TRANSITION PATHWAY INITIATIVE

CARBON PERFORMANCE ASSESSMENT OF ELECTRICITY UTILITIES: 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 electricity utilities.

The TPI is a global, asset owner-led initiative, supported by asset owners and managers with over £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 was launched in January 2017 with management quality assessments of the global top 20 companies by market capitalisation in each of the electricity utilities, and oil and gas, sectors (i.e. a total of 40 companies).[1] Further sectors and companies will be added over the course of 2017 and beyond.

The funds supporting TPI have committed to use the results in a number of different ways, including informing their investment decision-making, engagement with companies, and dialogue with fund managers and policy makers.

[1] http://www.lse.ac.uk/GranthamInstitute/tpi/early-analysis-tpi-toolkit-shows-companies-are-building-capacity-to-manage-transition-risk/

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.[2] 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.

[2] 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).[3] 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]

[3] 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 CO_2 equivalent ($GtCO_2e$).[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 $GtCO_2e$ 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 electricity utilities sector, while Table 1 provides the underlying data on emissions and electricity production. For example, under the Paris Pledges scenario in 2020, total global emissions from the power sector are projected by IEA to be 13,770 million metric tonnes or megatonnes of CO_2. Under the same scenario in 2020, gross electricity generation is projected to be 27,627 terawatt hours. Therefore the average carbon intensity of a power generator aligned with the Paris Pledges path is 13770 / 27627 = 0.498 megatonnes of CO_2 per terawatt hour (equivalent to tonnes of CO_2 per megawatt hour) of electricity produced.

Figure 1 Benchmark global carbon intensity paths for the power sector (tonnes of CO_2 per MWh electricity generation) consistent with limiting warming to 2°C and with the sum of the Paris Pledges

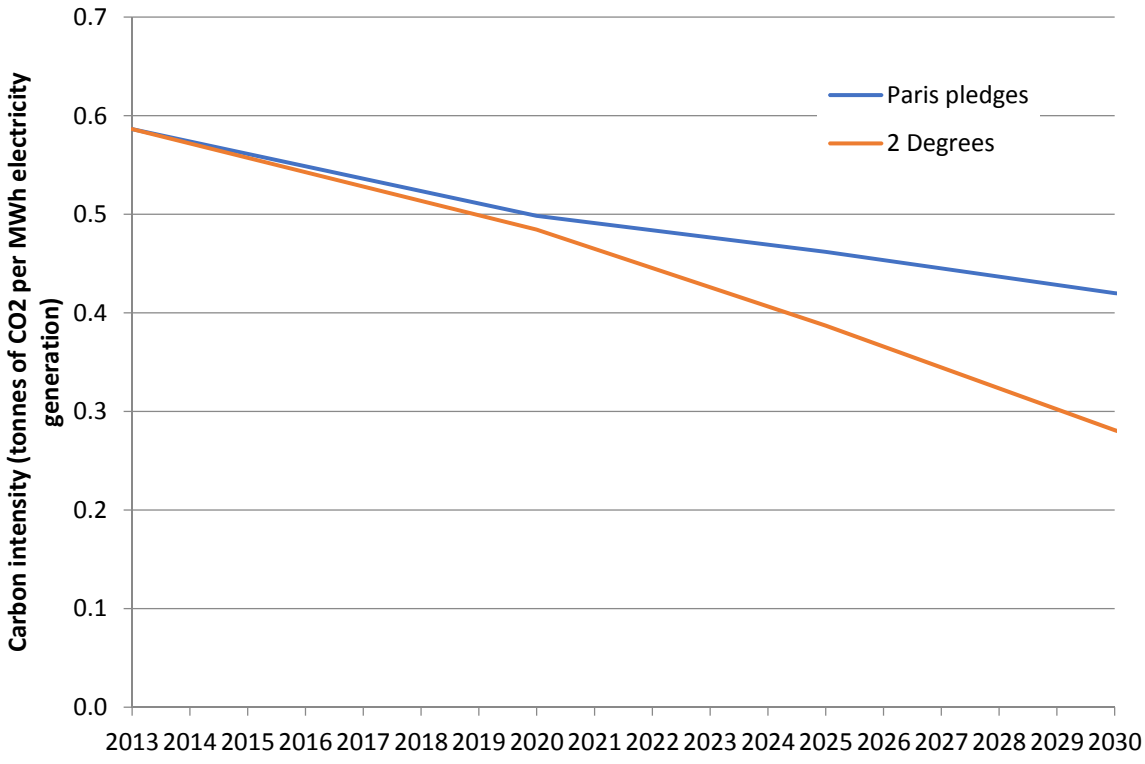

Table 1 Projections of emissions and electricity production used to calculate intensity paths (Source: IEA)

	2013	2020	2025	2030
Paris Pledges scenario				
Direct CO_2 emissions from power (Mt)	**13656**	**13770**	**14242**	**14457**
Gross electricity generation (TWh)	**23290**	**27627**	**30842**	**34424**
Carbon intensity (tCO_2 / MWh)	**0.586**	**0.498**	**0.462**	**0.420**
2 degrees scenario				
Direct CO_2 emissions from power (Mt)	**13656**	**13018**	**11305**	**8904**
Gross electricity generation (TWh)	**23290**	**26871**	**29208**	**31683**
Carbon intensity (tCO_2 / MWh)	**0.586**	**0.484**	**0.387**	**0.281**

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. Sectoral growth rates from the Paris Pledges (IEA 4DS) scenario are used. These lie in the middle of the range from the IEA's three scenarios, close to the average of them.

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 are also 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 ELECTRICITY UTILITIES

4.1. Measure of emissions intensity

In the electricity utilities sector, the specific measure of emissions intensity is:

- Greenhouse gas emissions per unit of electricity produced, in units of (metric) tonnes of CO2 equivalent per megawatt hour.

This specifically covers emissions from the electricity generation process. It is sometimes referred to as 'absolute emissions' from electricity production (e.g. in the CDP questionnaire). In most cases, these emissions constitute all or nearly all of the company's scope 1 emissions, but some companies have significant scope 1 emissions from other sources and these must be subtracted, or else a stand-alone figure for emissions from electricity generation must be provided.

There are three main reasons for the choice of measure. First, it is consistent with the data provided by the IEA for the benchmark paths, which comprise direct CO_2 emissions from electricity generation,[4] as well as the amount of electricity generated. Second, almost all power-sector emissions are from the generation process. Third, data are relatively widely available for the companies in the TPI sample.

4.2. Coverage of target

There are differences in the scope of companies' emissions targets. Some companies have set specific targets for emissions from electricity production, while others have set targets for total scope 1 emissions, or scope 1 and 2 emissions, etc.

Where a target covers a scope broader than just emissions from electricity production, 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 absolute emissions from electricity production.

Companies often express targets relative to emissions in a base year (e.g. 2010), but they do not always report absolute emissions from electricity production in the base year, rather they sometimes report base-year emissions in a different scope (e.g. total scope 1 emissions in 2010). If a company does not report absolute emissions in the base year, these are estimated where necessary using the ratio of absolute emissions to emissions in the company's chosen scope over the last three years (cumulatively).[5]

Most companies report recent and current absolute emissions of all greenhouse gases (i.e. CO_2 equivalent), but some have set future targets that relate to CO2 only. This disconnect is ignored due to the very small share of non-CO_2 greenhouse gases in companies' absolute emissions from electricity production, as explained above and in footnote 4.

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[4] IEA only provides an estimate of CO2 emissions and does not include other greenhouse gases. However, these are typically a very small share of companies' emissions from electricity production (0-3%), so we allow a comparison of company emissions intensity, in terms of all greenhouse gases, with benchmark emissions intensity, in terms of CO_2 only.

[5] Due to the occasional practice of companies re-basing their emissions, this adjustment is preferred to using disclosures of base-year absolute emissions from past years' reporting. Take for example 2010 as the base year for a company's target. It is often the case that the company's stated base-year (2010) emissions in their 2016 CDP response differ from the company's stated 2010 emissions in their 2011 CDP response.

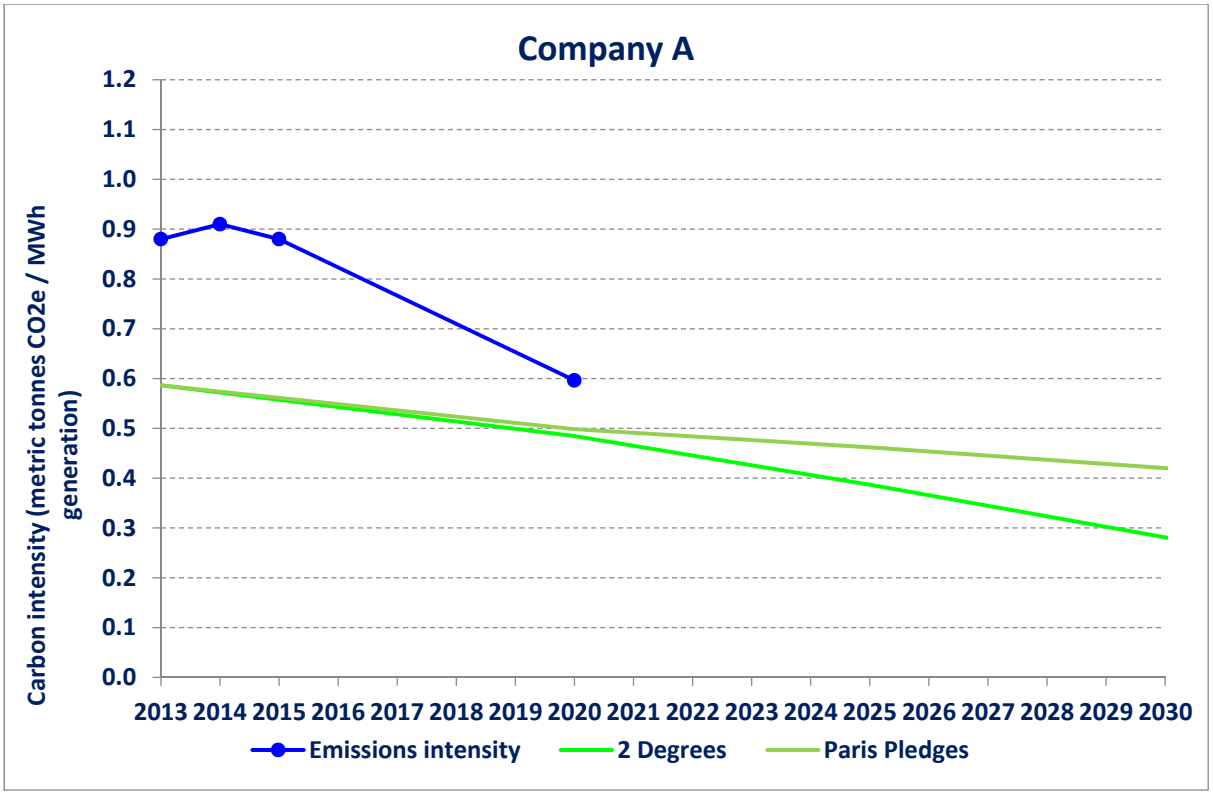
4.3. Worked examples[6]

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. absolute greenhouse gas emissions per unit of electricity produced. For example, in 2015 it was 0.88 tCO2e / MWh. After independently verifying the estimates using separate disclosures of emissions and activity, 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 29% below the 2007 level by 2020. This target is stated to cover 100% of the company's scope 1 and 2 emissions.

In 2007, the company's emissions intensity was 0.84 tCO2e / MWh. Therefore in 2020 the target is to reduce its emissions intensity (total scope 1+2 emissions) to (1-0.29) x 0.84 = 0.596 tCO2e/MWh.



Company B: an absolute emissions target

Company B reports its absolute greenhouse gas emissions per unit of electricity produced for the last three years (2013-15). For example, in 2015 it was 0.78 tCO_2e / MWh. After verification, these figures are used directly without adjustment.

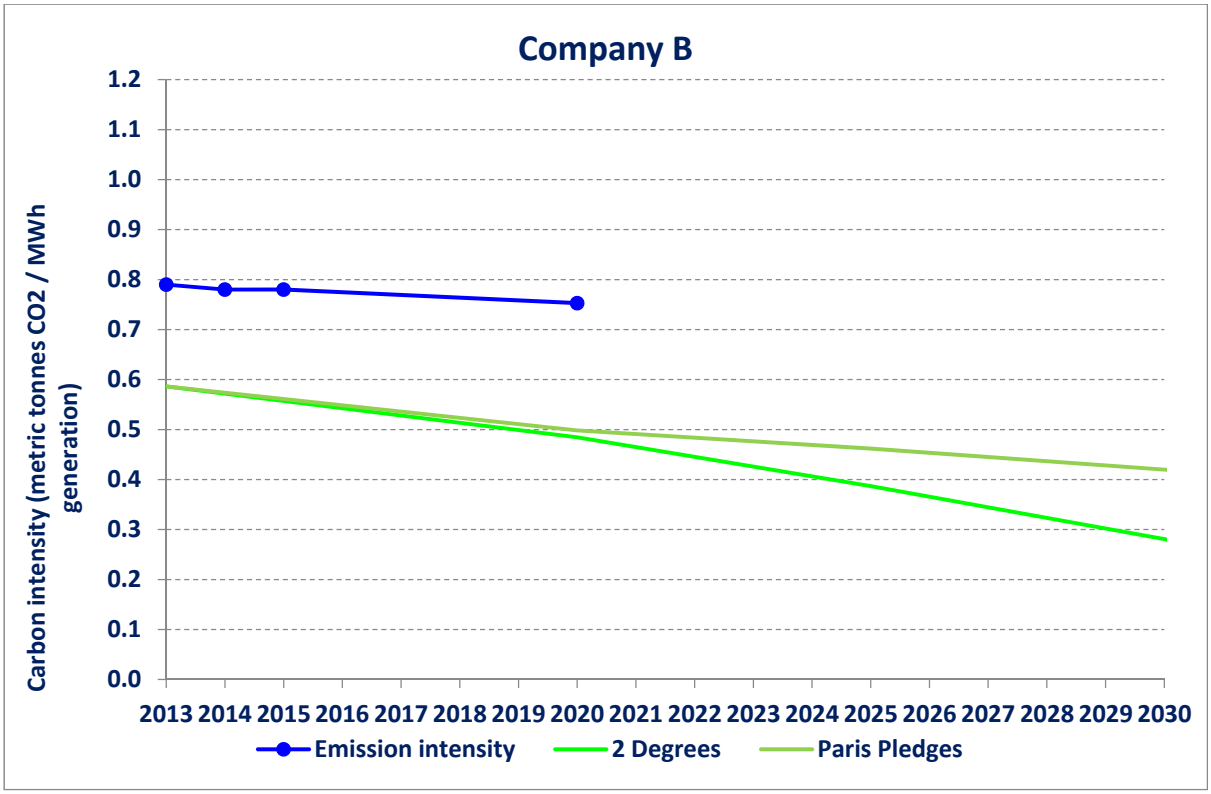
Company B also has a target to reduce the absolute quantity of its scope 1 emissions by 20% below the 2010 level by 2020. This target is stated to cover 93% of the company's total

[6] In the following examples various numbers are rounded for ease of presentation.

scope 1 emissions, but other information in the company's disclosures indicates that it covers 100% of absolute emissions from electricity production.

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

- The company's target relates to 93% of total scope 1 emissions. The company reports that scope 1 emissions covered by the target in the base year of 2010 were 39.7 $MtCO_2e$. This means that total scope 1 emissions in 2010 were 39.7 x 1/0.93 = 42.7 $MtCO_2e$.
- Over the period 2013-15 cumulatively, the ratio of absolute emissions from electricity production to total scope 1 emissions was 93.4%. The company's absolute emissions in the base year of 2010 are therefore estimated to be 42.7 x 0.934 = 39.9 $MtCO_2e$.
- The company's target is to reduce scope 1 emissions by 20% and this includes all absolute emissions, so target absolute emissions in 2020 will be 39.9 x 0.8 = 31.9 $MtCO_2e$.
- As the company does not provide an intensity target, its electricity production between 2015 and 2020 is assumed to grow at the same rate as regional electricity production according to the IEA scenarios. In particular, on the IEA 4DS scenario electricity production in the US (where the company is located) grows by 3.78% between 2015 and 2020. Therefore the company's electricity production in 2020 is its 2015 value, 40,830,000 MWh x (1 + 0.0378) = 42,371,393 MWh.
- Dividing the company's estimated 2020 emissions by this estimate of electricity production in 2020 gives an estimated intensity of 31.9 / 42,371,393 = 0.75 tCO_2e / MWh.


Company B
Carbon intensity (metric tonnes CO2 / MWh generation)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030
Emission intensity
2 Degrees
Paris Pledges

5. DISCUSSION

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

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, except in a very few 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 a very few cases, the information disclosed by companies is sufficient on its own to completely characterise the emissions intensity path.

5.2. Issues specific to electricity utilities

In the electricity utilities sector, the measure of carbon performance is absolute greenhouse gas emissions per unit of electricity produced. While this covers almost all power-sector emissions, is consistent with the IEA benchmarks and can be calculated for most companies, it is a narrow measure of carbon performance for some companies in the sample. This particularly concerns companies that, as well as generating electricity, are significantly engaged in distributing or retailing electricity generated by other companies, or are significantly engaged in other activities such as gas distribution/retail (thus straddling multiple sectors of the economy). These companies may have, respectively, a larger share of scope 2 emissions in total scope 1 and 2 emissions, and a larger share of scope 1 emissions coming from activities other than electricity generation.

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