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CARBON PERFORMANCE ASSESSMENT OF STEEL MAKERS: NOTE ON METHODOLOGY

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1. INTRODUCTION

The purpose of this note is to provide an overview of the methodology followed by the Transition Pathway Initiative (TPI) in its assessment of the carbon performance of steel makers.

The TPI is a global, asset owner-led initiative, supported by asset owners and managers with over £4/\$5.2 trillion of assets under management. The initiative assesses how companies are preparing for the transition to a low-carbon economy. The analysis is in two parts:

1. *Management Quality*: TPI evaluates and tracks the quality of companies' management of their greenhouse gas emissions and of risks and opportunities related to the low-carbon transition. Companies are assigned to one of five levels, from level 0 ("Unaware of, or not Acknowledging, Climate Change as a Business Issue") to level 4 ("Strategic Assessment"), based on how they perform against 14 criteria.
2. *Carbon Performance*: TPI also evaluates how companies' recent and future carbon performance might compare to the international targets and national pledges made as part of the Paris Agreement. This is the subject of this methodology note.

TPI publishes the results of this analysis through an open online tool hosted by the Grantham Research Institute on Climate Change and the Environment at the London School of Economics (LSE), which can be accessed at <http://www.transitionpathwayinitiative.org>.

TPI encourages investors 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.

2. THE BASIS FOR TPI'S CARBON PERFORMANCE ASSESSMENT: THE SECTORAL DECARBONIZATION APPROACH

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

Another initiative that is also using the SDA is the Science Based Targets Initiative.¹ But, while the Science Based Targets Initiative is using the SDA to help companies that have *opted into* the said initiative to set targets consistent with international emissions reduction commitments, TPI is using the SDA for the broader purpose of evaluating all the companies in its sample.

The SDA is built on the principle of recognising the different challenges faced by different sectors of the economy (e.g. oil and gas production, electricity generation and auto manufacturing) in aligning themselves with the low-carbon transition, in particular the different possibilities each sector has to reduce emissions, and consequently the different costs each sector faces. Other approaches to translating international emissions targets into company benchmarks have applied the same decarbonization pathway to all sectors, regardless of these differences.[2]

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 path for emissions *intensity* in each sector:

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

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

¹ <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 paths for companies.
- Companies' emissions intensity paths are compared with each other and with the relevant sectoral benchmark path.

While companies will have different initial emissions intensities – i.e. different starting points – a fundamental tenet of the SDA approach is that all companies in a sector are required to converge to the average emissions intensity in 2050. Not only does this correspond with a fair distribution of effort across companies, there are good reasons to expect companies' emissions intensities to converge over time, as techniques and technologies for reducing emissions diffuse from leaders to laggards.[3]

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

3. HOW TPI IS APPLYING THE SDA

3.1. Deriving the benchmark paths

The key inputs to calculating the benchmark paths are:

- A time path for carbon emissions, which is consistent with the delivery of a particular climate target (e.g. limiting global warming to 2°C). Consistency requires that cumulative carbon emissions are within the associated carbon budget.
- A breakdown of this economy-wide emissions path into emissions from key sectors (the numerator of sectoral emissions intensity).
- Consistent estimates of the time path of physical production from, or economic activity in, these key sectors (the denominator of sectoral emissions intensity).

TPI obtains all three of these inputs from the International Energy Agency (IEA), via its biennial *Energy Technology Perspectives* report.[4] The IEA has established expertise in modelling the cost of achieving international emissions targets. It also provides unprecedented access to the modelling inputs and outputs in a form suitable for applying the SDA.

The IEA's economy-energy model simulates the supply of energy and the path of emissions in different sectors burning fossil fuels, or consuming energy generated by burning fossil fuels, given assumptions about key inputs, such as economic and population growth.

In low-carbon scenarios, the IEA model minimises the cost of adhering to a carbon budget by always allocating emissions reductions to sectors where they can be made most cheaply, subject to some constraints as mentioned above. These scenarios are therefore cost-effective, within some limits of economic, political, social and technological feasibility.

The IEA's work can be used to derive two benchmark emissions paths, against which companies are evaluated by TPI:

1. A **2 Degrees scenario**, which is 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".[5]
2. A **Paris Pledges scenario**. It has been established that the sum of the emissions reductions pledged by individual countries as part of their Nationally Determined Contributions (or NDCs) to the Paris Agreement is insufficient to put the world on a path to limit warming to 2°C, even if it will constitute a departure from a business-as-usual trend. Analysis by various groups suggests that, if the NDCs are fully implemented, then annual global greenhouse gas emissions in 2030 will be in the range 52-61 gigatonnes of CO₂ equivalent (GtCO₂e).[6]–[8] The IEA '4DS' scenario (standing for 4 degrees), which takes into account recent national commitments to limit emissions and increase energy efficiency, delivers 53 GtCO₂e in 2030, using the IEA's own estimate of greenhouse gas emissions from outside the energy sector. Thus the 4DS scenario is within the envelope of forecasts of what the NDCs can achieve on aggregate, and is used in the TPI as the basis for a 'Paris Pledges' scenario. It must be stressed that this does not imply the Paris NDCs will lead to 4°C warming. This largely depends on what happens after 2030, a period that is not

covered by current NDCs. It must also be stressed that, while this scenario is representative of the *global sum* of emissions cuts pledged in NDCs, the emissions cuts pledged by individual countries in their NDCs do of course vary and will in most cases differ from the global average cuts.

For each scenario, IEA modelling output provides sector-specific emissions paths. It also provides associated estimates of production in each sector. Alternatively input assumptions on overall economic growth can be used as a measure of sectoral activity (under the assumption that the sector grows at the same rate as the overall economy). Emissions are then divided by activity to derive sectoral pathways for emissions intensity.

Figure 1 shows the benchmark emissions intensity paths for the steel sector, while Table 1 provides the underlying data on emissions and steel production. For example, under the Paris Pledges scenario in 2020, global Scope 1 and 2 emissions from the steel sector are projected by IEA to be 3,788 million metric tonnes or megatonnes of CO₂. Under the same scenario in 2020, steel production is projected to be 1,750 megatonnes. Therefore the average carbon intensity of a steel maker aligned with the Paris Pledges path is $3788 / 1750 = 2.16$ tonnes of CO₂ per tonne of steel produced.

Figure 1 Benchmark global carbon intensity paths for the steel sector (tonnes of CO₂ per tonne of crude steel) consistent with limiting warming to 2°C and with the sum of the Paris Pledges

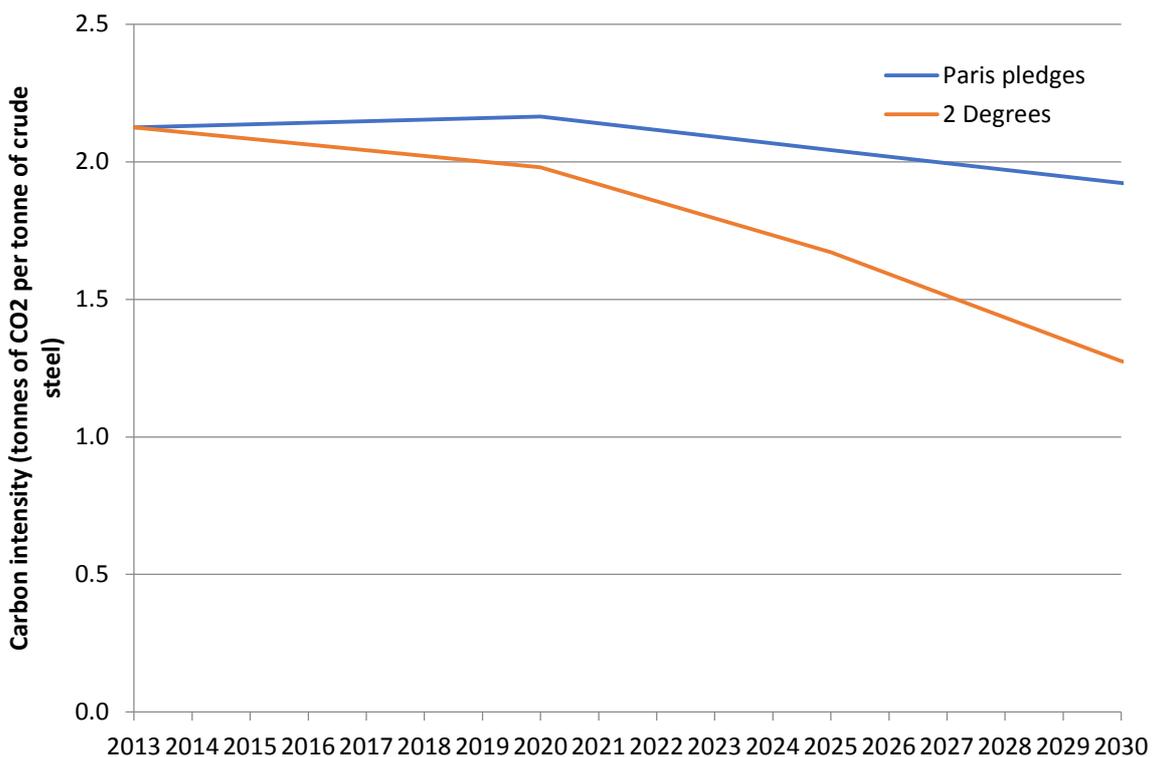


Table 1 Projections of emissions and crude steel production used to calculate intensity paths (Source: IEA)

	2013	2020	2025	2030
Paris Pledges scenario				
Scope 1 CO ₂ emissions (Mt)	2817	3110	3141	3168
Scope 2 CO ₂ emissions (Mt)	687	678	680	657
Steel production (Mt)	1649	1750	1871	1989
Carbon intensity (tCO ₂ / t steel)	2.12	2.16	2.04	1.92
2 Degrees scenario				
Scope 1 CO ₂ emissions (Mt)	2817	2843	2604	2141
Scope 2 CO ₂ emissions (Mt)	687	621	523	396
Steel production (Mt)	1649	1750	1871	1989
Carbon intensity (tCO ₂ / t steel)	2.12	1.98	1.67	1.28

3.2. Calculating company emissions intensities

TPI is based on public disclosures by companies. In any given sector, disclosures that are useful to TPI's carbon performance assessment tend to come in one of three forms:

1. Some companies disclose their recent and current emissions intensity and some companies have also set future emissions targets in intensity terms. Provided these are measured in a way that can be compared with the benchmark scenarios and with other companies (e.g. in terms of scope of emissions covered and measure of activity chosen), these disclosures can be used directly. In some cases, adjustments need to be made to obtain estimates of emissions intensity on a consistent basis. The necessary adjustments will generally involve sector-specific issues (see below).
2. Some companies disclose their recent and current emissions on an absolute (i.e. un-normalised) basis. Provided emissions are appropriately measured, and an accompanying disclosure of the company's activity can be found that is also in the appropriate metric, recent and current emissions intensity can be calculated by TPI.
3. Some companies set future emissions targets in terms of absolute emissions. This raises the particular question of what to assume about those companies' future activity levels. The approach taken in the TPI is to assume company activity increases at the same rate as the sector as a whole (i.e. this amounts to an assumption of constant market share), using sectoral growth rates from the IEA in order to be consistent with the benchmark paths. While companies' market shares are unlikely to remain constant, there is no obvious alternative assumption that can be made, which treats all companies consistently. For the steel sector, IEA makes a single set of assumptions about production growth rates, which are the same across all of its scenarios. We use the growth rate of global aggregate production, in view of the multi-national nature of some companies' production bases.

The length of companies' emissions intensity paths will vary depending on how much information companies provide on their emissions in the last three years, as well as the time horizon for their emissions targets.

3.3. Emissions reporting boundaries

Company emissions disclosures vary in terms of the organisation boundary that a company sets. There are two high-level approaches: the equity share approach and the control approach, and within the control approach there is a choice of financial or operational control. Companies are free to choose which organisation boundary to set in their voluntary disclosures and there is variation between companies assessed by TPI.

TPI accepts emissions reported using any of the above approaches to setting organisation boundaries, as long as:

1. The boundary that has been set appears to allow a representative assessment of the company's emissions intensity;
2. The same boundary is used for reporting company emissions and activity, so that a consistent estimate of emissions intensity is obtained.

At this point in time, limiting the assessment to one particular type of organisation boundary would severely restrict the breadth of companies TPI can assess.

3.4. Data sources and validation

All company data in TPI come from companies' own disclosures. The sources for the carbon performance assessment include responses to the annual CDP questionnaire, as well as companies' own reports, e.g. sustainability reports.

Given that TPI's carbon performance assessment is both comparative and quantitative, it is essential to understand exactly what the data in company disclosures refer to. Company reporting varies not only in terms of what is reported, but also in terms of the level of detail and explanation provided. The following cases can be distinguished:

- Some companies provide data in a suitable form and they provide enough detail on those data for analysts to be confident appropriate measures can be calculated or used.
- Some companies also provide enough detail, but from the detail it is clear that their disclosures are not in a suitable form for TPI's carbon performance assessment (e.g. they do not report the measure of company activity needed). These companies cannot be included in the assessment.
- Some companies do not provide enough detail on the data disclosed and these companies may also be excluded from the assessment (e.g. the company reports an emissions intensity estimate, but does not explain precisely what it refers to).
- Some companies do not disclose their carbon emissions and/or activity.

Once a company's preliminary performance assessment has been made based on the principles and procedures described above, it is subject to the following quality assurance:

- *Internal findings review*: the preliminary assessment is reviewed by analysts who were not originally involved in making it.
- *Company review*: once the initial findings review is complete, TPI writes to companies with their assessment and requests companies to review it and confirm the accuracy of the company disclosures being used. The company review includes

all companies, i.e. it also includes those who provide unsuitable or insufficiently detailed disclosures.

- *Final assessment*: company assessments are reviewed and, if it is considered appropriate, revised.

3.5. Responding to companies

Allowing companies the opportunity to review and, if necessary, correct their assessments is an integral part of TPI's quality assurance process. We send each company its draft TPI assessment and the data that underpin the assessment, offering them the opportunity to review and comment on the data and assessment. We also allow companies to contact us at any point to discuss their assessment.

If a company seeks to challenge its result/representation, our process is as follows:

- TPI reviews the information provided by the company. At this point, additional information may be requested.
- If it is concluded that the company's challenge has merit, the assessment is updated and the company is informed.
- If it is concluded that there are insufficient grounds to change the assessment, this decision is explained to the company.
- If a company chooses to further contest the assessment and reverts to legal means to do so, the company's assessment is withheld from the TPI website and the company is identified as having challenged its assessment.

3.6. Presentation of assessment on TPI website

The results of the carbon performance assessment will be posted on the TPI website, within the 'toolkit' (<http://www.lse.ac.uk/GranthamInstitute/tpi/the-toolkit/>). On each company page, its emissions intensity path will be plotted on the same chart as the benchmark paths for the relevant sector. Different companies can also be compared on the toolkit main page, with the user free to choose which companies to include in the comparison.

4. SPECIFIC CONSIDERATIONS IN THE ASSESSMENT OF STEEL MAKERS

4.1. Measure of emissions intensity

In the steel sector, the specific measure of emissions intensity used by TPI is:

- Scope 1 and 2 greenhouse gas emissions from steel-making, per unit of crude steel produced, in units of (metric) tonnes of CO₂ equivalent per tonne of crude steel.

Unlike some other sectors, whose carbon performance is being assessed by TPI (e.g. cement, and electricity utilities), Scope 2 emissions from purchases of power are sufficiently important in the steel sector that they should be included in the measure of company emissions, alongside direct or Scope 1 emissions. According to the IEA modelling used to derive the benchmark paths, global Scope 2 emissions from steel production were 24% of total Scope 1 and 2 emissions in 2013, for example. This compares with 10% in the cement sector.

The objective is to measure emissions from steel-making 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 steel companies assessed by TPI label their disclosed emissions as being operations-wide, rather than steel-making-specific. When this is the case, further assessment is required of whether the company in question has included significant sources of emissions other than steel production, or whether operations-wide and steel-making-specific emissions are equivalent, or at least approximately so.

There is also variation between companies in terms of how steel production is quantified. It is common to disclose production of crude steel and this is the desired measure, as the IEA benchmark paths are also based on modelling of crude steel production. However, some companies report production in a metric that may or may not be equivalent to crude steel. Examples of terminology in use include "liquid steel", "steel products", or simply "product", or "steel". Under these circumstances, further assessment is also required of whether the production measure can be equated to crude steel, at least approximately.

Emissions from steel-making of greenhouse gases other than CO₂ are negligible, so emissions measured in tonnes of CO₂ and tonnes of CO₂ equivalent are approximately identical.

4.2. Coverage of steel-making facilities

While some steel makers disclose emissions from all their facilities, others explicitly do not, or it is unclear from their disclosures. When it is explicitly incomplete or unclear, further assessment is required of whether coverage is incomplete, to what extent it is incomplete and whether the omission of some facilities is likely to bias the estimate of a company's emissions intensity. Ultimately TPI makes a judgement on whether its estimate of a company's emissions intensity is likely to be biased, and sufficiently so for the company to be excluded from the carbon performance assessment, in line with the principles set out in Section 3.3 above.

4.3. Coverage of target

There are often differences in the scope of companies' emissions targets. In the steel sector, some companies have set specific targets for Scope 1 and 2 emissions combined,

while others have set targets covering Scope 1, 2 and 3 emissions. Where a target covers more than just Scope 1 and 2 emissions from steel-making, it is assumed – in the absence of any other specific information – that the percentage reduction in emissions is uniform across scopes, so the target percentage (e.g. a 20% cut) can be directly applied to Scope 1 and 2 emissions from steel-making.

Some companies set targets that only apply to a subset of emissions in scope, e.g. 90% of Scope 1 and 2 emissions from steel-making. Relevant emissions that are not covered by the target are assumed to be unchanged from the base year to the target year.

Companies often express targets relative to emissions in a base year (e.g. 2007), but they do not always report Scope 1 and 2 emissions from steel-making in the base year, rather they sometimes report base-year emissions in a different scope (e.g. they include upstream Scope 3 emissions in 2007). If a company does not report Scope 1 and 2 emissions from steel-making in the base year, these are estimated using the ratio of Scope 1 and 2 emissions from steel-making to emissions in the company's chosen scope over the last three years (cumulatively).³

4.3. Worked examples⁴

Company A: a simple case

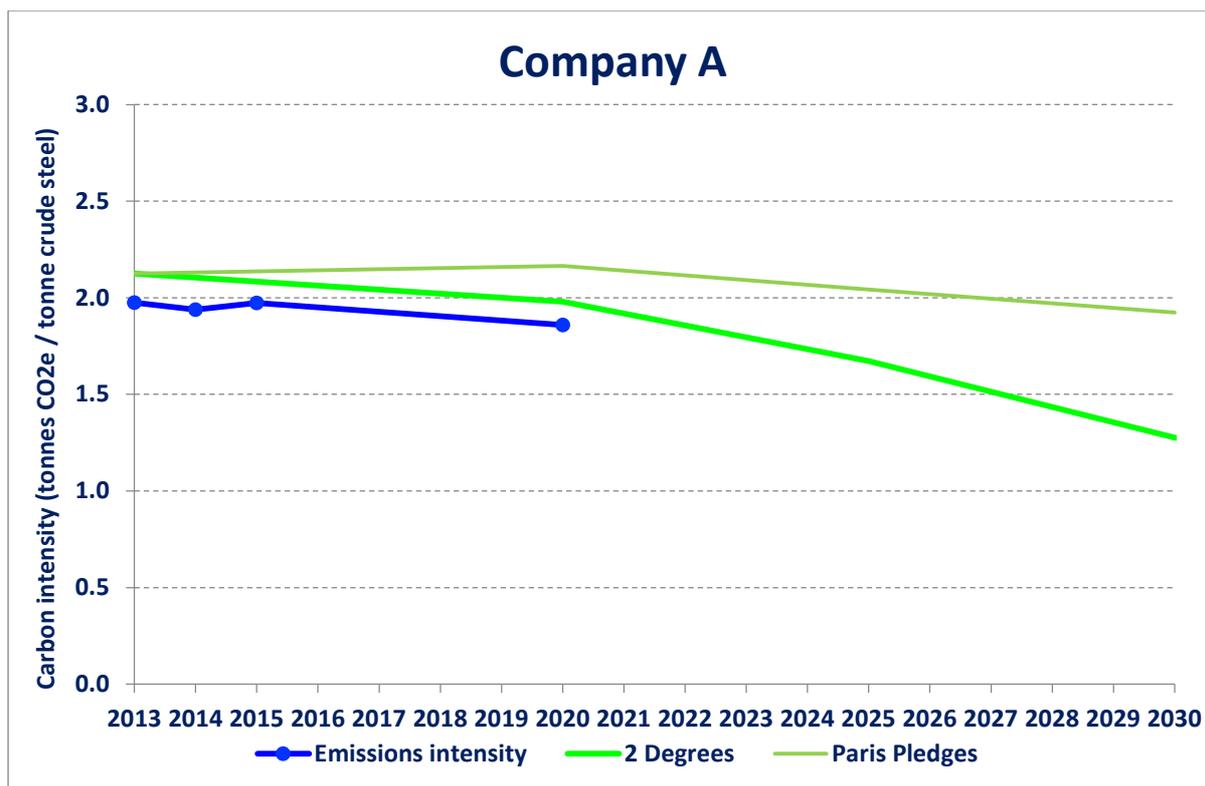
Company A reports its emissions intensity for the last three years (2013-15) and it does so in the required metric, i.e. Scope 1 and 2 emissions from steel-making per tonne of crude steel. For example, in 2015 it was 1.97 tCO_{2e} / t steel. After independently verifying the estimates using separate disclosures of emissions and steel production, these figures are used directly without adjustment.

Company A has also set a target to reduce the intensity of its Scope 1 and 2 emissions by 8% below the 2008 level by 2020. This target is stated to cover 100% of the company's Scope 1 and 2 emissions.

In 2008, the company's emissions intensity was 2.0 tCO_{2e} / t steel. Therefore in 2020 the target is to reduce its emissions intensity (total scope 1+2 emissions) to $(1-0.08) \times 2.0 = 1.8$ tCO_{2e} / t steel.

³ Due to the occasional practice of companies re-basing their emissions, this adjustment is preferred to using disclosures of base-year Scope 1 and 2 emissions from steel-making from past years' reporting.

⁴ In the following examples various numbers are rounded for ease of presentation.



Company B: an absolute emissions target

Company B reports an operations-wide emissions intensity of steel production per tonne of crude steel for 2013 and 2014 (in 2015, they report their intensity per tonne of 'production volume'). Further investigation indicates that there are no significant sources of company emissions other than steel production, so operations-wide emissions are taken to be equivalent to steel-making-specific emissions. In 2014, the company's Scope 1 and 2 emissions intensity was 0.84 tCO₂e / t steel. The company's 2015 emissions intensity is excluded, due to the switch to another measure of steel production that appears different to crude steel.

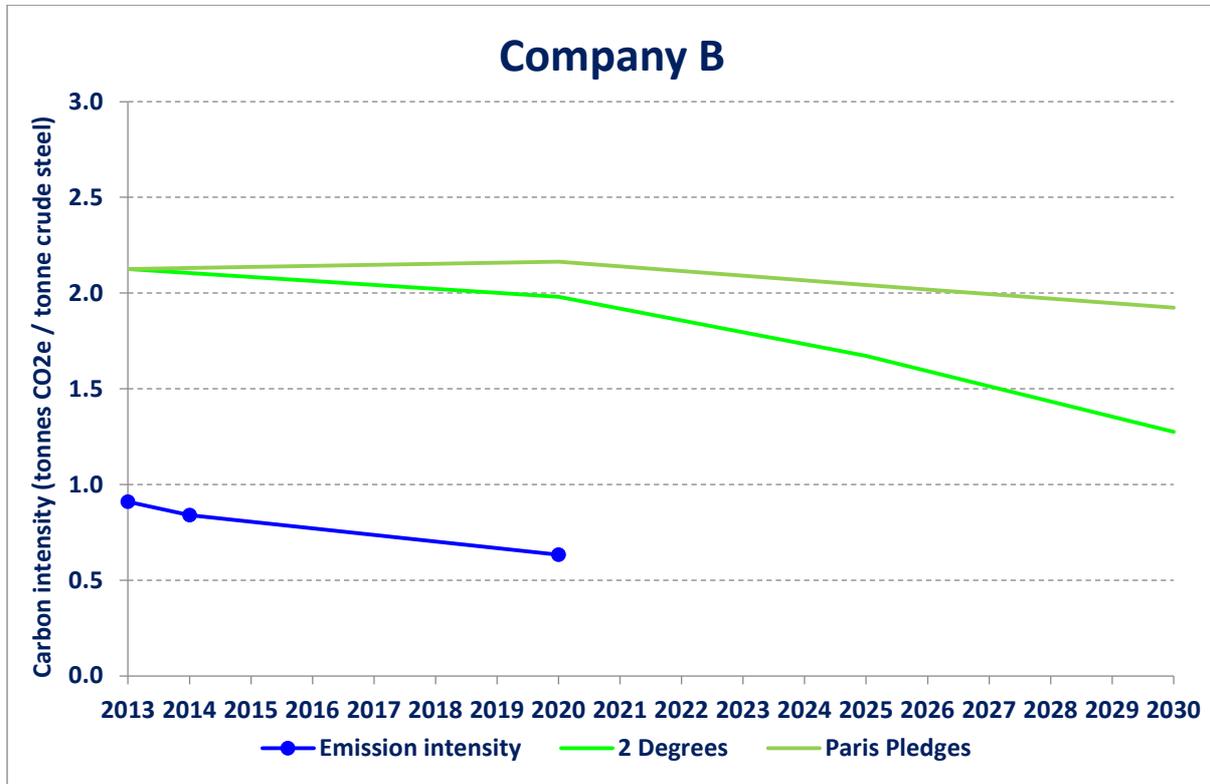
Company B has a target to reduce the absolute quantity of its Scope 1 and 2 emissions by 7% below the 2013 level by 2020. This target can be shown to cover 83% of the company's total Scope 1 and 2 emissions in 2013.

In order to translate this information into an estimate of emissions intensity in 2020, the following steps are taken:

- The company's target covers 83% of total Scope 1 and 2 emissions in 2013. The company reports that Scope 1 and 2 emissions covered by the target in the base year of 2013 were 13.2 MtCO₂e. This means that 2.7 MtCO₂e were not covered by the target. We assume that those uncovered emissions remain constant between the base year and the target year.
- Total Scope 1 and 2 emissions in 2020, consistent with the target, can be estimated as $13.2 \times (1 - 7\%) + 2.7 = 15.0$ MtCO₂e.
- As the company does not provide an intensity target, its steel production between 2014 and 2020 is assumed to grow at the same rate as global steel production according to the IEA scenarios. In particular, IEA projects that global crude steel

production grows by 5.22% between 2014 and 2020. Therefore the company's crude steel production in 2020 is its 2014 value, 22.5 Mt, multiplied by $(1 + 5.22\%) = 23.7$ Mt steel.

- Dividing the company's estimated 2020 emissions by this estimate of steel production in 2020 gives an estimated intensity of $15.0 / 23.7 = 0.63$ tCO₂e / t steel in 2020.



5. DISCUSSION

This note has described the methodology followed by TPI in carrying out carbon performance assessment of companies, with a particular focus on steel makers.

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. General issues

The assessment follows the Sectoral Decarbonization Approach (SDA), which involves comparing companies' emissions intensity with sector-specific benchmark emissions intensities that are consistent with international targets (i.e. limiting global warming to no more than 2°C, and the sum of the Paris Pledges).

TPI uses the modelling of the International Energy Agency (IEA) to calculate the benchmark paths. The IEA modelling has a number of advantages, but it is also subject to limitations, like all other economy-energy modelling. In particular, model projections often turn out to be wrong. The comparison between companies and the benchmark paths might then be inaccurate. However, there is no way to escape the need to make a projection of the future in forward-looking exercises like this. IEA updates its modelling every two years with the aim of improving the accuracy of its projections and TPI plans to update its benchmark paths accordingly.

TPI uses companies' self-reported emissions and activity data to derive emissions intensity paths. Therefore companies' paths are only as accurate as the underlying disclosures.

Estimating the recent, current and especially the future emissions intensity of companies involves a number of assumptions. Therefore it is important to bear in mind that, in some cases, the emissions path drawn for each company is an estimate made by TPI, based on information disclosed by companies, rather than the companies' own estimate or target. In other cases, the information disclosed by companies is sufficient on its own to completely characterise the emissions intensity path.

5.2. Issues specific to steel makers

The principal challenge in the steel sector, relative to other sectors whose carbon performance TPI is assessing, is inconsistent reporting of emissions and steel production, particularly in terms of whether emissions disclosures are steel-making-specific or operations-wide, whether production is measured in tonnes of crude steel, an equivalent measure or something different (which itself is not always clear), and whether disclosures cover all or merely a subset of a company's production facilities.

On the other hand, most of those companies with emissions targets have set them in intensity terms and with nearly or exactly 100% coverage of Scope 1 and 2 emissions from steel-making, so relatively few assumptions are necessary in order to convert companies' stated emissions targets into intensity paths.

6. DISCLAIMER

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