Carbon Performance Assessment of Other Industrials Companies Discussion Paper

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EXECUTIVE SUMMARY

The Transition Pathway Initiative (TPI) is a global initiative led by asset owners and supported by asset managers. Aimed at investors and free to use, it assesses companies' progress on the transition to a low-carbon economy, supporting efforts to address climate change.

TPI assesses companies' progress in two ways: (1) Management Quality and (2) Carbon Performance. Management Quality is a measure of the quality of companies' governance/management of greenhouse gas emissions and climate issues. Carbon Performance is a quantitative comparison of companies' current and targeted carbon emissions against international climate goals.

To date, TPI has developed methodologies to assess the Carbon Performance of 10 high-carbon sectors, including electricity utilities, oil and gas producers, high-carbon industrial sectors, and transport sectors. The four industrial sectors whose Carbon Performance we currently assess are aluminium, cement, paper, and steel. These sectors have been prioritised because they meet three criteria. First, they have a high carbon footprint. Second, low-carbon modelling scenarios are available for them, notably those produced by the International Energy Agency (IEA). Third, there is enough suitable information disclosure at the company and industry levels. The chemicals sector does not currently meet this third criterion but has a high carbon footprint and is partly covered by IEA modelling.

The rest of industry – henceforth called Other Industrials – is still important, both economically and environmentally. Therefore, we have prepared this Discussion Paper presenting a methodology that could be used to assess the Carbon Performance of some Other Industrials companies.

Assessing the Carbon Performance of Other Industrials is challenging. First, there is no explicit modelling of this sector in low-carbon scenarios. Second, it is by definition a heterogeneous sector that manufactures many different kinds of product. We have sought to develop a workable methodology given these limitations, which **focuses on Scope 1 and 2 emissions and uses revenue as a common activity denominator**.

In this Discussion Paper, we describe how to construct Carbon Performance benchmarks for Other Industrials companies consistent with the three scenarios currently used for other sectors assessed by TPI: the 2015 Paris Pledges (i.e., Nationally Determined Contributions or NDCs), 2 Degrees and Below 2 Degrees scenarios. We do this by using data from the IEA's *Energy Technology Perspectives 2017* report.

Specifically, we calculate a residual industry emissions pathway by using the carbon budget allocated to industry as a whole and subtracting from it the carbon budgets allocated to the five explicitly modelled industrial sectors mentioned above (aluminium, cement, chemicals, paper, and steel). Initial Scope 1 and 2 emissions

per unit revenue figures for 2019 are estimated using as a sample the 18 companies currently included in the TPI universe that are categorised as Other Industrials. These initial values could be refined in future work using a larger and more targeted sample of companies.

We encourage the further development and use of this methodology to assess manufacturing and construction companies (outside aluminium, cement, chemicals, paper, and steel), whose material emissions are limited to Scopes 1 and 2. Such companies might be involved in the manufacturing of clothing, construction materials, or electronics. Investors must satisfy themselves that individual companies are not responsible for material Scope 3 emissions, for example from purchased goods and services or from the use of sold products.

This methodology could also provide the foundation for benchmarks that include additional emissions categories. For example, aircraft manufacturers like Boeing and Airbus could be assessed using this methodology, when it is combined with an additional Scope 3 use of sold product component that shows how the fuel efficiency of aircraft should evolve over time in line with the goals of the Paris Agreement.

We seek feedback from industry experts, companies, researchers, and investors on the following topics:

- Sector application: TPI focuses on the material emissions in each sector, defined as those emissions accounting for the majority of total lifecycle emissions. Such material emissions must clearly be abated for companies to align with a low-carbon future. We seek feedback on which sub-sectors our methodology can reasonably be applied to, based on this understanding of material emissions. We would not apply this methodology, for example, to aircraft manufacturers whose sold products burn jet kerosene and create emissions that are orders of magnitude higher than the Scope 1 and 2 emissions from manufacturing the aircraft in the first place.[1] We welcome feedback specifically on whether and to what extent this methodology could be applied to clothing, construction materials, or electronics manufacturers, or any other appropriate companies.

- Intensity denominator: The diversity of products sold by companies included in the Other Industrials sector requires a broad activity metric for the emissions intensity denominator. We propose using company revenue, given its widespread use in calculating corporate emissions intensities and its reliable disclosure by companies. We welcome suggestions of alternative activity metrics that are less volatile than revenue and that do not favour the sale of expensive goods, or companies which outsource large parts of their production. We also welcome advice on data collection from publicly available sources for suggested metrics.

1. INTRODUCTION

1.1 The Transition Pathway Initiative

The Transition Pathway Initiative (TPI) is a global initiative led by asset owners and supported by asset managers. Established in January 2017, TPI investors now collectively represent over US$30 trillion of assets under management and advice.

On an annual basis, TPI assesses companies' progress on the transition to a low-carbon economy in terms of their:

- Management Quality – all companies are assessed on the quality of their governance and management of greenhouse gas emissions and of risks and opportunities related to the low-carbon transition;
- Carbon Performance – in selected sectors, TPI quantitatively benchmarks companies' carbon emissions against international climate goals.

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

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

1.2 About this report

This Discussion Paper proposes a methodology to assess the Carbon Performance of 'Other Industrials' companies, i.e., manufacturing companies outside the main CO_2-emitting industrial sectors of aluminium, cement, chemicals, paper, and steel.

The structure of the paper is as follows:

- *Section 2* explains how TPI has assessed Carbon Performance in other sectors, like aviation, cement, steel, oil and gas, and electricity.
- *Section 3* establishes the fundamentals of adapting the methodology to Other Industrials.
- *Section 4* presents the benchmarks created from applying this methodology to the companies currently in TPI's Other Industrials sector.
- *Section 5* discusses the limitations of this methodology as well as potential applications.

2. TPI'S CARBON PERFORMANCE ASSESSMENT

TPI's Carbon Performance assessment is based on the Sectoral Decarbonization Approach (SDA).[2] The SDA translates greenhouse gas emissions targets made at the international level (e.g. under the Paris Agreement to the UN Framework Convention on Climate Change) into appropriate benchmarks, against which the performance of individual companies can be compared.[1]

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

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

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

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

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

- Assumptions about sectoral activity need to be consistent with the emissions modelled and therefore should be taken from the same economy-energy modelling, where possible.

[1] Another initiative that is also using the SDA is the Science Based Targets Initiative (http://sciencebasedtargets.org/).

- Companies' recent and current emissions intensity is calculated, and their future emissions intensity can be estimated based on emissions targets they have set (i.e. this assumes companies exactly meet their targets).[2] Together these establish emissions intensity pathways for companies.
- Companies' emissions intensity pathways are compared with each other and with the relevant sectoral benchmark pathway.

TPI currently uses three sectoral benchmarks for our industrial and materials cluster:

1. *Paris Pledges*, consistent with the emissions reductions pledged by countries as part of the 2015 Paris Agreement in the form of Nationally Determined Contributions or NDCs. These are insufficient to limit the increase in global average temperature to 2°C or below.[4] This has become more apparent with the recent announcement of net zero goals by several national governments, which, if delivered, can close the gap between national pledges and the 2°C ceiling on warming.
2. *2 Degrees*, consistent with the overall aim of the Paris Agreement to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels", albeit at the low end of the range of ambition. This scenario gives a probability of 50% of holding the global temperature increase to 2°C by 2100.
3. *Below 2 Degrees*, consistent with a more ambitious interpretation of the Paris Agreement's overall aim. This scenario gives a 50% probability of holding the global temperature increase to 1.75°C by 2100.

The source of data for these scenarios is usually the modelling of the International Energy Agency (IEA), via its Energy Technology Perspectives (ETP) report.[5] Over the coming year, we will be phasing in a new set of scenarios based on the latest IEA data, including a 1.5 Degrees scenario and an updated National Pledges scenario.

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

Further details of how the Carbon Performance methodology is applied in specific sectors can be found in TPI's sectoral methodology notes:
https://www.transitionpathwayinitiative.org/tpi/publications

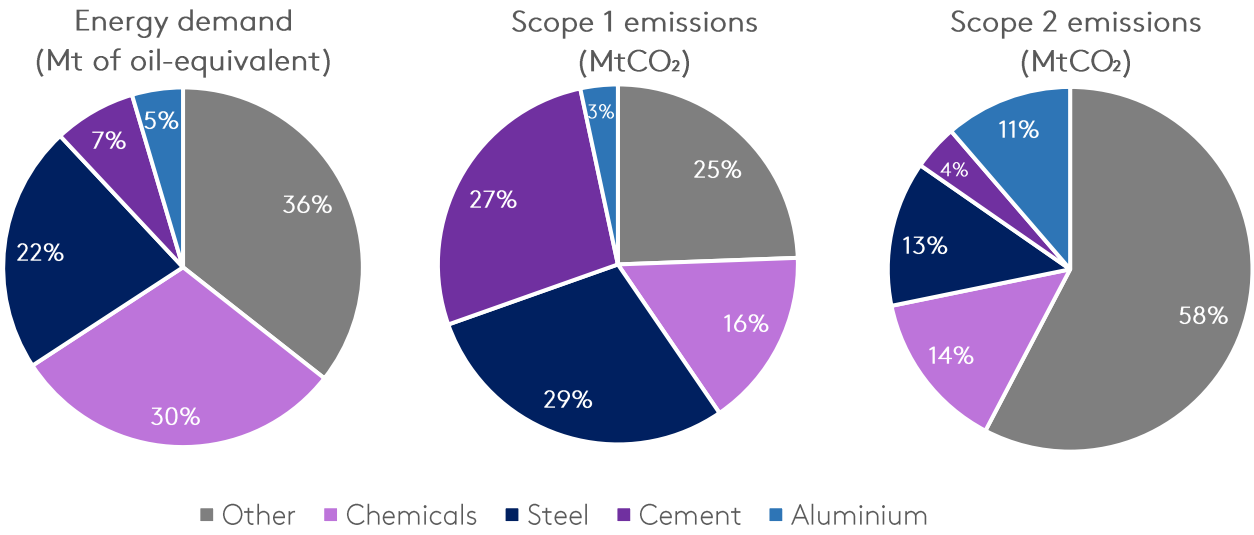
[2] Alternatively, future emissions intensity could be calculated based on other data provided by companies on their business strategy and capital expenditure plans.

3. APPLYING THE METHOD TO OTHER INDUSTRIALS

3.1 Establishing sector boundaries

Industrial activity emits significant greenhouse gases. Industry accounted for 37% of global energy consumption, 42% of electricity consumption, and 25% of global direct CO_2 emissions in 2019.[6] TPI currently assesses companies in four of the highest-emitting industrial sectors on Carbon Performance: aluminium, cement, paper, and steel (see Figure 1). A fifth high-emitting industrial sector, chemicals, is also modelled by the IEA, but TPI does not currently assess it on Carbon Performance due to a lack of suitable company/industry data.

Figure 1. Energy consumption and emissions from industry in 2019 (ETP 2020).



Besides aluminium, chemicals, cement, paper and steel, IEA models "residual" industrial emissions from mining, construction, and manufacturing of various intermediate and finished goods like glass, ceramics, tobacco products, engines, machinery, vehicles, and electronic devices. See Table 1 in the Annex for a full list of the ISIC sub-sectors included in the IEA's definition of industry (note that some of the ISIC sub-sectors are already partially or entirely assessed under TPI's existing industry sector methodologies). Of these residual industrial emissions sources, TPI already assesses the Carbon Performance of diversified mining companies. The methodology presented in this Discussion Paper is intended for a subgroup of the remaining Other Industrials companies, specifically those **whose material carbon emissions are limited to Scope 1 and 2.**

Evidently this depends on not having material Scope 3 emissions. To give a familiar analogy, the material emissions attributable to oil and gas producers are mostly from use of sold products (Scope 3). Oil and gas companies could transition by shifting to the sale of low-carbon energy carriers, managing large-scale negative

emissions operations, or winding down their businesses. An assessment limited to oil and gas producers' Scope 1 and 2 emissions would not provide a useful understanding of their alignment with climate goals and could misrepresent their mitigation ambitions.

One sub-sector of Other Industrials, which may justifiably be assessed only on its Scope 1 and 2 emissions, is manufacturing of construction materials (excluding cement, which has its own assessment methodology). A lifecycle analysis of ceramic tiles, for example, found that most emissions occur in the manufacturing stage.[7] Another sub-sector that may be assessed on its Scope 1 and 2 emissions is electronics manufacturing. However, care must be taken as emissions resulting from the use phase of electronic devices can be significant. In the case of smartphones, for example, there are two main use phase sources of emissions: the emissions from electricity consumed while devices are charged, and the emissions from the data centres that provide network services to users. The latter is particularly significant relative to the total lifecycle emissions of a smartphone.[8] Assessing Other Industrials may thus require broadening the scope of assessment to upstream and/or downstream Scope 3 emissions, where more carbon-intensive activities take place (e.g. upstream agriculture for textile manufacturers or downstream use of sold products for aircraft manufacturers).

Based on the ISIC sub-sectors included in the IEA's definition of industry, the Other Industrials sub-sectors that we believe could be assessed using the proposed methodology include:

- Construction materials (e.g. glass, ceramics, etc.);
- Electronic devices (e.g. smartphones, laptops, etc.);
- Clothing and textiles;
- Beverages;
- Printing and recorded media;
- Furniture.

These sub-sectors, as well as individually chosen companies, could be researched on a case-by-case basis to determine whether any Scope 3 categories include material emissions.

Few of the 18 companies currently researched by TPI under Other Industrials (see Appendix, Table 2) meet the above criteria, because they have significant Scope 3 emissions. For this reason, we are not proposing to roll out the Carbon Performance methodology developed in this paper to the sector as a whole. Instead, subject to feedback and further refinement, it could be applied to specific Other Industrials companies such as those manufacturing electronic devices (General Electric, Hitachi, Hon Hai Precision Industry, Philips, and Siemens) and construction materials (Saint Gobain). In addition, the methodology could prove useful to third parties researching companies outside the TPI universe and we encourage that.

3.2 Establishing emissions boundaries

For this methodology, we establish an emissions boundary of **Scope 1 and 2**. Unlike some other sectors whose Carbon Performance is assessed by TPI (e.g. aviation and electricity), Scope 2 emissions from purchased power are sufficiently important in Other Industrials that they should be included in the measure of company emissions, alongside Scope 1. Indeed, the electricity consumption of residual industry is higher than the combined electricity consumption of aluminium, cement, chemicals, paper, and steel.[5] Electricity consumption and the related Scope 2 emissions from the universe of Other Industrials companies is therefore globally significant.

Scope 3 emissions, although material in the Other Industrials sector, are not included in this methodology, primarily because of the difficulty in establishing benchmark intensities for companies that manufacture such varied products. The two categories of Scope 3 emissions that are likely to be important for Other Industrials companies are Category 1, the emissions embodied in the goods and services purchased by the company, and Category 11, the emissions arising from the use of sold products by the company's customers. As discussed in Section 5, we can envisage ways to incorporate relevant Scope 3 emissions into the benchmarks if the methodology is applied to a more specific sub-sector of Other Industrials such as aircraft manufacturers.

Our objective is to measure emissions from manufacturing specifically, so that emissions arising from any other activities that companies are engaged in are excluded, otherwise companies' emissions intensity may be over-estimated. However, some companies might label their disclosed emissions as being operations-wide, rather than manufacturing-specific. When this is the case, further assessment is required of whether the company in question has included significant sources of emissions other than manufacturing, or whether operations-wide and manufacturing-specific emissions are equivalent, or at least approximately so.

3.3 Establishing an activity metric

Choosing an activity metric in industrial sectors like cement and steel is facilitated by the existence of a homogeneous product in each sector. The heterogeneity of Other Industrials makes it much harder to find an activity metric based on physical production, which is usually preferred. Tonnage of sold products was considered, but this approach does not account for the sometimes huge differences in the value of products per unit weight. Tonnage of sold products is also rarely disclosed by the relevant companies. In addition, a growth forecast for the global tonnage of manufactured products consistent with the emissions scenarios of the IEA would be needed to project sectoral activity and construct the benchmarks, but such data are unavailable.

We therefore propose using **revenue** as the activity metric in Other Industrials. Revenue is widely used as the denominator in the calculation of carbon intensities[3] and it is nearly always disclosed by companies. There is some variation between companies in terms of how revenue is disclosed. Usually, companies will disclose revenue, but they sometimes disclose net sales instead, which we consider approximately the same as revenue. As is the case with emissions, revenue generated by non-industrial activities should be excluded from a company's intensity pathway.

This approach does suffer from drawbacks, such as the volatility of revenue. These limitations are discussed further in Section 5. One option to address the volatility of revenue is to construct a rolling average emissions intensity over several years (volatility is not, however, expected to be as serious an issue as it is in Diversified Mining, where the unit price of mined commodities is extremely variable). In the case of Other Industrials, it is reasonable to expect that revenue is correlated with emissions, and therefore that intensities are relatively unaffected by revenue volatility. When companies operate in different countries and disclose their current and historical revenue in other currencies, we recommend using constant average annual exchange rates to prevent distortions from currency fluctuations.

There are no long-run revenue growth projections for Other Industrials. We therefore assume that revenue grows in line with global Gross Domestic Product (GDP) as projected in ETP 2017. This ensures internal consistency with the emissions scenarios we use.

3.4 Estimating and forecasting the intensity benchmarks

In this methodology for Other Industrials companies, the specific measure of emissions intensity used is:

- Scope 1 and 2 CO_2 emissions per unit revenue, in units of (metric) tonnes of CO_2 per million USD in revenue.

We propose limiting this methodology to CO_2 emissions given that other relevant greenhouse gases, such as methane from waste management[4] and hydrofluorocarbons from cooling devices, are typically emitted in Scope 3 downstream use and end-of-life phases of the relevant products' lifecycles.

TPI currently builds Carbon Performance benchmarks based on the IEA's modelling. Besides pathways for aluminium, cement, chemicals, paper, and steel, the IEA provides emissions and electricity consumption pathways for all of industry. It is

[3] See for example the MSCI index carbon footprint metrics.

[4] Waste management companies themselves would not be covered by this methodology as they were not included in the IEA's definition of industry in ETP 2017.

therefore possible to calculate **residual industrial emissions and electricity consumption**.

To calculate how Scope 1 emissions from Other Industrials should evolve over time in each benchmark scenario, we take the direct emissions budget allocated to industry as a whole and subtract direct emissions allocated to aluminium, cement, chemicals, paper, and steel. The rates of change in the resulting residual industrial emissions are used to forecast direct Scope 1 emissions from Other Industrials.

To forecast Scope 2 emissions, TPI multiplies a sector's electricity consumption by the emissions intensity of the electricity grid, along each of the IEA scenario paths. However, since there is no electricity consumption allocated to Other Industrials specifically, we calculate residual industrial power consumption by subtracting the electricity allocated to aluminium, cement, chemicals, paper, and steel from total industrial electricity consumption. This is then multiplied by the carbon intensity of the electricity grid over time in the three scenarios (see Fig. 1).

In the case of some industrial sectors, like paper and steel, we make an adjustment to Scope 2 emissions to account for the fact that some companies in these sectors generate a significant portion (>5%) of the electricity they consume. To estimate the proportion of power consumption that is purchased, we draw on data published in company responses to the CDP Climate Change questionnaire. Question CC11.5, introduced in the 2016 and 2017 questionnaires (it is unfortunately not included in the 2020 CDP Climate Change questionnaire), specifically asks respondents to list their power consumption and purchases. Using this data, it is possible to calculate the average ratio of electricity purchased to total electricity consumed.

Using the 2017 CDP questionnaire responses of 12 of the 18 Other Industrials companies currently in the TPI universe, we found that on average 97% of electricity consumption was purchased. We therefore do not adjust for self-generated power in this methodology. If our methodology were to be applied to a different sub-sector or a different set of companies, we recommend undertaking the adjustment of removing the emissions from self-generated electricity from Scope 2 emissions if the proportion of electricity consumed that is purchased is less than 95%.

Using revenue as the activity metric for Other Industrials creates an initialisation problem. Unlike existing TPI sectors assessed on Carbon Performance such as cement, we lack a sector-wide estimate of activity. That is, the IEA scenarios provide a sector-wide estimate of cement production, for example, but no corresponding estimate of total revenue across Other Industrials is available. An alternative approach is to construct an estimate of emissions per USD revenue by sampling. Ideally, this estimate should be based on a large, representative sample of companies. For now, we estimate initial emissions per USD revenue using TPI's existing Other Industrials sector, which is a rather small sample. Hence, our initial values could be refined in further work. As residual Scope 1 and 2 emissions from the

IEA modelling evolve differently over time in the three scenarios (i.e., Paris Pledges, 2 Degrees and Below 2 Degrees), separate Scope 1 and Scope 2 emissions intensity starting values should be calculated.

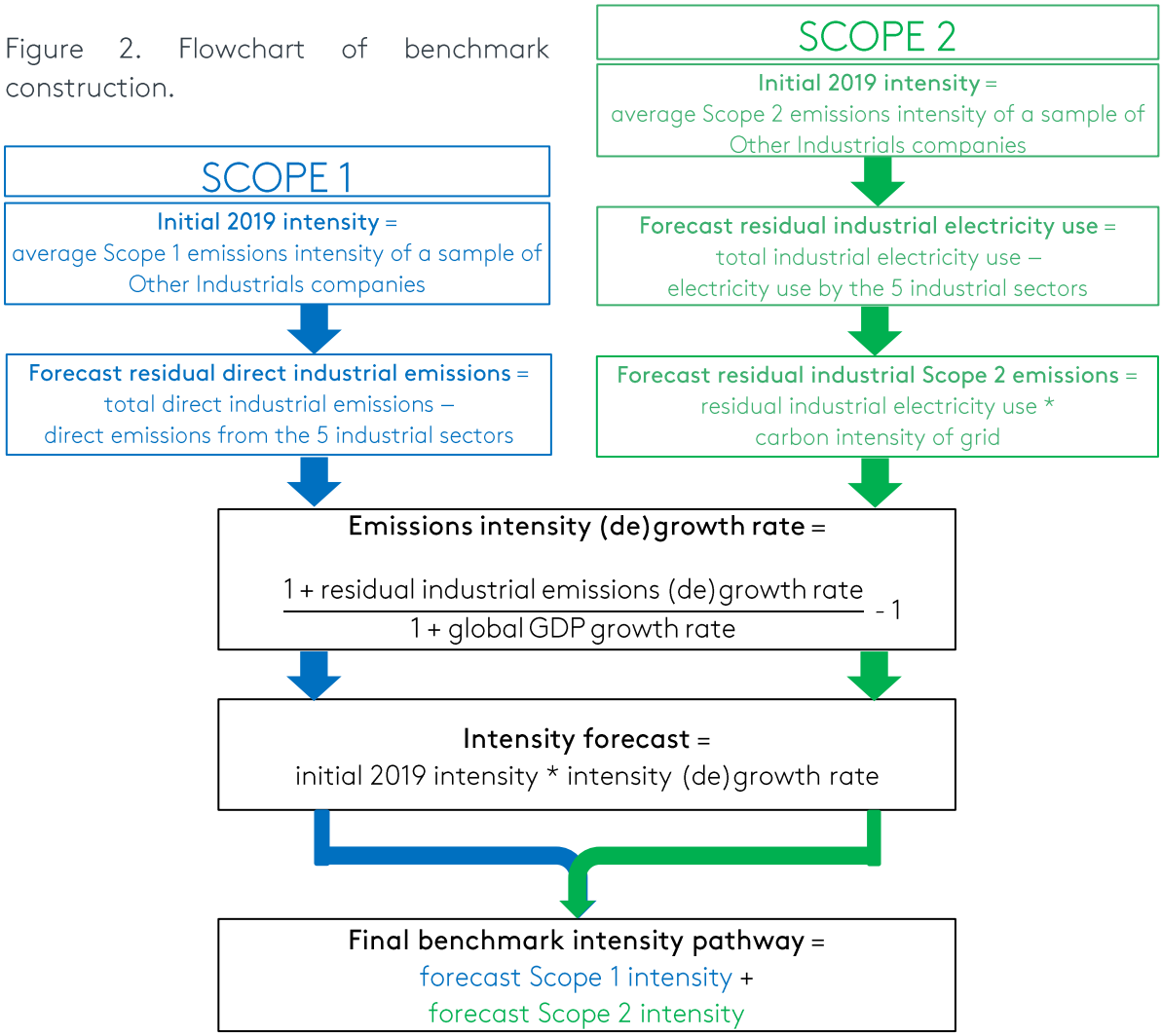
Emissions intensity (de)growth rates are calculated using the rates of change of residual emissions from industry and global GDP growth rates in ETP 2017 according to the following formula:

$$\text{Emissions intensity degrowth rate} = \frac{1 + \text{residual industrial emissions degrowth rate}}{1 + \text{global GDP growth rate}} - 1$$

For each scenario, the rates of change of Scope 1 and 2 emissions between 2019 and each year modelled by the IEA (5-year intervals between 2025 and 2050) can be calculated. The Scope 1 emissions intensity degrowth rate is applied to the average Scope 1 intensity and the same is done to the average Scope 2 intensity. Finally, the two projected intensities are summed to obtain a total Scope 1 and 2 carbon intensity benchmark for each scenario.

Figure 2 summarises the steps necessary to calculate the benchmarks.

Figure 2. Flowchart of benchmark construction.



4. PROOF OF CONCEPT: BENCHMARKS FOR TPI'S OTHER INDUSTRIALS SECTOR

We calculate illustrative benchmarks for Other Industrials using data from the 18 companies currently included in TPI's Other Industrials sector (see Appendix, Table 2). To establish a starting value for the benchmarks, we take the average carbon intensity of Other Industrials companies for which we could find relevant emissions and revenue data.

As explained in Section 3.4, we calculate separate initial values of Scope 1 and Scope 2 emissions intensity, since these two types of emissions evolve differently over time in the three scenarios. The average Scope 1 intensity of the Other Industrials companies was 10.35 tonnes of CO_2 per million US dollars of revenue in 2019 and the average Scope 2 intensity was 13.0 tCO_2/mUSD. When revenues were disclosed in currencies other than US dollars, we converted them using the average annual exchange rate for the year 2019.Figure 3 shows the benchmark emissions intensity paths, while Table 2 provides the underlying data on emissions and global GDP growth. For example, under the 2 Degrees scenario, global Scope 1 emissions from the Other Industrials group are projected to fall by 5.7% between 2019 and 2025, while their Scope 2 emissions are projected to fall by 18.2%. Under all scenarios, global GDP is projected to increase by 28% between 2019 and 2025. Therefore, the carbon intensity required to align with the 2 Degrees path in 2025 can be calculated as below:

$$10.35 \times \frac{1 + (-5.7\%)}{1 + 28\%} + 13.0 \times \frac{1 + (-18.2\%)}{1 + 28\%} = 15.93 \text{ } tCO_2 \text{ per million USD of revenue}$$

Figure 3. Benchmark global carbon intensity paths for the Other Industrials group.

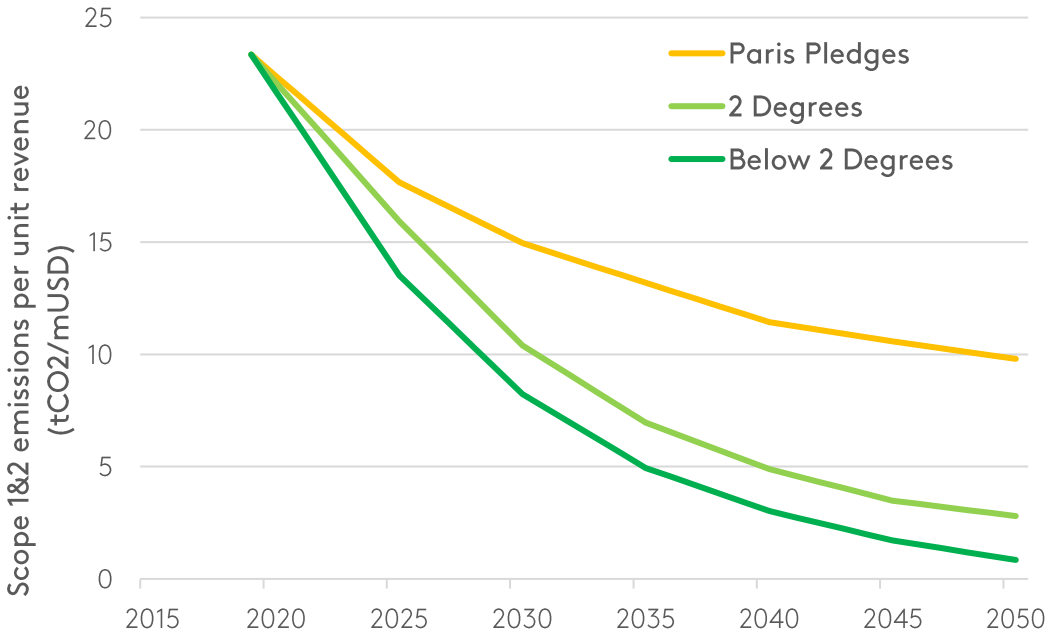


Table 2. Projections of emissions and global GDP growth rates (from 2019 to each year) used to calculate intensity pathways. Source: IEA and own calculations.

	2025	2030	2035	2040	2045	2050
Global GDP growth rate	28.0%	56.2%	85.5%	117.5%	142.5%	170.4%
Paris Pledges Scenario						
Scope 1 emissions growth rate	-2.2%	0.5%	4.4%	3.5%	7.1%	15.4%
Scope 2 emissions growth rate	-3.0%	-0.3%	5%	9.0%	12.2%	12.0%
Intensity (tCO2/mUSD)	**17.66**	**14.96**	**13.18**	**11.44**	**10.58**	**9.80**
2 Degrees Scenario						
Scope 1 emissions growth rate	-5.7%	-16.1%	-22.7%	-30.4%	-39.2%	-41.5%
Scope 2 emissions growth rate	-18.2%	-42.0%	-62.2%	-73.6%	-83.4%	-88.4%
Intensity (tCO2/mUSD)	**15.93**	**10.39**	**6.96**	**4.89**	**3.49**	**2.80**
Below 2 Degrees Scenario						
Scope 1 emissions growth rate	-23.8%	-40.4%	-54.0%	-60.1%	-66.8%	-75.0%
Scope 2 emissions growth rate	-27.6%	-48.6%	-66.1%	-81.2%	-94.4%	-102.4%
Intensity (tCO2/mUSD)	**13.52**	**8.23**	**4.94**	**3.02**	**1.71**	**0.84**

5. DISCUSSION

This paper has described a methodology that could be used to assess Other Industrials companies on Carbon Performance. TPI's Carbon Performance assessment is designed to be easy to understand and use, while robust. There are inevitably many nuances surrounding each company's individual performance, how it relates to the benchmarks and why. Investors may wish to dig deeper to understand these.

5.1 Limitations of this methodology

The main challenge in devising a methodology for Other Industrials companies is the variety of their activities. We would prefer to use a measure of physical production as the basis of our intensity calculations, rather than revenue. Among other things, physical activity metrics are less volatile and easier to project into the future in a way that is consistent with the corresponding emissions projections. However, Other Industrials companies are too heterogeneous to have a coherent physical activity metric. We therefore suggest using revenue as a common denominator.

To estimate future activity levels, we assume the total revenue of the Other Industrials sector grows at the same rate as the global economy, specifically according to the IEA's GDP forecasts. This is equivalent to assuming Other Industrials have a constant share of global output. In general, economies undergo a process of structural change away from extractive industries towards manufacturing and eventually services. This is likely to change the share of the economy occupied by Other Industrials, although ironically the heterogeneous, residual nature of the sector may render the assumption of a constant share better than for most other extractive or industrial sectors.

Another disadvantage of revenue is that the intensities of assessed companies can be biased towards those who sell relatively more expensive products. For example, luxury clothing manufacturers would have a lower carbon intensity when measured on a revenue basis simply because their products are expensive, even if their emissions per unit of clothing sold are not lower than those of a more affordable clothing brand.

There is also the issue of where a manufacturer is situated in the supply chain. An aircraft manufacturer may purchase components like engines from other manufacturers and only assemble the final aircraft, selling the finished product for a higher price than the sum of the components it purchased and producing fairly minimal emissions in the process. The manufacturers of aircraft *components* would likely end up with both higher emissions and lower revenue, resulting in a higher carbon intensity. Among aircraft manufacturers, some outsource the manufacturing of components while others do not, resulting in differing emissions intensities on a revenue basis that do not necessarily indicate differing mitigation efforts. Alternative metrics, which could reflect more accurately the added value

generated by companies, are profits or gross value added. However, profit tends to be especially volatile, while gross value added is not routinely disclosed by companies.

5.2 Applications to other sectors

Despite these limitations, the current methodology could be applied to Other Industrials companies without material Scope 3 emissions. As discussed above, it may be reasonable to apply this methodology to manufacturers of electronics and construction materials other than cement. Further sub-sectors to consider include construction companies and manufacturers of clothing, beverages, printing and recorded media, and furniture. These sub-sectors and the companies within them could be researched on a case-by-case basis to determine whether any Scope 3 categories qualify as material emissions. If this methodology were to be applied to one of these sub-sectors, the initialisation of Scope 1 and 2 intensities in 2019 would need to be recalculated using disclosure from a representative sample of companies in the chosen sub-sector.

Alternatively, this methodology can be complemented by a relevant Scope 3 carbon budget applied to a specific manufacturing sub-sector. The Other Industrials group includes the world's biggest aircraft manufacturers: Airbus and Boeing. TPI has already developed an assessment methodology for airlines, whose mitigation options depend greatly on the products sold by civilian aircraft manufacturers. This sector could therefore be a starting point for further development of the Other Industrials methodology. The most relevant Scope 3 emissions of aircraft manufacturers are use of sold product emissions. The corresponding carbon budget could be derived from the Scope 1 emissions benchmarks currently used in the TPI assessment of airlines. One approach to estimate companies' performance on Scope 3 use of sold product emissions could be to use the average fuel efficiency or carbon intensity of produced aircraft. Another approach could be to calculate the absolute carbon footprint of a manufacturer's plane fleet based on average aircraft lifetime and passenger load factor estimates. Notwithstanding the above, the feasibility of developing a methodology for civilian aircraft manufacturers is dependent on the availability of data on the stock of airplanes which are currently in use.

TPI is also currently exploring the applicability of the methodology presented here to the food processing sector with certain adjustments involving Scope 3 emissions from purchased goods and services.

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ANNEX

Table 1: International Standard Industrial Classification (ISIC) categories included under industry in the IEA's ETP 2017

ISIC Section	ISIC Division	Description	Notes
B. Mining and quarrying	7	Mining of metal ores	*These three divisions are used in TPI's diversified mining methodology*
	8	Other mining and quarrying	
	099	Support activities for other mining and quarrying	
C. Manufacturing	10	Manufacture of food products	*This division will be used in TPI's food methodology*
	11	Manufacture of beverages	
	12	Manufacture of tobacco products	
	13	Manufacture of textiles	
	14	Manufacture of wearing apparel	
	15	Manufacture of leather and related products	
	16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	
	17	Manufacture of paper and paper products	*This division is used in TPI's pulp and paper methodology*
	18	Printing and reproduction of recorded media	
	20	Manufacture of chemicals and chemical products	*This division would be used if TPI were to develop a chemicals methodology*
	21	Manufacture of pharmaceuticals, medicinal chemical and botanical products	*See above*
	22	Manufacture of rubber and plastics products	*See above*
	23	Manufacture of other non-metallic mineral products	*This division contains the cement sector; it is used in TPI's cement methodology*
	24	Manufacture of basic metals	*This division contain steel and aluminium; it is used in TPI's steel and aluminium methodologies*

	25	Manufacture of fabricated metal products, except machinery and equipment	
	26	Manufacture of computer, electronic and optical products	
	27	Manufacture of electrical equipment	
	28	Manufacture of machinery and equipment n.e.c.	
	29	Manufacture of motor vehicles, trailers and semi-trailers	
	30	Manufacture of other transport equipment	
	31	Manufacture of furniture	
	32	Other manufacturing	
F. Construction	41	Construction of buildings	
	42	Civil engineering	
	43	Specialized construction activities	

Table 2: Other Industrials companies with current Management Quality scores

Company name	MQ score	ICB sub-sector
Boeing	3	Aerospace
Raytheon Technologies	4	Aerospace
Rolls-Royce	3	Aerospace
Airbus	4	Aerospace
Lockheed Martin	4	Defense
Daikin Industries	3	Building materials & fixtures
St Gobain	4	Building materials & fixtures
Trane Technologies	4	Building materials & fixtures
Hon Hai Precision Industry	3	Electrical Components & Equipment
Hitachi	4	Electronic Equipment
General Electric	3	Diversified Industrials
Siemens	3	Diversified Industrials
Philips	4*	Medical Equipment
Caterpillar	3	Commercial vehicles & trucks
United Tractors	2	Commercial vehicles & trucks
PACCAR	4	Commercial vehicles & trucks
Cummins	4	Commercial vehicles & trucks
Volvo	3	Commercial vehicles & trucks