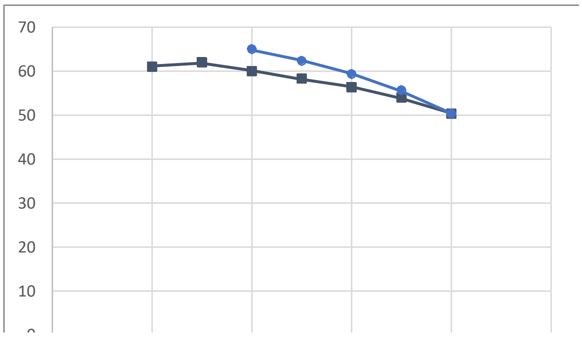
$$d^p = CI_b^p - SI_{2050}^p$$

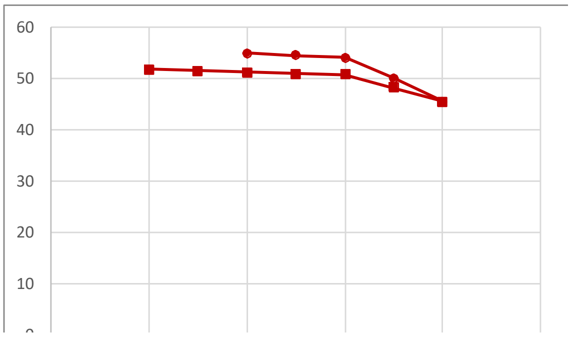
$$p_y^p = \left(SI_y^p - SI_{2050}^p\right) / \left(SI_b^p - SI_{2050}^p\right)$$

d^p Emissions intensity difference for product p between company in base year and sector in 2050 (tCO_2/TJ)
CI^p_b Company emissions intensity of product p in base year b (tCO_2/TJ)
SI^p_{2050} Sector emissions intensity of product p in convergence year 2050 (tCO_2/TJ)
p^p_y Convergence index parameter of the sector for product p in year y
SI^p_y Sector emissions intensity of product p in year y (tCO_2/TJ)
SI^p_b Sector emissions intensity of product p in base year b (tCO_2/TJ)
CI^p_y Company emissions intensity of product p in year y (tCO_2/TJ) [note: if $SI^p_b - SI^p_{2050} = 0$, then $CI^p_y = CI^p_b$ in all years]

Text box 5 – Step 1 and 2

Using the procedure highlighted above we calculate in Step 1 a company carbon intensity of 65 tCO_2/TJ for oil and 55 tCO_2/TJ for Gas. In Step 2 we apply the SDA convergence mechanism to calculate the carbon intensity pathway for oil (1) and gas (2), converging to the sector intensity figure in 2040 (in this example, and given the scenario only goes that far) [Y axis = carbon intensity in tCO_2/TJ primary energy; X axis = year].





Step 3 is to calculate the company's absolute product emissions pathway by combining the company's converged product emissions intensity pathway with the sector's product production pathway. Implicit in this calculation is that the company will maintain a fixed market share, i.e. follow sector's index of production. The calculation is expressed in Equation 6.

Equation 6 – Company emissions for product p

$$CE_y^p = CI_y^p * CA_b^p * \left(SA_y^p / SA_b^p\right)$$

CE^p_y Company emissions from product p in year y (tCO_2)
CI^p_y Company emissions intensity of product p in year y (tCO_2/activity)
CA^p_b Company activity (production) of product p in base year b (TJ)
SA^p_y Sector activity (production) of product p in year y (TJ)
SA^p_b Sector activity (production) of product p in base year b (TJ)

Step 4 is to aggregate together the emission pathways of all primary energy products. This is expressed by Equation 7.

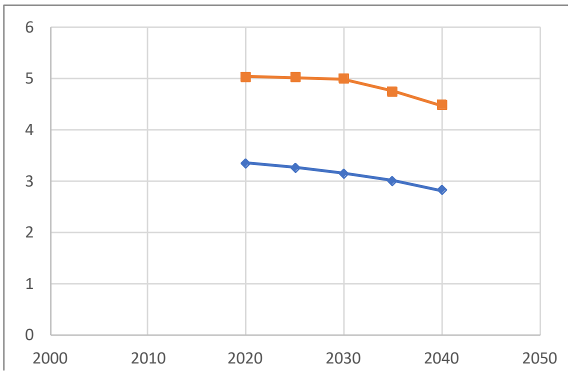
Equation 7 – Company emissions

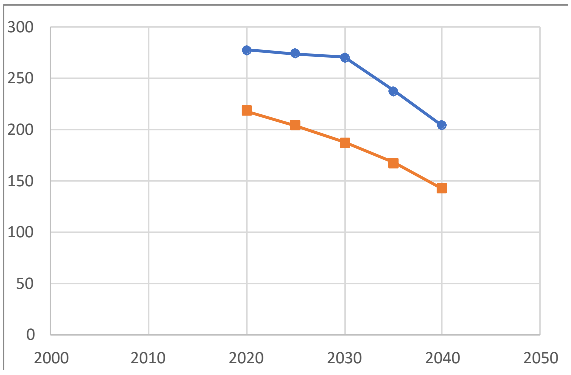
$$CE_y = \sum_p CE_y^p$$

CE_y Company emissions from all products in year y (tCO_2)
CE^p_y Company emissions from product p in year y (tCO_2)

Text box 6 – Step 3, 4 and 5

Using Step 3, we calculate how the Oil (blue) and Gas (orange) activity profile should change (1) [Y axis = EJ]. By multiplying (in each year) by the profile of carbon intensity for each energy product (calculated in step 1 and 2), we obtain an absolute emissions profile for Oil and Gas (2) [Y axis = MtCO2]. Step 4 (not shown) would consist in adding the blue and orange line in graphic (2). By adding all years of the emission profile for all products (step 5) we obtain a carbon budget for the specified period (2020-2040), which in this case, is 8815 $GtCO_2$.





Step 5 is to determine the company's allocated emissions budget via the relationship expressed in Equation 8. The budget is cumulative emissions over time and makes up the area beneath the absolute emissions curve when plotted against time. The budget may be computed by summing company emissions in every year from the first year after the base year up to and including the target year.

Equation 8 – Company carbon budget

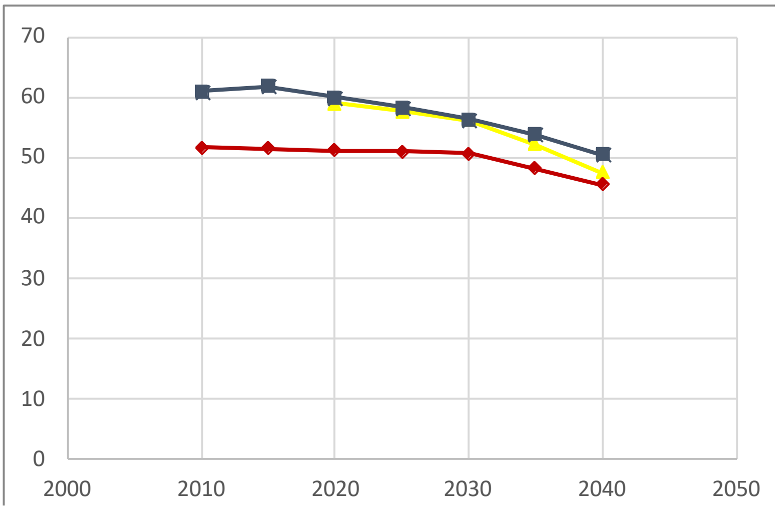
$$CB_t = \int_t^b CE_y \, . dy$$

CB_t Company emissions budget from base year b to target year t (tCO_2)
CE_y Company emissions from all products in year y (tCO_2)

Step 6 (optional) is to determine the aggregate company S3, USP emissions intensity pathway. As expressed in Equation **Error! Reference source not found.**, this is the aggregate absolute e missions pathway divided by the company's own projection of aggregate primary energy production.

Text box 7 – Step 6

Finally, by dividing total emissions by total activity, we obtain the carbon intensity of primary energy for the company (yellow curve). (Blue line is the sector carbon intensity for oil and the red the sector carbon intensity for gas).



If the company is considering expansion to renewables, it could also perform similar calculations to its renewable energy products. This would be added to both the primary energy delivered and emissions and would lead to further reductions in intensity than the ones shown in the graphic above.

Equation 9 – Company primary energy carbon intensity pathway

$$CI_y = \frac{CE_y}{CA_y}$$

CI_y Company emissions intensity (product aggregate) in year y (tCO_2/TJ)
CE_y Company emissions (product aggregate) in year y (tCO_2)
CA_y Company activity (aggregate product production) in year y (TJ)

Upstream: Direct (Scope 1) Methane emissions (SDA, convergence)

Indicator

The indicator being proposed for the setting of SBT for Direct (Scope 1) methane emissions from upstream operations is

Equation 10 - Upstream methane intensity indicator

$$CI(CH_4)_y^P = \frac{CH_4 Emissions * 28}{Energy\ in\ products_y}$$

$CI(CH4)^P_y$	Company upstream CH_4 intensity in mass CO_2e per energy produced in year y (tCO_2e/TJ) and for product P (Oil or Gas).
y	Year y.
CH_4 emissions	Methane emissions resulting from the production of energy products (tCH_4).
28	Methane 100-year Global Warming potential.
Energy in $products_y$	Primary Energy in upstream products sold in given year y

As per the boundary considerations in Chapter 2, the company should follow an equity share approach to consolidate its CH_4 but may use an operational control approach to consolidate CH_4 emissions.

Text box 3 – Alternative indicator (%)

A common alternative to express CH_4 emissions is to express it on a percent basis, this is, amount of methane emissions per natural gas (CH_4) produced. This percentage can be calculated on a volume, mass or energy basis, for example, the OGCI (Oil and Gas Climate Initiative) has a methane intensity target of 0.25% by 2025. Companies wanting to validate their targets using some alternative indicator, will be asked to provide the conversion basis to compare them versus the indicator proposed here.

Construction of the scenario pathway

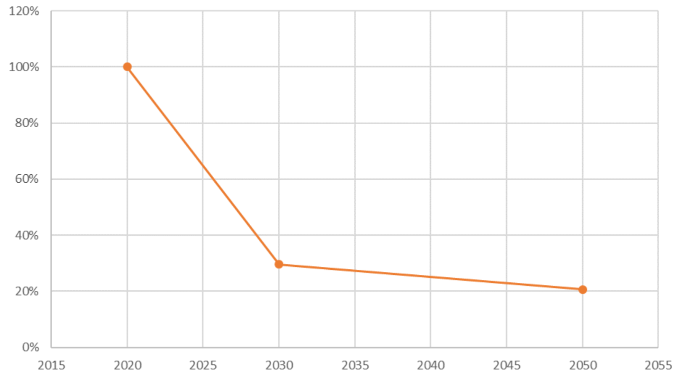
For the application of this method we have built "CH_4 Emissions for Upstream Oil and Gas" based on IEA WEO 2018 data, which provides for oil supply (upstream and midstream) a CH_4 benchmark of 32.64 ($kgCO_2$-eq/boe) for oil and 60.90 for gas ($kgCO_2$-eq/boe). Details can be found in Annex H CH4 emissions scenarios. These values are further partitioned between the upstream/ midstream/downstream parts, using the values (%) of 98/2/0 for oil and 66/26/7 for gas, resulting in the following benchmark for upstream oil and gas:

Table 4 – CH4 Benchmark for oil and gas (kgCO2-eq/boe)

Oil Upstream	31.99
Gas Upstream	40.19

These values are then scaled down proportionally using CH_4 scenario data, using IEA WEO 2019 SDS data, as per figure below.

Figure 5 – CH4 reductions from Oil and Gas supply globally (source: IEA 2019)

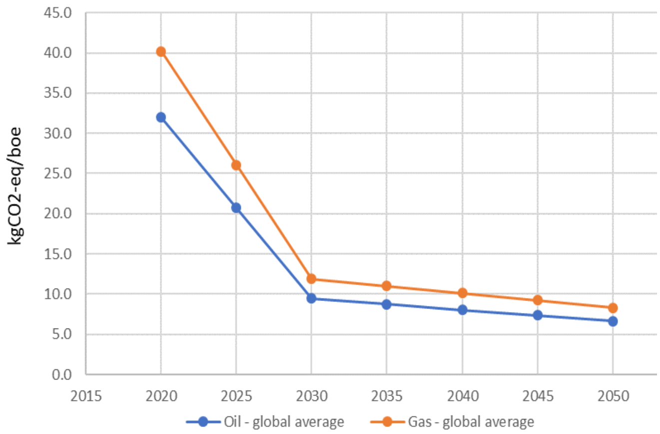


Which results in the scenario shown in **Error! Reference source not found.** and Figure 6.

Table 5 – Scenario for global average Upstream CH_4 emissions intensity ($kgCO_2$-eq/boe) (source: IEA 2018)

	Oil	Gas
	[kgCO2-eq/boe]	
2020	32.0	40.2
2025	20.7	26.1
2030	9.5	11.9
2035	8.8	11.0
2040	8.1	10.1
2045	7.3	9.2
2050	6.6	8.3

Figure 6 – CH_4 emissions intensity reductions from Oil and Gas supply globally



In summary the scenario pathway was constructed in the following manner:

- IEA WEO 2019 projection on absolute CH_4 emission reductions for Oil and Gas upstream operations;
- The IEA WEO 2018 global average CH_4 emission intensities for upstream oil and gas, taken as 31.99 kgCO2-eq/boe for oil and 40.19 kgCO2-eq/boe for gas;
- Applying the overall methane emission reduction to the average CH_4 emission intensities.

Application

The allocation mechanism for methane emissions upstream production is the SDA convergence, with a requirement for a faster convergence (agreed within the industry, governments and civil society) to be reached by 2030[32].

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[32] E.g. through such initiatives as Climate and Clean Air Coalition (Methane Guiding Principles and Oil & Gas Methane Partnership) or the Oil and Gas Climate Initiative (OGCI) methane targets.

So, for a given CH4 intensity in the base year $CI(CH_4)_b^P$, the methane target by year y will be

Equation 3 – SDA convergence allocation formula

$$CI_y^P = d^P * p_y^P + SI_{2030}^P$$

$$d^P = CI_b^P - SI_{2030}^P$$

$$p_y^P = (SI_y^P - SI_{2030}^P) / (SI_b^P - SI_{2030}^P)$$

CI^P_y Company methane emissions intensity of product P in year y (kg CO_2e/BOE)
d^P Methane emissions intensity difference for product P between company in base year
p^p_y and sector in 2030 (kg CO_2e/BOE)
SI^P_{2030} Convergence index parameter of the sector for product P in year y
p^P_y Sector emissions intensity of product p in year y (tCO_2/TJ)
SI^p_y Convergence index parameter of the sector for product P in year y
SI^p_b Sector methane emissions intensity of product P in year y (kg CO_2e/BOE)
CI^p_y Sector emissions intensity of product P in base year b (kg CO_2e/BOE)
Company emissions intensity of product P in year y (kg CO_2e/BOE) [note: if $SI^p_b - SI^p_{2030}$ = 0, then $CI^P_y = CI^P_b$ in all years]

After 2030, the target should follow the benchmark, so

$$CI_y^P = SI_{2030-2050}^P$$

CI^P_y Company methane emissions intensity of product P in year y (kg CO_2e/BOE)
d^P Methane emissions intensity difference for product P between company in base year
p^p_y and sector in 2030 (kg CO_2e/BOE)
SI^P_{2030} Convergence index parameter of the sector for product P in year y
Sector emissions intensity of product p in year y (tCO_2/TJ)

Alternative 1 (CH_4 Contraction)

An allowed alternative to the “Upstream: Direct (Scope 1) Methane emissions (SDA Convergence)” method is to use an absolute contraction method based on a CH_4 scenario that favours decisive action within the next decade (2020 to 2030). In absolute contraction methods emissions reduce proportionally to the scenario.

Equation 11 – SDA contraction formula (for methane)

$$CE_{CH4,y} = CE_{CH4,b} * \frac{SE_{CH4,y}}{SE_{CH4,b}}$$

$CE_{CH4,y}$ Company methane emissions in year y (t CO_2e)
$CE_{CH4,b}$ Company methane emissions intensity in base year (t CO_2e)
$SE_{CH4,y}$ Sector emissions in year y (t CO_2e)
$SE_{CH4,b}$ Sector emissions in base year (t CO_2e)

Alternative 2 (Upstream+midstream; Midstream)

The same method can be used to construct a CH_4 emission reduction intensity target for Upstream + Midstream operations or just for Midstream targets.

Upstream: Direct (Scope 1) CO_2 emissions (SDA convergence)

Indicator

The indicator being proposed for the setting of SBT for Direct (Scope 1) CO_2 emissions from upstream operations is

Equation 12 - Upstream CO_2 indicator

$$CI(CO_2)_y^P = \frac{CO_2 Emissions}{Energy\ in\ products_y}$$

$CI(CO_2)^P{}_y$	Company upstream CO_2 intensity in mass CO_2 per energy produced in year y (tCO_2e/TJ) and for product P (Oil or Gas).
y	Year y.
CO2 emissions	Methane emissions resulting from the production of energy products (tCO_2).
Energy in $products_y$	Primary Energy in upstream products sold in given year y.

As per the boundary considerations in Chapter 2, the company should follow an equity share approach to consolidate its CO_2 but may use an operational control approach to consolidate CO_2 emissions.

Construction of the scenario pathway

To date, it has not been possible to address outstanding questions that allow for the presentation of a scenario set for purpose of application of this methodology.

Upstream: Direct (Scope 1) CO_2 emissions (SDA contraction)

Indicator

The indicator being proposed for Direct (Scope 1) CO_2 emissions from upstream operations is total CO_2 emissions from Upstream production. The company should follow an equity share approach to consolidate its CO_2 emissions but may use an operational control approach.

Construction of the scenario pathway

IEA scenarios do not contain data on CO_2 emissions for Oil and Gas Upstream and Midstream operations. Several scenarios from the IAMC 1.5ºC Scenario Explorer do contain scenarios for "CO2 emissions from fuel combustion and fugitive emissions from liquid fuel extraction and processing (e.g. oil production, refineries, synfuel production, IPCC category 1A1b, parts of 1A1cii, 1B2a)", which could potentially be used to set targets. Unfortunately, to date, it has not been possible to address outstanding questions that allow for the presentation of a coherent scenario set allowing the application of this methodology.

Application

For a given level of CO_2 emissions in the base year the CO_2 emission target by year y will be

Equation 13 – SDA contraction formula (for CO_2)

$$CO_{2,y} = CO_{2,b} * \frac{SE_{CO2,y}}{SE_{CO2,b}}$$

$CO_{2,y}$ Company methane emissions intensity of product P in year y (kg CO_2e/boe)
$CO_{2,b}$ Company methane emissions intensity of product P in base year (kg CO_2e/boe)
SE Sector emissions intensity of product P in year y (kg CO_2e/boe)
SI^P_b Sector emissions intensity of product P in base year (kg CO_2e/boe)

Scope 2 (SDA, Convergence)

Indicator

The indicator being proposed Scope 2 CO_2 emissions is total CO_2 emissions from electricity consumption. Scope 2 includes emissions from the generation of electricity, steam, heat, and cooling that is purchased by the company for its own consumption. It is treated equally over the whole value chain due its relatively low influence on the company's overall carbon footprint. Purchases of steam, heat, and cooling are excluded from the methodology due to their low impact and the paucity of relevant scenario data.

The company should follow an equity share approach to consolidate its Scope 2 CO_2 emissions but may use an operational control approach.

Construction of scenario pathways

Scope 2 emissions pathways are the result of two factors: 1) how the carbon intensity of the grid supplying electricity evolves in the future (power sector intensity scenario); 2) how the electricity consumption of the company evolves in the future (activity scenario). For both cases, it should be indicated if they are WB2C or 1.5C scenarios.

Power sector carbon intensity scenarios can be obtained from several sources, namely the IAMC Database and the IEA, and with different levels of granularity. Ideally, they should come from the same scenarios use to set Scope 3 and Scope 1 emission targets but may come from a different scenario. The company should analyse the carbon intensity of its electricity and generate a company specific pathway for the carbon intensity of its electricity.

The evolution of electricity consumption of different segments of the Oil and Gas value chain, while undergoing severe transformation, are generically not available. For this reason, the company should propose and justify its own scenario for how its electricity consumption is likely to evolve.

Electricity systems carbon intensity differs significantly by country and region. The application of the methodology should be done at a country level but can be done, for simplicity, at higher levels of granularity. This will highly depend of the type of company that is applying it. Multi-national companies operating in more than 5 countries, may use a regional granularity. Companies operating in 5 or less countries, shall use country level (or state level, if available) granularity.

Application

Given the provision of the two scenarios – the power sector carbon intensity scenario and the company activity scenario – absolute Scope 2 emissions pathways can be calculated using Equation 14.

Equation 14 - Scope 2 absolute emissions target calculation

$$CE_{S2,y} = Cec_y * CeI_y$$

$CE_{S2,y}$ Company Scope 2 emissions in year y (tCO_2)

Cec_y Company electricity consumption in year y (GWh)

CeI_y Company specific electricity emissions intensity pathway in year y (tCO_2/GWh)

Section 2: Context and Background

Chapter 5: Context

The Paris Agreement has set a clear direction for the economy in decades to come. The agreement aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by holding 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, recognizing that this would significantly reduce the risks and impacts of climate change.

The combustion of fossil fuels represents the single largest source of carbon dioxide emissions. The Oil & Gas industry is one of the largest contributors of methane emissions. On the other hand, the Oil & Gas industry holds considerable scientific, technical, economic and financial assets that can provide significant contributions to the low-carbon transition.

As such, the Oil & Gas sector is highly exposed to low-carbon transition risks (and opportunities) and needs to undergo significant transformation for society to meet the goals adopted by over 195 countries through the Paris Agreement.

Guidance Objective

The purpose of this project is to develop science-based target-setting methodologies that allow stakeholders, including companies, investors, governments and civil society, to understand the alignment of Oil & Gas company emissions reduction targets with the level of transformation required to meet the goals of the Paris Agreement. The project, first and foremost, will address embedded emissions in fuel supplied, but will also seek to address scope 1 emissions (energy and methane process emissions). At a later stage the project should consider scope 2 emissions and links to refinery and petrochemical industry, consistent with the SBTi's chemical sector development.

Methodology Development Process

The methodology development is led and supported by CDP. CDP drafts the methodology documents and makes proposals to the technical working group, which then provides input and recommendations. The technical working group, composed of approximately 20 members representing civil society organizations, Oil & Gas companies, investors, policymakers, academics, and other experts, convene regularly to provide input and critique the methodology.

The project was launched by CDP in November 2019 and was kicked off with the first meeting of its technical working group. Ten meetings have been held before August 2020.

A public consultation will take place from August 10th to October 4th, 2020. During the Public Consultation, the public is invited to provide feedback, opinions, and comments on setting science-based targets for Oil and Gas and Integrated Energy companies. The public consultation is available on the SBTi Oil and Gas website.

The feedback will then be reviewed, and CDP will produce a second draft that will be delivered to the SBTi for approval. The methodology will be delivered to the SBTi by the end of the year.

This development occurs simultaneously with the ACT – Assessing Low-Carbon Transition Oil & Gas sector methodology development, convened by ADEME and CDP, and with its own technical working group. Several meetings have been held with both the SBT and ACT technical working groups.

Technical Working Group

The SBTi O&G Methodology development is supported by a technical working group including:

- World Wildlife Fund (WWF)
- Shell
- Galp
- Total
- Bp
- Eni
- Repsol
- California Resources Corporation (CRC)
- Agence de la transition écologique (ADEME)
- UK Oil & Gas Authority
- World Resource Institute (WRI)
- i Care & consult
- UN Global Compact
- Imperial College London
- University of Queensland Business School
- Carbon Tracker
- Climate Accountability
- Aviva Investors
- HSBC
- World Benchmarking Alliance

The Science Based Targets Initiative

The Science Based Targets initiative (SBTi), a collaboration among the CDP (formerly the Carbon Disclosure Project), the United Nations Global Compact (UNGC), World Resources Institute (WRI), and the World Wide Fund for Nature (WWF), champions SBT setting to boost companies' competitive advantage in the transition to a low-carbon economy.

Through setting and meeting science-based targets (SBTs), companies may receive benefits, such as increasing business resilience and competitiveness, thereby driving innovation and transforming business practices, building credibility and reputation, and influencing and preparing for shifts in public policy. The SBTi's overall aim is that by the end of 2020, science-based targets (SBTs) will become standard business practice, and corporations will play a major role in driving down global GHG emissions.

Science-based targets provide companies with a clearly defined pathway to future-proof growth by specifying how much and how quickly they need to reduce their greenhouse gas emissions. Targets adopted by companies to reduce greenhouse gas (GHG) emissions are considered "science-based" if they are in line with what the latest climate science says is necessary to meet the goals of the Paris Agreement – to limit global warming to well-below 2°C above pre-industrial levels and pursue efforts to limit warming to 1.5°C.

Chapter 6: Overview of O&G industry

[to be added in future version]

Chapter 7: Challenges of transitioning to a net-zero economy

This chapter provides a simplified approach to an overly complex challenge: how can Oil and Gas companies contribute to the transition to a net-zero economy?

It presents a brief layout of the nature of the challenge and then proceeds to propose a framework of "transition modes": archetypes of specific strategic moves that companies can adopt to support the transition. The approach taken to define these archetypes is a reflection based on readings and conversations with many actors – including industry – actively involved in finding ways forward for this challenge.

Each archetype is briefly described and characterized as to its: 1) applicability; 2) risks and opportunities; 3) barriers/critical issues; 4) key indicators of change and; 5) a company example of its applicability, where possible.

Transition modes were provided as a starting point for a facilitated discussion in a face-to-face workshop that occurred in November 2019, bringing together the Technical Working Groups of the Assessing Low-Carbon Transition (ACT) and SBT initiatives working with the Oil and Gas sector. The objective of this workshop was to build shared visions and narratives on individual company pathways to transition to a broad range of stakeholders.

The nature of the challenge is amply known to dispense lengthy treaties, and at the same time sufficiently broad to grant some pages that highlight some of the key topics relevant for the discussion. Our approach is to embrace its complexity, trying to not single[33] out any dimension - for example, political, economic, technical, legal, social or moral - but for each option trying to look at a broader picture of how these dimensions might interplay.

For individual companies, the available transition pathways are more diverse and more uncertain than the overall narrative for the sector. These different pathways will be chosen by a multitude of contextual factors including company culture, history, geography, regulatory and political environment, etc.[34], as well as internal , generically called "capabilities". In simple terms, there are many ways to make - and to lose – money, and these will be shaped by technical, political and social forces.

Oil and Gas companies will react differently to the transition and this diversity is an asset for the transition. Oil and Gas companies[35] pursuing "defensive" strategies[36] would likely want to explore

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[33] Garcia *et al.* (2014) "Strategic partnering in oil and gas: a capabilities perspective", Energy Strategy Reviews, 3, pp. 21-29

[34] Which can be found in the academic literature on strategic response of corporates to environmental issues, e.g. Levy, D. L., & Newell, P. (2000). Oceans Apart? Business Responses to Global Environmental Issues in Europe and the United States. Environment: Science and Policy for Sustainable Development, 42(9), 8–21. doi:10.1080/00139150009605761

[35] Or oil-producing countries, as the same challenges can be posed at the geopolitical level.

[36] "Defensive" in the sense that is designed to sustain the demand for a product or to fend off an attack from a potential competitor - in this case, non-fossil fuel types of energy. See e.g. Steger, U. (1993) "The Greening of the board room: how German companies are dealing with environmental issues", in

the market opportunities left by more active oil companies that leave the market. A company leaving the market will do so due to signs of decreased profitability[37], increased risks[38], lower access to finance[39] and potential lower demand[40] – among other factors likely to shape the industry in decades to come. The future will reveal exactly how certain tensions would unfold, e.g. whether demand and supply interactions will meet future expectations of key actors. The low-carbon transition requires effective ways to curtail demand[41] as well as supply[42]. Policy intervention seems inevitable if we are to successfully transition, which might require the emergence of strong social movements such as the ones recently emerging[43]. Without policy intervention, some companies might argue that they prefer to let their operations decline, but only after there is no more demand for their products. In this case, if we are to meet the Paris agreement, such companies must, at some point, be brought to the point of closure by a combination of supply, demand, and regulatory and social pressure, which would increase risks and severely reduce their profitability.

For all the higher purposes of Oil and Gas companies – from providing cheap energy to powering the energy transition to minimize damages of climate change – Oil and Gas generating "superior returns to shareholders" remains as an important motivation. This is unlikely to change and is a key part in the transition. Companies are faced with key strategic challenges: 1) Continuing operations until their social license to operate terminates; 2) Managing their decline; or otherwise 3) Actively transitioning their capital into some other profitable business model. Many within the industry understand that they are faced with an existential challenge, and that actively managing the transition is better than waiting for things to happen[44]. For these actors, it is clear that the level

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K. Fischer and J. Schot (eds.), Environmental Strategies for Industry: international Perspectives on Research Needs and Policy Implications, Washington, DC, island Press.

[37] For example, on relationship and trends between profitability and Energy Return on Investment see King and Hall (2011) "Relating Financial and Energy Return on Investment", Sustainability, 3, pp.1810-1832; and Murphy DJ. (2014) "The implications of the declining energy return on investment of oil production", Phil. Trans. R. Soc. A 372: 20130126.

[38] See for example "Building a Resilient Energy Gulf Coast" (2010), published by Entergy and America's Wetland Foundation

[39] For example, "Financial Stress in the Oil and Gas Industry: Strategic Implications for Climate Activism"(May 2018) by the Institute for Energy Economics and Financial Analysis and Sightline Institute

[40] For example, David J. Murphy and Charles A. S. Hall. 2011. Energy return on investment, peak oil, and the end of economic growth in "Ecological Economics Reviews." In Robert Costanza, Karin Limburg & Ida Kubiszewski, Eds. Ann. N.Y. Acad. Sci. 1219: 52–72;

[41] Brandt *et al.* (2013) "Peak Oil Demand: The Role of Fuel Efficiency and Alternative Fuels in a Global Oil Production Decline", Environmental Science & Technology 2013 47 (14), 8031-8041

[42] Lazarus, M. and Asselt, & Harro van (2018) "Fossil fuel supply and climate policy: exploring the road less taken", Climatic Change (2018) 150:1–13

[43] Farmer *et al.* (2019) "Sensitive intervention points in the post-carbon transition", Science, 12 April 2019, Vol. 364, issue 6436

[44] Lovell, Bryan (2010) "Challenged by Carbon – The Oil Industry and Climate Change"

of transformation requires a will to change, and that where there is a will, there is a way - which they are beginning to explore.

Setting public commitments, like the adoption of a science-based target, are an expression of this willingness to embrace change. There is thus an increased responsibility from the SBT community in terms of defining methods that allow the public recognition of these commitments, while guaranteeing that they do represent a meaningful contribution to meet the Paris goals and can be effectively used as tools to help transform companies. Given how much depends on the transition, finding a way to implement it is so important - to investors, to the companies and to society overall - to be left only to the companies themselves. Furthermore, the complexity of the energy system[45] means that the transition will depend on a multitude of actors, networks, technologies, policy and social interactions.

The following sections define archetypes of potential transition pathways for companies. All archetypes are, to a certain extent, unrealistic and incomplete. Reality is too complex to be captured in simplified narratives. But the aim of these narratives is to capture the imagination of people who are willing to lead the sector. Differentiating between the leaders and those unwilling to lead (who may better deserve the moral condemnation[46] of present and future generations) might itself be a powerful incentive to change.

Literature review

The field of strategic responses to the low-carbon energy transition by Oil and Gas companies is relatively new. However, there are at least two reports which classify the possible strategies.

A report by E3G and the Sustainable Finance Programme at the University of Oxford outlines three viable transition strategies[47]:

- First one out: maximise profits through cost-cutting and asset sweating during a process in which company operations are slowly ramped down and capital returned to shareholders.
- Last one standing: gain market share from competitors in order to take over what remains of the declining oil market.
- Planned transformation: shift company offering to focus on either renewables or services related to the company's expertise in Oil and Gas.

[45] Bale *et al.* (2015) "Energy and complexity: New ways forward", Applied Energy, 138, pp.150-159

[46] For an interesting discussion on climate change and morality and the role of institutions and bureaucracies see Nestar Russell and Annette Bolton (2019) "Climate Catastrophe and Stanley Milgram's Electric Shock "Obedience" Experiments: An Uncanny Analogy", Social Sciences, MDPI, Open Access Journal, vol. 8(6), pages 1-27, June.

[47] Caldecott, B., Holmes, I., Kruitwagen, L., Orozco, D., et al. (2018) *Crude Awakening: Making Oil Major Business Models Climate-compatible*.

The report also points out that there are also possible strategies that are unlikely to be successful for any company in the long run. These include, for example, continuing with Oil and Gas business as usual as the energy transition progresses.

The IEA presents four categories of possible transition responses, which are likely to be taken up in combinations or in sequence[48]:

- Optimising continuing Oil and Gas operations by minimising costs and reducing emissions.
- Deploying carbon capture, utilisation and storage techniques to minimise emissions.
- Shifting business focus to low-carbon liquids and gases such as hydrogen, biomethane and advanced biofuels.
- Undergoing a transition from an Oil and Gas company to an energy company.

The introduction of “transition modes” in this paper adds to the discussion by presenting a framework that aims to be both comprehensive, covering all viable transition strategies, and focused, presenting only those strategies that can lead to the type of large-scale company transformations required by the energy transition.

In our view, a key advantage of presenting these options in a thorough format is to be able to name them and be very specific about their implications and how stakeholders can detect early signals of them happening.

Transition modes

The transition modes are specific strategic responses to the challenge of the energy transition. The term “transition mode” is taken here as an explicit analogy to the vibration modes of greenhouse gases (GHG) in the atmosphere. Different molecules vibrate and react to the same incoming energy in their own way, depending on their chemical composition. In the same way, faced with the same challenge, companies will “vibrate”, or respond, differently. As with GHG molecules, a company “molecule” does not vibrate in one single mode, rather, several co-exist but some dominate . The transition modes should be viewed as archetypes of strategic moves that companies can adopt to support the transition and that can coexist and be combined within companies in varied ways.

We propose that the following transition modes are made available to Oil and Gas companies:

- Energy company: diversifying to other forms of energy.
- Carbon company: transition to a circular economy model around carbon dioxide.
- Managed decline: ramping down Oil and Gas operations and returning capital to shareholders while maximising shareholder value.
- New direction: transition away from Oil and Gas to other activities.

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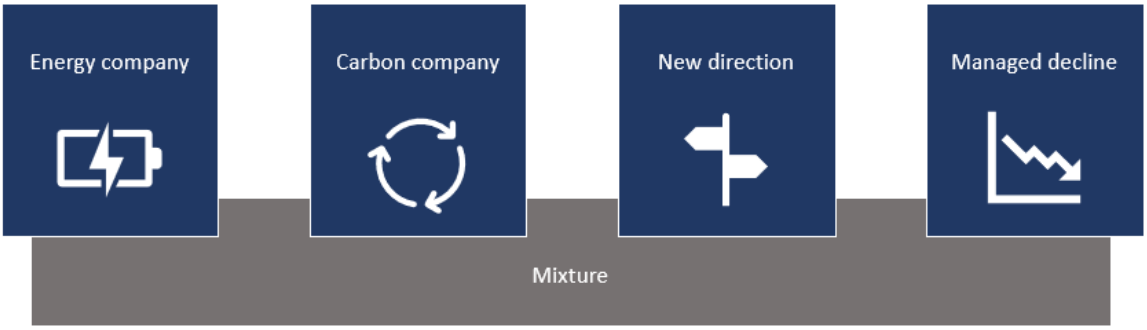
[48] IEA (2020) The Oil and Gas Industry in Energy Transitions.



For each transition mode or archetype, we provide: 1) A brief description of its applicability; 2) Key opportunities and risks; 3) Likely barriers; 4) Key indicators that the mode is taking place; and 5) Brief description of actual company behaviour as an example, if possible.

Energy company

Description

The energy (diversification) mode assumes that companies see themselves not as “Oil and Gas companies” but as energy companies – the term Integrated Energy Company seems to be emerging. Oil and Gas companies providing energy to their clients broaden the scope of their activities and transition into non-carbon forms of energy supply. The analogy for this transition mode is the strategic change of European Electric Utilities in the early 2000’s from power producers to renewable and energy service companies. This change is likely to see many Oil and Gas companies transformed into, for example, electricity companies – given that all scenarios predict a critical role for electricity in the transition – potentially integrating generation, retail , etc.

Currently integrated companies seem to most likely take this transition route. These companies are driven by the energy demand of their customers – but the demand might not be compatible with the Paris goals. In all this debate, there is a constant tension between demand requirements and the extent to which the supply side can actively influence it and still maintain profitability. Moving too early or too late might lead to wasted capital and business opportunities. For this reason, collaboration along the value chain and across economic sectors will be extremely important, particularly in providing energy to energy intensive and hard-to-abate sectors like shipping, aviation, metals, mining and cement production. The new Energy C companies might transform themselves into large Energy conglomerates actively exploring a range of renewable or non-renewable sources, such as nuclear, biofuels, hydrogen or ammonia.

Risks and opportunities

Key risks with this approach relate to the ability of maintaining the “core Oil and Gas function” and managing its decline - or its returns to risk profile - while increasing and expanding the alternative energy offering and maintaining or transforming the corporate structure, culture, technology base and operations. It is likely that the investments required will lead to decreased profitability, which might create challenges with short-term shareholders. Maintaining two (or more) different business models at the same time can create internal tensions that might lead the transition process to be faster than intended. The rate at which the change happens is a critical issue, likely to be determined by pressure from governments, shareholders and other stakeholders, as well as the need for the transition to be financially viable. The increased speed of transition could be triggered both by internal and external factors (social, technical, political or other, such as the COVID 19 pandemic).

Barriers

One main barrier to this transition mode is the change in culture and capacity required to enter new businesses like electricity production with different sets of clients, delivery modes, regulations and policies, while keeping current activities. This implies a very significant re-structuring of companies and considerable leadership and vision. It is likely that the strategy is only possible through acquisitions, which might be costly, or mergers, which are complex. These might require substantial support from regulators and market supervision authorities. Financing this transition while still generating value for shareholders is also crucial.

A second barrier is the need to get the timing and pace of the change right. Established companies will have to innovate as if they were disruptors of their own businesses. Otherwise, existing potential for innovation in hydrogen, ammonia, energy storage and energy efficiency might be realised too late. Companies cannot wait for demand to be there - they will need to help create demand for the new solutions.

The final barrier is the question of what might happen to the companies' assets. Companies can either manage the decline of their assets, strand them at an appropriate time, or sell them for reinvestment purposes. In most cases, the selling of assets will lead to the continuation of production by another party, causing a "leakage" effect of continued emissions.

Indicators

Key indicators of a significant move into this direction are:

- tCO_2/TJ of energy products provided to the economy (at point of sales).
- Key narratives on strategy and transition.
- Investment flows towards new renewable energy assets versus new fossil fuels.
- Investment flows towards acquisition of renewable energy assets vs. new fossil fuels.
- Overall percentage of EBITDA coming from fossil fuels.

Examples

The best example of this approach to date is DONG Energy, which transformed itself into what is now called Orsted. DONG was a state-owned company, created in 1972, operating in Upstream Production of oil and natural gas. DONG Energy was founded in 2006 from the merger of six Danish energy companies, comprising of private energy producers, public utilities, and energy distribution businesses. At this stage, it owned significant power production facilities comprising oil, gas, and coal, as well hydrocarbon E&P, offshore wind farms, and the development of CCS technology.

Over the course of a decade, the company has transformed from a fossil fuel company to the largest offshore wind developer in Europe and the largest utility in Western Europe[49]. The carbon

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[49] Harries, T. & Annex, M. (2018) Orsted's profitable transformation from oil, gas and coal to renewables | Powering Past Coal Alliance. [Online]. 12 December 2018. Powering Past Coal Alliance.

footprint of the company reduced by 52% between 2006 and 2017[50]. The transition strategy is focused on investing in building new energy business in wind and biofuels.

In addition to the "energy company" strategy, one can find elements of the strategies highlighted in Caldecott *et al.* (2018)[51] "first one out" option, building on profit maximization through cost-cutting and asset sweating, and a considerable focus on core business, selling off non-strategic assets. During this process, the company was part of a significant reform of the Danish power sector[52]. This seemed to be the result of a carefully planned and executed transformation: shifting the company offering to focus on electricity and from there to renewable energy, off-shore wind in particular, which made use of existing engineering capabilities at DONG[53] .

Orsted fully divested its upstream fossil fuel assets in 2017 through a sale to the petrochemical company, Ineos, in 2017[54]. The downside of the transition is that, the fossil fuel assets divested by the company are still largely in operation and emitting carbon.

Elements of this strategy can be found in, for example, Shell, Total, BP and Eni's publicly available documents. However, the extent to which much larger companies can follow a similar path with little to no state support is doubtful.

Carbon company (circular economy)

Description

Oil and Gas companies have considerable expertise in finding appropriate geological structures that contain hydrocarbons, drilling through them, extracting oil and gas, and transporting them to markets. They are the point where carbon gets introduced into the world's economy. This model can potentially be reversed to close the carbon loop, at least for key sources of carbon, by moving to a circular economy model. This would mean Oil and Gas companies initially providing services to store CO_2 into deep geological formations – potentially allowing further extraction of oil and gas through Enhanced Oil Recovery – and building infrastructure that allows the capture of CO_2 and its transportation to storage sites. Companies could potentially be transformed into "carbon neutral" companies or even "carbon negative" companies, providing carbon removal and storage services or technologies to other companies, e.g. by helping to implement Bioenergy

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Available from: https://poweringpastcoal.org/insights/economy/orsteds-profitable-transformation-from-oil-gas-and-coal-to-renewables [Accessed: 27 April 2020].

[50] Orsted (2017) DONG Energy to change company name to Ørsted. [Online]. 2 October 2017. Available from: https://orsted.com/en/company-announcement-list/2017/10/1623554 [Accessed: 27 April 2020].

[51] Caldecott, B., Holmes, I., Kruitwagen, L., Orozco, D., et al. (2018) *Crude Awakening: Making Oil Major Business Models Climate-compatible*.

[52] IRENA (2013) 30 Years of Policies for Wind Energy: Lessons from 12 Wind Energy Markets.

[53] Lu, H., Guo, L. & Zhang, Y. (2019) Oil and gas companies' low-carbon emission transition to integrated energy companies. Science of the Total Environment. [Online] 686, 1202–1209. Available from: doi:10.1016/j.scitotenv.2019.06.014.

[54] Megaw, N. (2017) Dong Energy sells oil and gas business to Ineos. [Online]. 24 May 2017. Financial Times. Available from: https://www.ft.com/content/57482c0b-db29-3147-9b7e-c522aea02271 [Accessed: 27 April 2020].

Carbon Capture and Storage (BECCS). This model can be further extended to include Carbon Capture and Usage value chains, where the captured CO_2 is used as raw material for other processes where it is either permanently or temporarily captured.

Risks and opportunities

There are significant challenges in the implementation of a CCS, CCUS and/or BECCS strategy. Relying on fossil CCS for climate change mitigation leads to an expansion of the allowance of fossil fuel use . Overall societal risks of these approaches have been the focus of ongoing discussion, also at academic levels, where concerns have been identified on the ethics of negative emission technologies (Lenzi, 2018), including Fossil CCS. These are 1) Mitigation obstruction potential; 2) Potential for dangerous policy gamble; 3) Technological optimism or the systematic overestimation of the human potential to manage the carbon cycle.

As a consequence of some of these concerns, there might be social and economic limits to CCS that have to be considered more than physical limits, particularly within the first half of the century (Karayannis et al., 2014). it might be that these solutions are unavoidable in the long term, but the conditions for their successful implementation as a business are several decades away and, as such, should not be relied upon for an effective short to mid-term business transformation of Oil and Gas companies. As reported in the SR1.5 (IPCC, 2019), 1) CCS is largely absent from the Nationally Determined Contributions (Spencer et al., 2015); 2) It is lowly ranked in investment priorities (Fridahl, 2017); 3) Current “economic incentives for ramping up large CCS or BECCS infrastructure are weak (Bhave et al., 2017); and 4) Average investments costs to 2050 for BECCS infrastructure for bio-electricity and biofuels are very large, estimated at 138 and 123 billion USD per year respectively (Smith et al., 2016b).

Barriers

The main barrier to this transition mode is the lack of a business model, as there is no demand for the service. This is unlikely to change until governments move decisively on carbon. The second barrier is its social acceptability, with strong concerns that CCS will legitimize continuous fossil fuel extraction. Finally, there are uncertainties related to costs, safety and permanence of storage, technological capabilities and deployment pace.

Indicators

Key indicators of a significant move into this direction are thought to be:

- tCO2/TJ of energy products provided to the economy (at point of sales), considered on a net-basis (carbon inputted into economy – carbon removed and permanently stored).
- Key narratives on strategy and transition.
- Investment flows towards CCS, CCUS and BECCS technologies.
- Quantities of CO2 permanently stored vs. quantities of fossil carbon extracted.
- Overall % of EBITDA coming from this offering.

Examples

Several companies have been investing in CCS technologies. These include, for example, Equinor, Occidental, Chevron, BP, and others. In the UK, BP, Eni, Equinor, Shell and Total are working together on a large-scale CCS project to decarbonise the industrial region of Teesside[55]. However, a large-scale transition to this business model would require overcoming the barriers listed above via new government policies and incentives for companies. There are no familiar Oil and Gas companies to date which can reliably be considered as having implemented such a model. A summary of at scale experiments today is provided in the text box[56][57].

California Resources Corporation is designing California's first CCS system in the Elk Hills Field. Planned to be operational by 2030, the facility would be the largest of its kind in the Unites States, capturing and permanently storing 1.5 million tonnes of CO_2 annually. The carbon captured from a natural gas-fired power plant will be not only stored but also used for enhanced oil recovery.

Equinor is leading the planned development of the world's first CCS network in with Shell and Total. The Northern Lights project is planned to capture 5 million tonnes of CO_2 per year from industrial emitters in Europe for storage in Norway's continental shell. The CO_2 would be transported by ships and pipelines, which means the project would lead to the beginnings of the first full CCS value chain in the world. The facility is set to open by 2024.

Managed decline

Description

In the managed decline mode, companies seek to maximise value to shareholders while minimising transition risks and focusing less on future growth and more on value delivery. This last step is critical, as it is the fundamental change in aligning with the Paris goals and the need to reduce emissions. The strategy is based on a pragmatic and responsible response to the two perspectives commonly taken while discussing about the low-carbon transition: 1) The alignment perspective, which considers how emissions align with mitigation scenarios compatible with the Paris goals[58]; and 2) The risk perspective[59], i.e. minimising financial downside.

In the alignment perspective, there is a recognition that Oil and Gas extraction needs to be reduced overall might imply a necessary reduction in Oil and Gas investments as well as production. The risk perspective assumes that with smaller demand, oil prices are likely to decrease, and that a much tighter financial discipline in the sanction of new projects is economically and financially desirable to manage transition risks. In the past 20 years, a

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[55] Lammey, M. (2020) Oil majors commit to speeding up huge carbon capture project on Teesside. [Online]. 2020. *Energy Voice*. Available from: https://www.energyvoice.com/otherenergy/225633/oil-majors-commit-to-speeding-up-huge-carbon-capture-project-in-teesside/ [Accessed: 12 June 2020].

[56] California Resources Corporation (n.d.) *Carbon Capture & Sequestration: California's first CCS project.* [Online]. Available from: https://crc.com/images/documents/publications/Infographic_CRC_CarbonCaptureStorage.pdf [Accessed: 24 June 2020].

[57] Snieckus, D. (2020) Equinor, Shell and Total sign off on building world's first carbon capture network. *Recharge*. 15 May.

[58]

[59]

temporary period of rising commodity prices masked trend-setting structural changes in the Oil and Gas industry, namely that access to hydrocarbon reserves only gets harder with maturing fields (and despite technological improvements); tougher competition from national oil companies coupled with resource nationalism and the need to address climate change, driving an ever stronger policy and social pressure on companies.

Companies can be successful on both perspectives if they implement a much more disciplined approach to capital investment, sanctioning fewer projects at lower cost. This implies that they are increasing profit margins and decreasing risks while shrinking production in absolute terms and thus managing the necessary decline in oil and gas demand (and supply). For most Oil and Gas companies, this will mean that in the next investment cycles (2025 and beyond), a much smaller, or even zero, project pipeline will be required to exist.

Risks and opportunities

Opportunities from this model is derived from the clarity of focus, the risk avoidance philosophy and the potential higher returns in the short term - something that might be positively received by investors[60]. Investors might favour this option because it enables them to own the decision on the exposure of different segments within the Oil and Gas industry – e.g. being exposed to upstream but not to refining.

Although in the short to mid-term this can be an effective way to transition, in the long-term, it presents risks associated with the "last one standing" strategy (Caldecott *et al.*, 2018), some of which are the normal risks that an Oil and Gas company faces (political, geological, price, and supply and demand) but compounded for structural reasons that seem unlikely to go away. The end result of this strategy seems likely to be:

1) The company gets stranded by the materialization of some unforeseen or unmanaged risk. Winding down will be a delicate balancing exercise, since as the company shrinks it risks losing the hedge provided by diversified portfolios. Diversification is a relevant risk management strategy for Upstream companies exposed to multiple risks – e.g. volatility of commodity prices, political risks, environmental accidents and, in the long-term, the gradual loss of the social license to operate.
2) The company is effectively dissolved in a planned manner, its outstanding assets likely to be acquired at some point by another company, which will continue to explore the assets, or implement a proper plan for the shut-down and decommissioning of assets. Companies dissolving is a normal process in a capitalist economy, but these processes are usually not explicitly planned outcomes.
3) The company chooses one of the other exit strategies, if that is still possible.
4) The company will indeed be the last one standing, gaining market share from competitors or buying them out. This is unlikely for an IOC, given the relevance and access to cheap resources by some of the NOCs. Furthermore, there are many Oil and Gas companies, but only one "last one standing" - the likelihood of success in the long-run is not the most favourable.

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Barriers

A main barrier to this transition mode is the psychological barrier of normal business management of seeking "growth" in size, instead of "growth in value" delivered. Good management tends to be seen to mean expanding company operations and growth as an objective in itself. Traditionally, oil management operating performance is based on their success to maintain or increase their reserve-replacement ratio (RRR) - this is the amount of oil added to a company's reserves divided by the amount extracted for production. This vision is still prevalent within the industry, and so is likely to be a real barrier. Furthermore, it might be difficult for management to communicate and motivate its employees for a type of strategy that might leave them unemployed.

Indicators

- Reserve replacement ratio (RRR).
- Key narratives on strategy and transition.
- Breakeven cost of invested projects.
- Shareholder dividends.

Examples

While there is no clear example of a major Oil and Gas company following this transition mode , indications of the strategy can already be seen. In the last few years, many companies have announced revision and delay of investments that seem to indicate that they have begun to consider more careful analysis of early signals of transition risk. The reserves and resource replacement ratios of Oil and Gas majors have been in clear decline in recent years (Bousso, 2018; OGJ Editors, 2019)[61,62]. According to the Carbon Tracker Initiative, some companies such as Eni are alluding to the possibility of decelerating their oil production, although no company seems ready to clearly commit to this[63] (Grant, 2020).

New direction

Description

In this mode, an Oil and Gas company radically reinvents itself to start operating in a different sector and with an entirely different set of activities. Instead of going wider, as in the "Energy company" mode proposed above, the company decides to go "different" and reinvents itself, building on concrete opportunities that it might have encountered. It is not unusual for companies

[61] Bousso, R. (2018) For Big Oil, reserve size matters less than ever. [Online]. 16 May 2018. Reuters. Available from: https://www.reuters.com/article/us-oilmajors-reserves/for-big-oil-reservesize-matters-less-than-ever-idUSKCN1IH1I2 [Accessed: 27 April 2020].

[62] OGJ Editors (2019) Rystad: Oil and gas resource replacement ratio lowest in decades. [Online]. 9 October 2019. Oil & Gas Journal. Available from: https://www.ogj.com/exploration-development/reserves/article/14068305/rystad-oil-and-gas-resource-replacement-ratio-lowest-in-decades [Accessed: 27 April 2020].

[63] Grant, A. (2020) Eni – the first oil company to lay out a strategy of managed decline? - Carbon Tracker Initiative. Carbon Tracker.

to reinvent themselves in a capitalist society, responding to technological, market and social changes.

Risks and opportunities

Completely reinventing a company's business is a risky proposition, particularly when that transformation is driven not by the normal seizing of opportunities that appear, but as a response to higher threats to the current business model – as part of a re active approach to strategy, instead of an active one. However, as noted above, in the history of capitalism there are many examples of companies considerably reinventing themselves and changing towards new or unexpected direction[64]. Companies in the Oil and Gas value chain have many skills, knowledge and technologies that are transferable, to a certain extent, to other sectors. As some business activities decrease, others might be expected to grow, supplying services to other parts of the economy. For example, the considerable knowledge in off-shore platforms – an activity expected to decrease – is transferable and in high demand in the renewable energy sector. Oil and Gas service providers can potentially reinvent themselves as construction, engineering services or telecommunication providers.

Barriers

In the context of the significant transformation the Oil and Gas sector must go through, the size of the company might constitute a relevant barrier for this type of transition. Extremely large companies will have a diversity of capabilities and businesses, and clarity of focus will be harder to achieve and likely more difficult to implement. Smaller companies are more probable to be more agile in responding to emerging opportunities in the market, face less scrutiny and have fewer regrets if things go wrong.

Indicators

Key indicators of a significant move into this direction are thought to be:

- Key narratives on strategy and transition.
- Mergers, acquisitions and spin-offs from the company focusing on parts of the business.
- Business diversifying its client base to outside the Oil and Gas value chain.
- Overall % of EBITDA coming from non-Oil and Gas related businesses.

Examples

After a merger between rival companies FMC Technologies and Technip, TechnipFMC Plc announced in 2019 the spin-off of its engineering and construction operations, leaving TechnipFMC Plc as a technology-focused equipment supplier to oil and gas companies. According to its CEO, the move would improve flexibility and allow the new companies to unlock new opportunities[65], with the new construction company continuing to pursue opportunities in

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[64] An example of such transformations through a company history is for example Nokia which has started has a paper mill company, transformed into an industrial conglomerate, to a phone producing company and finally a network provider, as reported by Reuters.

[65] https://business.financialpost.com/pmn/business-pmn/oil-services-firm-technipfmc-to-split-into-two-publicly-traded-companies-2

liquefied natural gas and broadening its market focus to include biofuels and alternative energy projects. TechnipFMC, which had a market capitalization of $10.31 billion, said the new Paris-based company will deal with onshore and offshore oil and gas projects. The split was expected to be finalised in the first half of 2020.

Conclusions

With the mounting pressure of climate change and public demands of climate mitigation, Oil and Gas companies must decide how to respond to the low-carbon transition. Companies choosing to actively engage with the transition have four “transition modes”, all of which have both advantages and disadvantages and can be adopted in combinations:

- Becoming an “Energy Company” is an attractive option, as it allows for new business and continued growth, but achieving the required shift in culture and capabilities while getting the pace of change right may be tricky.
- Becoming a “Carbon Company” can be a way to leverage existing assets and skills, but lack of a viable business model is a significant barrier in the current policy and regulatory environment.
- “Managed decline” seems to serve the medium- to long-term interests of shareholders well but goes against traditional models of business management and may be difficult to balance against the interests of employees and more short-term investors.
- In theory, “New Direction” offers countless opportunities, but in practice it is likely to be difficult for established companies to completely change their field of operation.

The choice of transition mode will depend on the specific situation of each oil company. In all cases, this is an existential choice not only for the companies. Given their role in the current economic system, effective transition of Oil and Gas companies is a challenge with impact on the entire fabric of society, including on future generations. Effective transition from fossil fuels, will need the involvement and implication of all actors in the energy value chain.

Chapter 8: Resources and extra materials

[to be added]

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(Challenges)

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Glossary

Scope 1

Scope 2

Scope 3, Use of Sold Products

Scope 3, Purchased Goods and Services

Upstream

Midstream

Downstream

Integrated Energy company