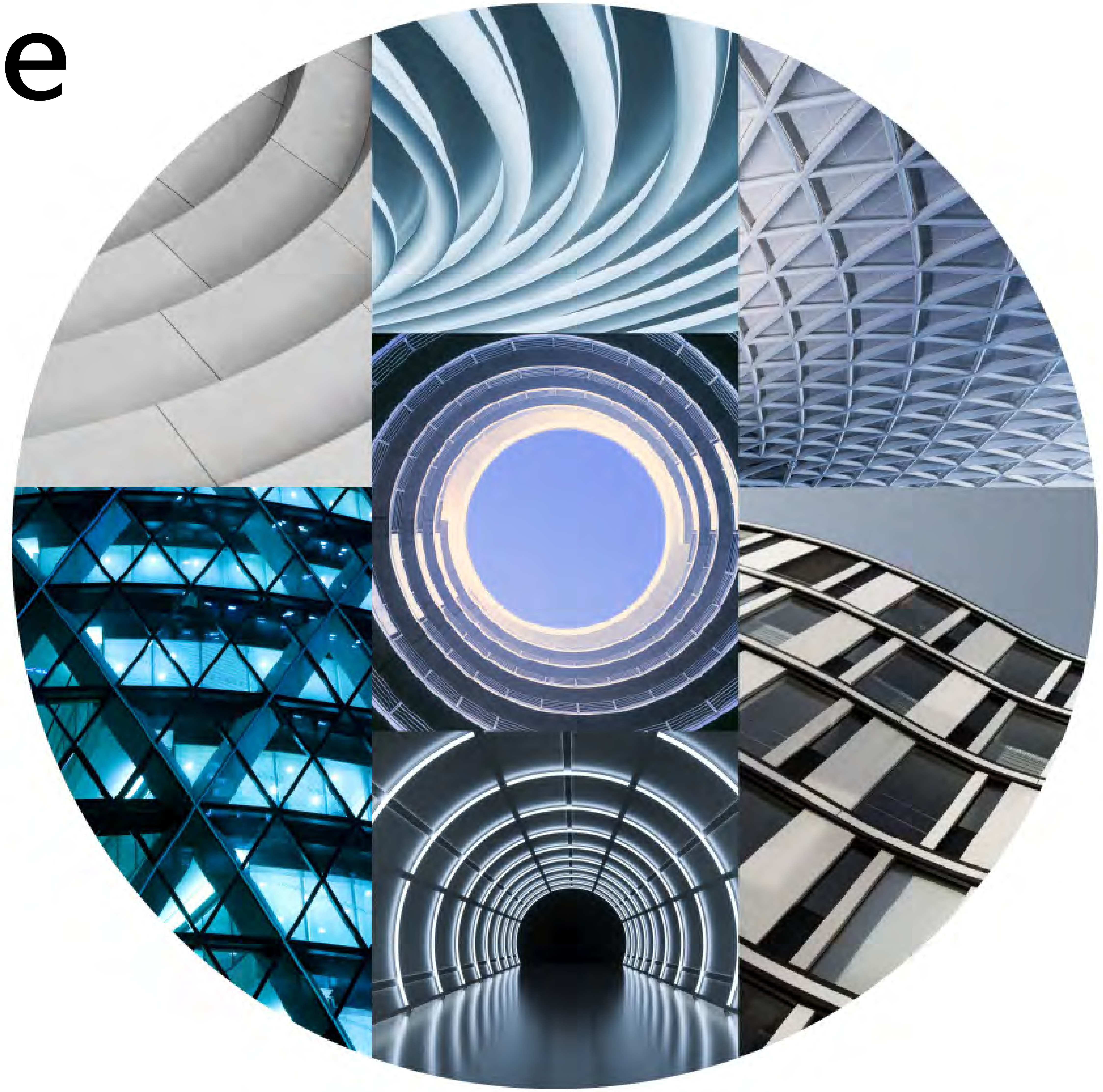
# Green equity exposure in a 1.5°C scenario

## Applying climate investment trajectories with green revenues



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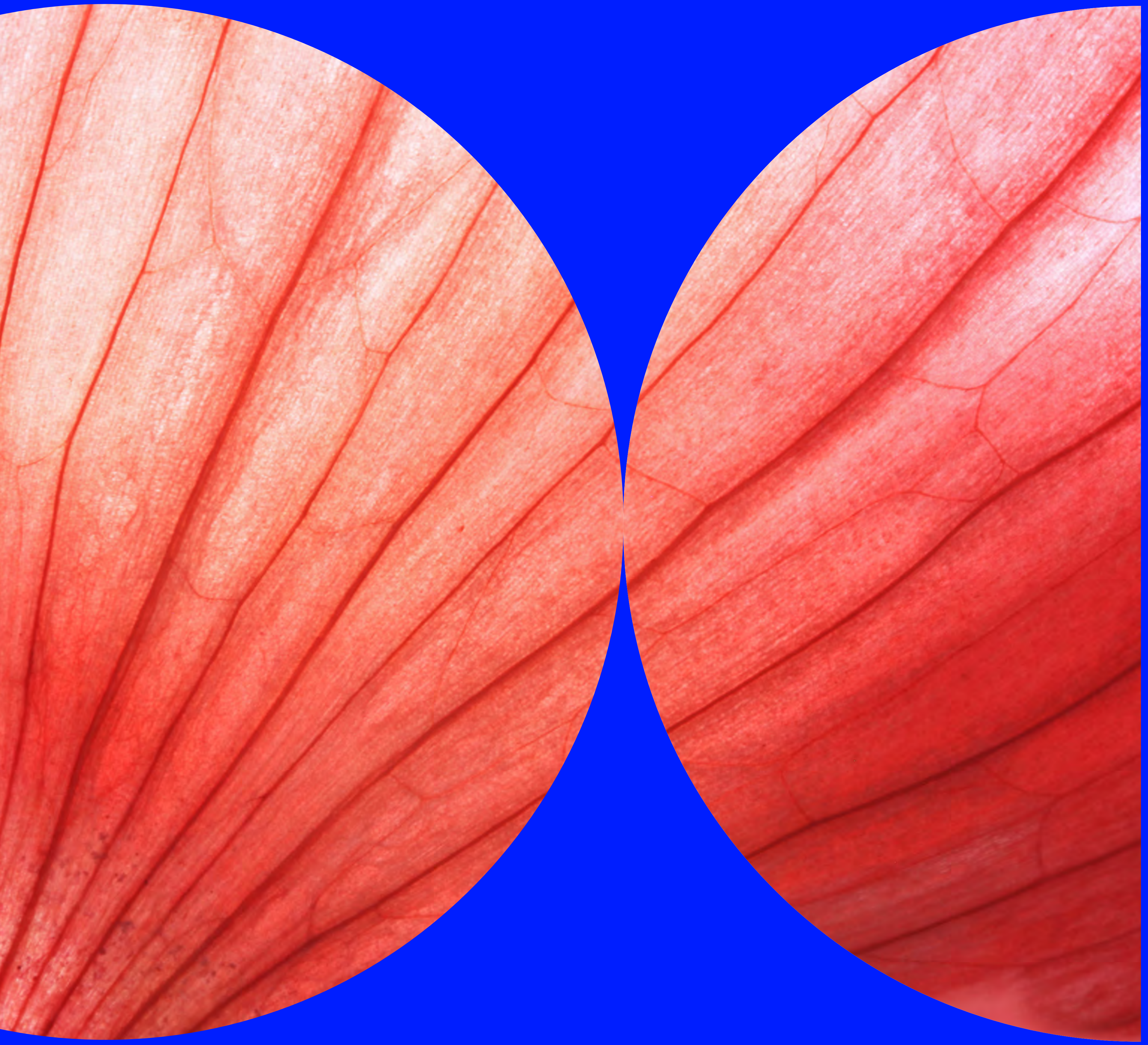

# Overview

This paper explores approaches for applying 1.5°C scenario-aligned investment trajectories to listed equities, projecting the 2030 and 2050 green economy exposure of global equity benchmarks, and informing investor discussions around the potential for targeting climate solutions in portfolios and Paris-aligned benchmarks.

## Acknowledgements

The authors would like to thank the members of the Institutional Investors Group on Climate Change's Climate Solutions Working Group and FTSE Russell's Sustainable Investment Advisory Committees for their valuable contributions. All errors and omissions remain the authors.

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# Contents

# Executive summary

**Investment opportunities in listed equities linked to climate and environmental solutions, such as renewable energy and electric vehicles, now exceed USD 3 trillion,** or c.6% of global equity market capitalisation.[1] Revenues from green products and services have grown at 5.4% p.a. since 2009, outpacing overall revenue growth in listed equities (3.4% p.a.).[2]

**However, green investment needs to scale significantly to accelerate the low-carbon transition and limit global temperature rise to 1.5°C.** A set of recent high-profile studies estimate that meeting global net-zero emissions by 2050 requires USD109-275 trillion of cumulative investment across renewable energy, low-carbon transport, energy-efficient buildings, the electrification of industrial processes, recycling and more.[3] However, there are few attempts to translate these economy-wide investment estimates into impacts on global equity markets.

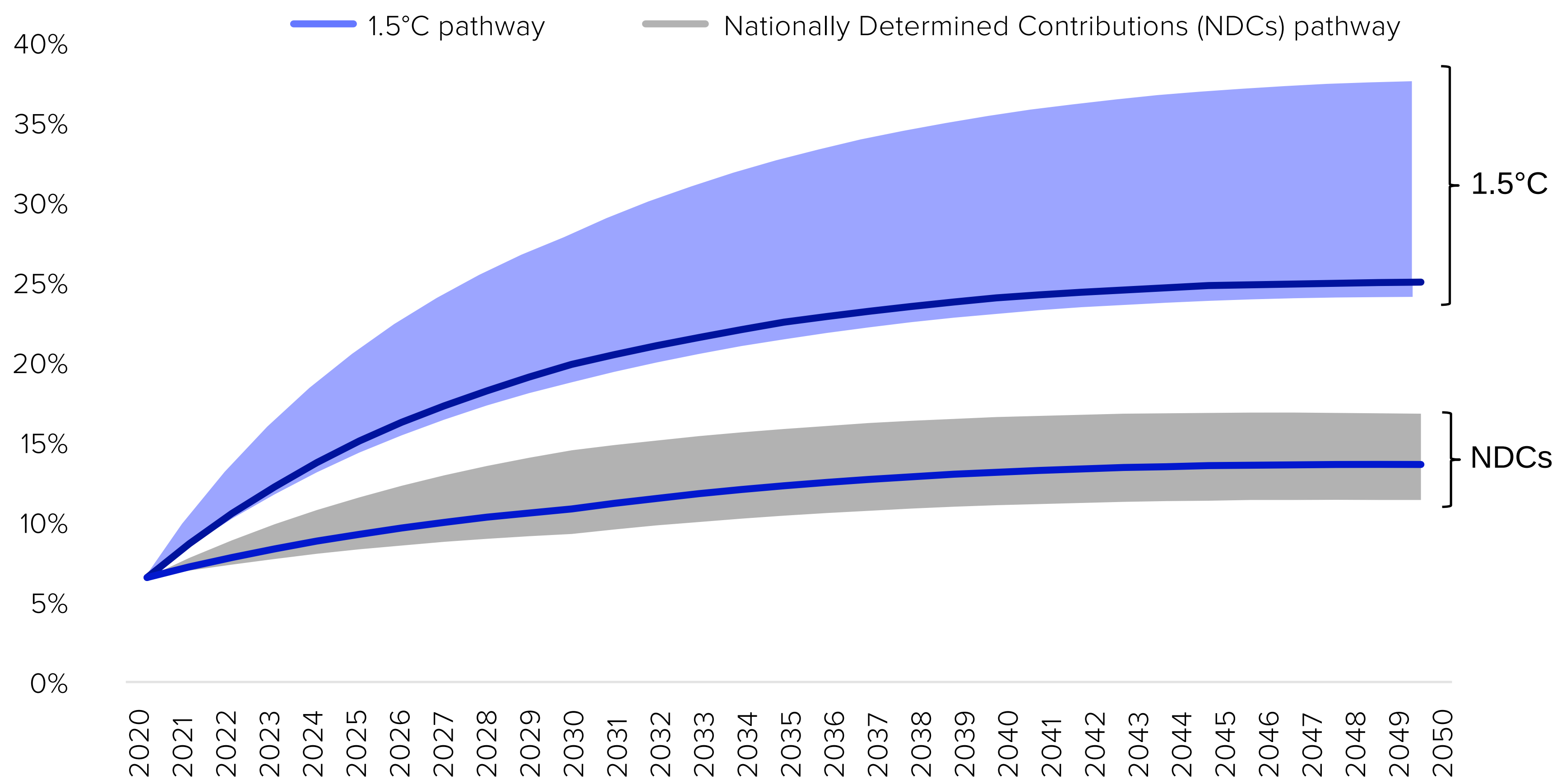
**Building on these studies and drawing on FTSE Russell Green Revenues data, this paper explores how the green economy exposure of the listed equity market would develop in a 1.5°C scenario.** It uses the FTSE All-World index universe, covering large and mid-cap companies, in both developed and emerging economies as a reference portfolio.

1 Based on the total green revenues of companies, included in the FTSE All-World universe, as of January 2022.

2 CAGR of green economy based on growth of revenue from USD 1.6 trillion to USD 3.0 trillion over 12 years; CAGR of All-World based on growth of revenue from USD 31.6 trillion to USD 47.2 trillion over the same period.

3 The upper estimate is from McKinsey & Company (2022), The net zero transition: what it would cost, what it could bring, and the lower estimate is from Network for Greening the Financial System (2021), Climate Scenarios Database Technical Documentation using the REMIND-MagPIE (Phase 2) model.

## Figure 1. Estimated green economy exposure under different climate scenarios




Notes: The 1.5°C scenario line is based on this analysis' base-case assumptions, and the ranges are triangulated against existing studies' estimates of total and additional investment; Similarly, the Nationally Determined Contribution (NDC) scenario and its upper and lower bounds are triangulated against business-as-usual scenarios that publish detailed data, including the IEA, NGFS and IRENA; See Section 2 for the review of existing studies, and Section 4 for a review of the methodology; 1.5°C upper (lower) bound total additional investment is USD 68 trillion (USD 32 trillion), and the NDC upper (lower) bound total investment is USD 19 trillion (USD 11 trillion).

Source: FTSE Russell, September 2022.

**We propose two approaches to transform economy-wide estimates of required climate investment into the impacts on listed equity markets.** A first top-down approach combines macro-economic investment trajectories from existing studies with the current green economy exposure of equity benchmarks, based on stylised assumptions on the relationship between the equity market and the real economy, a separation of additional and business-as-usual (BAU) investment, and the investment to revenue multiplier. An alternative bottom-up approach translates the International Energy Agency's (IEA) estimates of the sectoral 'green penetration' required by 2050 to achieve 1.5°C into sector-level estimates of green economy exposure. Figure 1 shows the results of the benchmark green economy exposure under different climate scenarios.

**Our results show that the green economy exposure in global benchmarks would jump significantly in a scenario where the global economy pivots to a 1.5°C path, increasing more than threefold (by 1.4 percentage points p.a.) from 2020-30.** Indeed, macroeconomic studies on average estimate that annual green investment during 2020-2030 needs to double the current level, and over USD 50 trillion is needed to shift the global economy onto a 1.5°C-aligned pathway. Under this scenario, green exposure in equity benchmarks would jump as governments and the private sector mobilise on a massive scale to rapidly decarbonise the economy.

**After 2030, the green economy exposure in equity markets is expected to grow gradually – an increase of 0.3 percentage points p.a. to reach 25% in 2050.** Substantial upfront investment and deep cuts in carbon emissions early on lower the cost of abatement and create a more gradual investment trajectory post 2030. The green economy is expected to boom in a similar way to the technology sector, with rapid growth in its size and prevalence – resulting in green products and services firmly embedding themselves throughout markets, akin to fintech and ecommerce today. However, with the current growth of the green economy (5% CAGR), the equity market is aligned with the NDC scenario, tracking a pathway close to 2.6°C.

**These results are intended to help shape investors' thinking on building the green economy exposure of their portfolio and climate benchmarks.** While targeting carbon emissions reduction can hedge against climate change risks, incorporating green economy exposure can better capture investment opportunities created by the low carbon transition when aligning portfolios with climate objectives.

This paper explores what the green economy exposure of global benchmarks would look like if the world achieved 1.5°C, characterised by accelerated climate investment from both public and private sectors. It aims to support investors' discussions on the potential for targeting climate solutions for their portfolios.

# Section 1: Introduction

Climate change creates challenges, including both physical and transition risks, as well as investment opportunities, such as the growth of renewable energy, electric vehicles (EVs) and broader environmental technologies like waste management and pollution control. In response, investors are increasingly looking for ways to both reduce their exposure to climate risks and grow their investment in climate solutions, aligning with the Paris Agreement climate objectives.

Climate benchmarks – adaptations of conventional investment indexes that are designed to align with climate goals – can play an important role in supporting investors in aligning portfolios with climate targets and assessing and tracking the performance of their investment against them. They typically incorporate a clear carbon emissions reduction target, requiring stepwise decarbonisation of the underlying portfolio over time. For example, the EU requires climate benchmarks to decarbonise at an annual rate of c.7%, aiming to approximately halve emissions by 2030 and achieve net zero emissions by 2050 – consistent with a 1.5°C alignment target with low or no overshoot.[4]

In contrast, there is currently no consensus on metrics for climate solutions exposure in climate benchmarks. Some climate benchmarks – including the FTSE Russell Paris Aligned (PAB) and Climate Transition Benchmarks (CTB)[5] – provide greater exposure to green products and services than conventional benchmarks, which is explicitly encouraged by the EU Technical Expert Group on Sustainable Finance.[6] Still, there are no widely used quantified targets or pathways for portfolio exposure today.

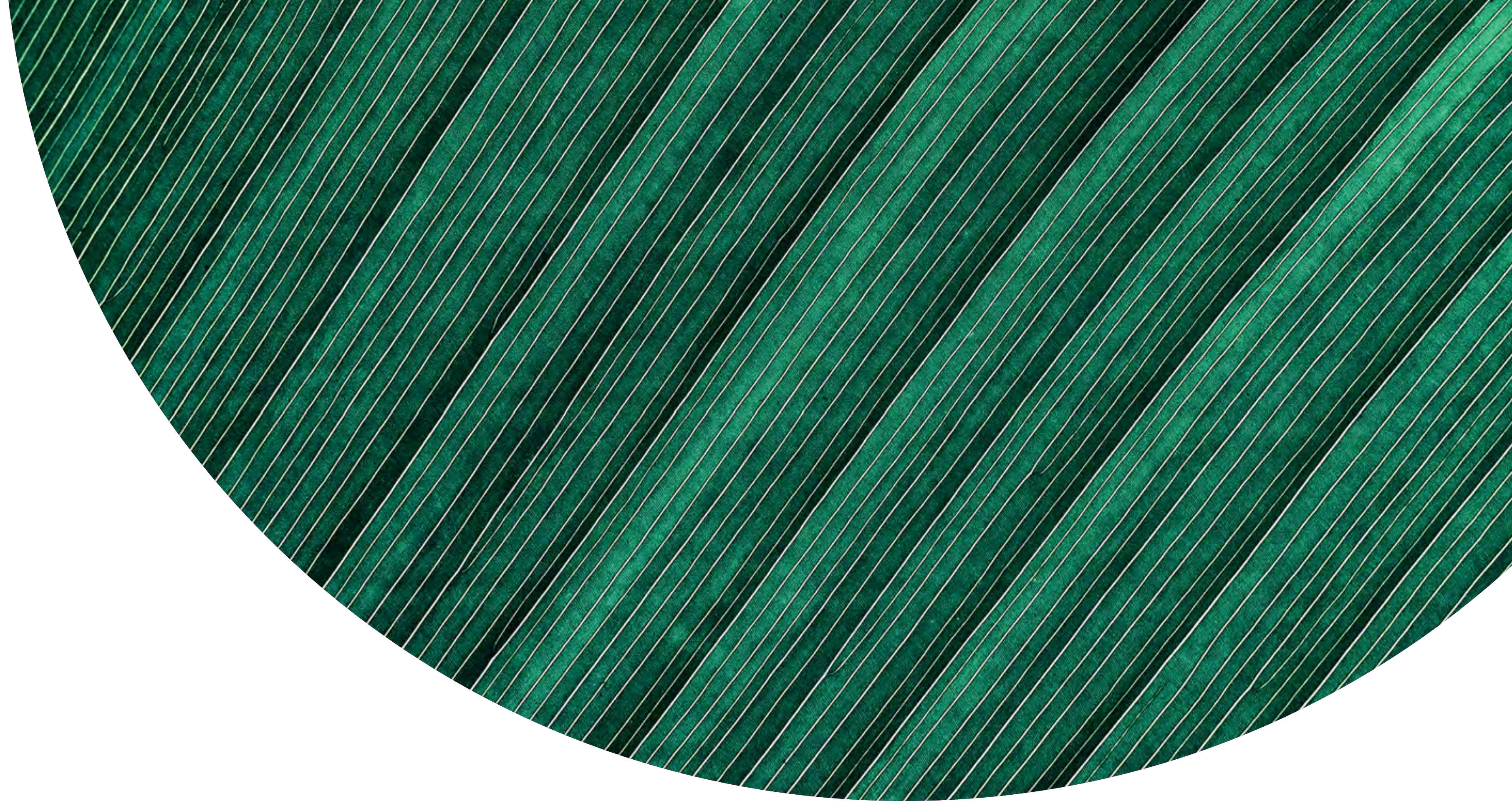
This paper first examines the exposure of conventional benchmarks and their climate versions (including the EU PAB and CTB) to climate solutions using FTSE Russell Green Revenues data, a bottom-up assessment of companies' revenues generated from products and services with climate and environmental benefits (see Box 1). It then reviews a set of recent macroeconomic studies from the IEA, IIGCC, NGFS and others that estimate the size of investment in green products and services that is required to move the economy onto a 1.5°C trajectory. Based on this, we propose both a top-down and a bottom-up approach to estimate how the green exposure of climate benchmarks would evolve to align with a 1.5°C scenario. This paper also discusses the sensitivity and limitations of these estimates and outlines areas for further research.

## Box 1. Green Definitions: FTSE Russell Green Revenues and EU Taxonomy alignment

The FTSE Russell Green Revenues Classification System (GRCS) identifies green products and services across value chains, covering 10 green sectors, 64 subsectors and 133 micro sectors, according to seven environmental objectives – all six environmental objectives set by the EU Taxonomy, plus "sustainable and efficient agriculture." Over 16,000 equities are assessed, of which c.3,000 are found to have green products and services, and categorised against the GRCS, as part of the FTSE Russell Green Revenues dataset. When detailed disclosures are lacking, it leverages additional data (such as product volumes) to produce robust, bottom-up estimates of revenues from green activities for each company.

The EU Taxonomy Regulation entered into force in July 2020 with the aim of providing clear definitions of sustainable economic activities. Companies and investors are required to disclose the extent to which their business activities are EU Taxonomy-aligned. The GRCS and the EU Taxonomy are broadly similar in structure and highly aligned on core activities, providing a tool for investors to identify companies and the share of their revenues that is likely to qualify under the EU Taxonomy.[7]

4 European Commission (2020), EU labels for benchmarks (climate, ESG) and benchmarks' ESG disclosures.
5 See Figure 4 and FTSE Russell (2022), Ground Rules: FTSE EU Climate Benchmarks Index Series.
6 For instance, EU TEG on Sustainable Finance (2019), TEG final report on EU climate benchmarks and benchmark ESG disclosures.
7 More research on the EU Taxonomy: FTSE Russell (2020), Sizing the green economy: Green Revenues and the EU taxonomy.
FTSE Russell (2021), Do No Significant Harm' and 'Minimum Safeguards' in Practice Navigating the EU Taxonomy Regulation.



# Section 2: Global climate investment needs in a 1.5°C scenario

This section reviews a set of recent prominent macroeconomic studies that estimate the investment needed to achieve specific climate outcomes, which form the basis of this paper's proposed methods for estimating the future green economy exposure of equity markets.

These estimates build on climate scenarios which, based on projections of population change and GDP growth, energy demand, technology maturity and more, define a specific mitigation pathway that results in a given temperature outcome.[8] The mitigation pathway describes the emission reductions required in different sectors (such as power generation, buildings and transportation), from which additional mechanisms can be derived, such as the necessary (permitted) production volumes or capacities of green technologies (fossil fuels). Additional data and assumptions (such as the unit capital costs of technologies and their abatement potential), then allow the scenarios to calculate an estimate of the required investments for delivering the necessary technologies and emission reductions to achieve a temperature outcome.

Table 1 summarises climate investment estimates derived from six such recent studies, including the IEA, IIGCC, IRENA, GFANZ, McKinsey and NGFS.[9] While all use climate scenarios that are aligned with limiting global temperature rise to 1.5°C, their estimates of the total cumulative climate-related investment to 2050 differ significantly, with NGFS' estimate being the lowest (USD 109 trillion), and McKinsey's estimate being the highest (USD 275 trillion).

These differences derive both from diverging assumptions and model granularity, with each study defining and breaking down sectors and technologies in their own way. For example, IIGCC, IRENA and McKinsey provide estimates for various technologies in detail, whereas GFANZ and IEA use a less granular technology breakdown. IIGCC includes granular estimates for nature restoration and food waste reduction in the AFOLU sector, while NGFS focuses mainly on energy supply technologies, which leads to lower estimates. McKinsey, meanwhile, broadens the scope of capital spending (incorporating spending by both businesses and households on assets that use energy such as passenger cars), generating higher estimates than others (see Appendix 1 for details on the sectors and technologies covered by these different studies).

Despite these differences, there are also important commonalities in the findings of these studies. Two of them stand out:

1. **The investment required to shift the global economy on a 1.5°C is substantial.** On average, the studies estimate that USD 5.1 trillion annual investments are required to 2050, or 6% of global 2020 GDP, almost double current investment levels.[10]

2. **The investment needs for a 1.5°C pathway are decidedly frontloaded.** As shown in Figure 2, annual investment levels initially jump between 2020 and 2030 – consistent with the need to not only reach net zero emissions by 2050, but also to deliver emissions savings early on to cap total cumulative emissions before 2050 to limit global warming to 1.5°C. Post 2030, investments are projected to grow much more slowly (in the GFANZ and McKinsey scenarios) or even decline gradually (in the IIGCC, IEA, NGFS, and IRENA scenarios).

8 There is a variety of climate scenarios available using different assumptions and models – e.g. the International Institute of Applied System Analysis (IIASA) hosts 30 such models, with over 1184 climate scenarios, see https://secure.iiasa.ac.at/webapps/ ene/AR5DB/dsd?Action=htmlpage&page=about#.

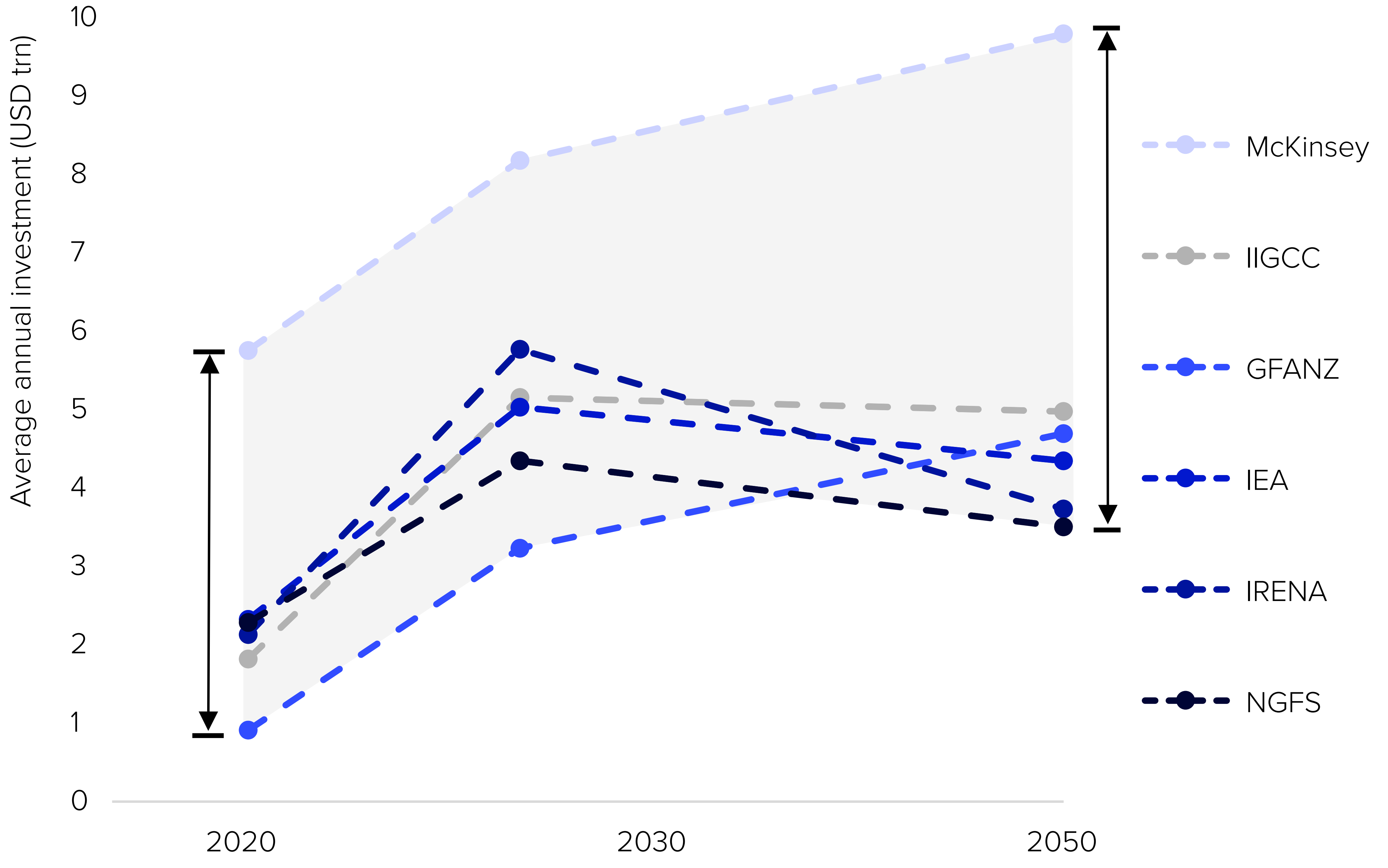
9 Studies were included based on a literature review and the public availability of their estimates; McKinsey & Company (2022), The net zero transition: what it would cost, what it could bring; IIGCC (2022), Climate Investment Roadmap: A tool to help investors accelerate the energy transition through investment and engagement; Glasgow Financial Alliance for Net Zero (GFANZ) (2021), Financing Roadmaps; IEA (2022), Net Zero Emissions by 2050 Scenario (NZE); International Renewable Energy Agency (IRENA) (2022), World Energy Transitions Outlook: 1.5ºC Pathway; The Network for Greening the Financial System (NGFS) scenario shown here follows McKinsey (2022) by using the REMIND-MAgPIE (Phase 2) model, from NGFS (2022), NGFS IIASA Scenarios Portal; for more information see NGFS (2021), NGFS Climate Scenarios for Central Banks and Supervisors.

10 The current (US 2.7 trn) required annual investment levels are calculated as the mean current investment need across the six studies; The 2050 required annual investment levels are calculated as the mean estimated investment need across the six studies between now and 2050; 2020 global GDP was US 84.9 trn, from World Bank (2022), World Bank national accounts data, and OECD National Accounts data files.

Table 1. Key studies estimating investment needs for shifting the global economy to a 1.5°C pathway

| Source | Cumulative investment by 2030 (USD trillion) | Cumulative investment by 2050 (USD trillion) | Number of sectors covered | Number of technologies covered |
|---|---|---|---|---|
| GFANZ (2021) | 32 | 125 | 6 | NA |
| IEA (2022) | 50 | 136 | 6 | 8 |
| IIGCC (2022) | 51 | 150 | 7 | 44 |
| IRENA (2022) | 57 | 131 | 9 | 23 |
| McKinsey (2022) | 81 | 275 | 7 | 13 |
| NGFS (2021) | 38 | 109 | 5 | 24 |

Figure 2. Estimates of the climate investment against 1.5°C temperature alignment by 2050




Notes: McKinsey & Company (2022), The net zero transition: what it would cost, what it could bring; IIGCC (2022), Climate Investment Roadmap: A tool to help investors accelerate the energy transition through investment and engagement; Glasgow Financial Alliance for Net Zero (GFANZ) (2021), Financing Roadmaps; IEA (2022), Net Zero Emissions by 2050 Scenario (NZE); International Renewable Energy Agency (IRENA) (2022), World Energy Transitions Outlook: 1.5°C Pathway; The Network for Greening the Financial System (NGFS) scenario shown here follows McKinsey (2022) by using the REMIND-MAgPIE (Phase 2) model, from NGFS (2022), NGFS IIASA Scenarios Portal; for more information see NGFS (2021), NGFS Climate Scenarios for Central Banks and Supervisors.

Source: FTSE Russell, September 2022.

# Section 3: Establishing a baseline: Green economy exposure of global equity markets

The studies reviewed in the previous section provide useful insights on how global investment trends need to shift to achieve a decarbonisation trajectory consistent with limiting global warming to 1.5°C. However, they focus on capital flows in the real economy. How would exposure to the green economy in global equity markets change over time in a 1.5°C scenario?

To answer this question in the first instance requires establishing an empirical baseline to capture green economy exposure in equity markets today, which is the topic of the current section. Section 4 then discusses how such green economy exposure in equities is likely to evolve in a 1.5°C aligned transition pathway, enabling investors to track how green exposure in their portfolios compares against long-term climate goals and can contribute to closing the climate investment gap.

## Current green economy exposure of the market benchmark

We rely on FTSE Russell Green Revenues data, which provides granular bottom-up data on revenues from green products and services for over 16,000 companies.[11] This allows us to calculate the green economy exposure of the equity markets as the share of total revenues that listed companies derive from green products and services. We focus on the FTSE All-World universe as a reference portfolio – a broad based, market capitalisation-weighted index comprised of over 4,000 large and mid-cap firms from developed and emerging markets, and which covers over 90% of the world's investable market capitalisation.[12]

11 See FTSE Russell (2022), Investing in the Green Economy 2022: Tracking growth and performance in green equities.

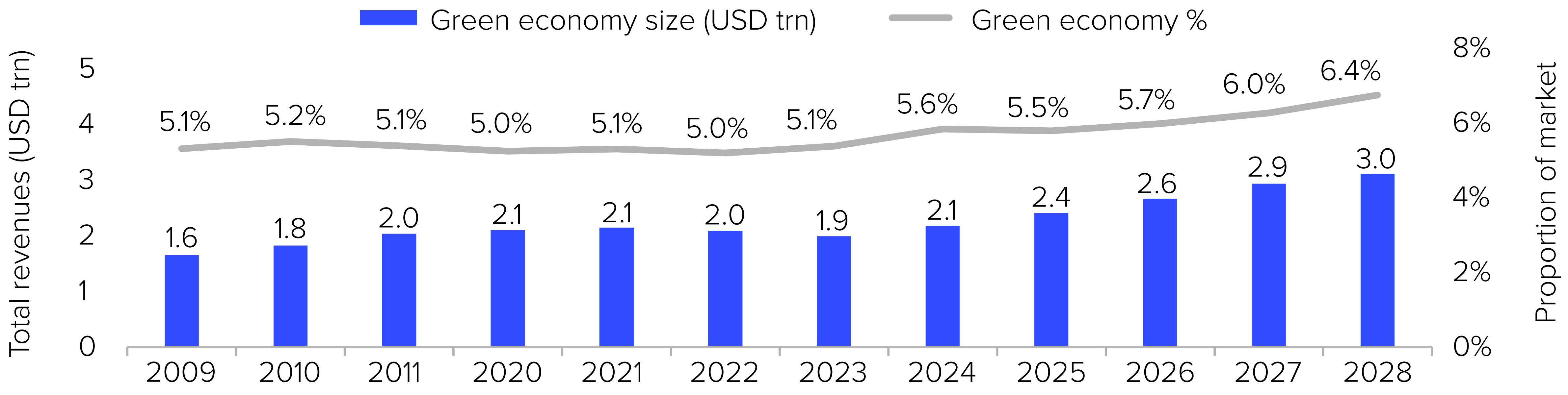
12 FTSE Russell, FTSE All-World Factsheet; Note: this study uses the absolute revenues of constituents rather than market capitalisation weights to measure the green exposure of the FTSE All-World universe, see Appendix 5.

13 For an example of how the green revenues data reflects the Automobiles & Parts value chain, see FTSE Russell (2022), Investing in the Green Economy 2022: Tracking growth and performance in green equities, page 20.

The results show that the green economy already accounts for a sizeable share of global equity markets – USD 3.0 trillion of listed company revenue in 2020, or 6.4% of total revenues of FTSE All-World companies (Figure 3). Green revenues are growing at a faster rate than the market; between 2009 and 2020, revenues from green products and services grew at a compound annual growth rate (CAGR) of 5.4%, outpacing overall revenue growth of 3.4% CAGR. Green exposure of equity markets gradually increased over the last decade, from 5.1% in 2009 to 6.4% in 2020.

Green products and services are diverse, spanning entire value chains and tackling a wide range of environmental and climate change issues. For example, the development of electric vehicles (EVs) drives growth in the business of assembling vehicles (in the autos sector) as well as in the manufacturing of batteries, power semiconductors and control systems (in sectors like industrial goods).[13] Utilities is the greenest sector, with 28% of its revenue derived from climate solutions such as renewable power generation.

### Figure 3. Green economy exposure of the equity market (FTSE All-World)




Notes: Green economy size is calculated as the sum of green revenue of the FTSE All-World constituents, including disclosed information and estimates (for more information on the calculation, see P15 Figure 12 FTSE Russell (2022), Investing in the Green Economy 2022: Tracking performance and growth).

Source: FTSE Russell, September 2022.

## Box 2. Green economy exposure in climate benchmarks

Building on conventional investment benchmarks, climate benchmarks incorporate specific climate objectives, both to hedge against climate risks and to increase exposure to opportunities created by the low-carbon transition. Climate objectives of a benchmark can be met through, for example, adjusting a portfolio's composition or re-weighting constituents.

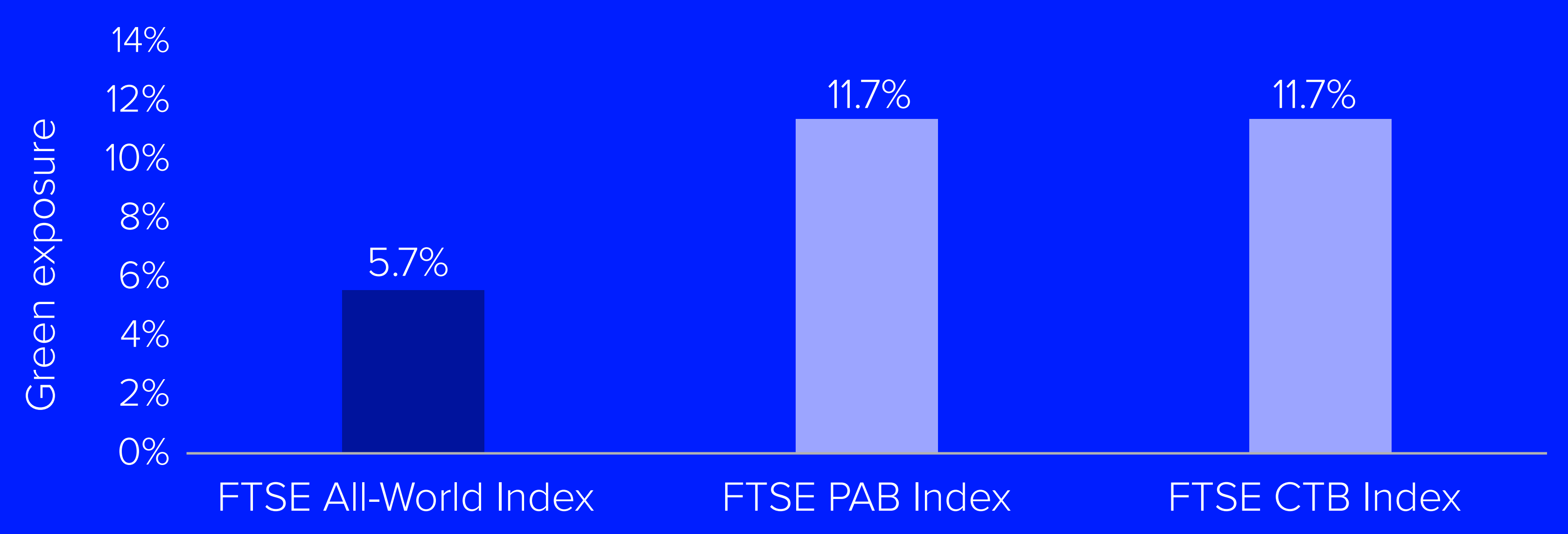
In April 2020, the EU climate benchmarks regulations entered into the application, providing guidelines on how investment products in Europe can align with the Paris Agreement's objectives. The FTSE EU Climate Benchmarks Index Series is designed to meet the EU Paris Aligned Benchmark regulation, relying on an innovative index design and climate data, including on emissions, green revenues, and transition efforts of companies measured through data from the Transition Pathway Initiative (Figure 4).

### Figure 4. Inputs into the FTSE EU Climate Benchmarks Index Series

| | | |
|---|---|---|
| Climate Risks & Opportunities /Disclosed | Fossil fuel reserves | Underweight or exclude companies with fossil fuel reserves |
| | Carbon emissions | Underweight companies according to their GHG emissions (see also "Net zero pathways" (below) |
| | Green revenues | Overweight companies engaged in the transition to a green economy |
| | TPI Management quality | Over or underweight companies according to their management quality ("climate governance") |
| Transition Alignment | TPI Carbon performance | Over or underweight companies according to their carbon performance ("2DC/Below 2DC pathways") |
| | Net zero pathways | Apply annual decarbonisation (carbon emissions reduction) target – to reach 'net zero' over c. 10 years |

Although the regulation does not mandate targeting a specific level of climate solutions in climate benchmarks, this is explicitly encouraged by the EU Technical Expert Group, and it is intuitive given that climate benchmarks are designed to support the low-carbon transition. FTSE Russell Climate Benchmarks go beyond the regulation by specifically aiming to double their green revenue exposure compared to market benchmarks. As shown in Figure 5, the FTSE Paris-Aligned Benchmark and FTSE Climate-Transition Benchmark uses the FTSE Target Exposure Framework to adjust constituent weighting and maintain double the exposure to the green economy versus the market benchmark (FTSE All-World).

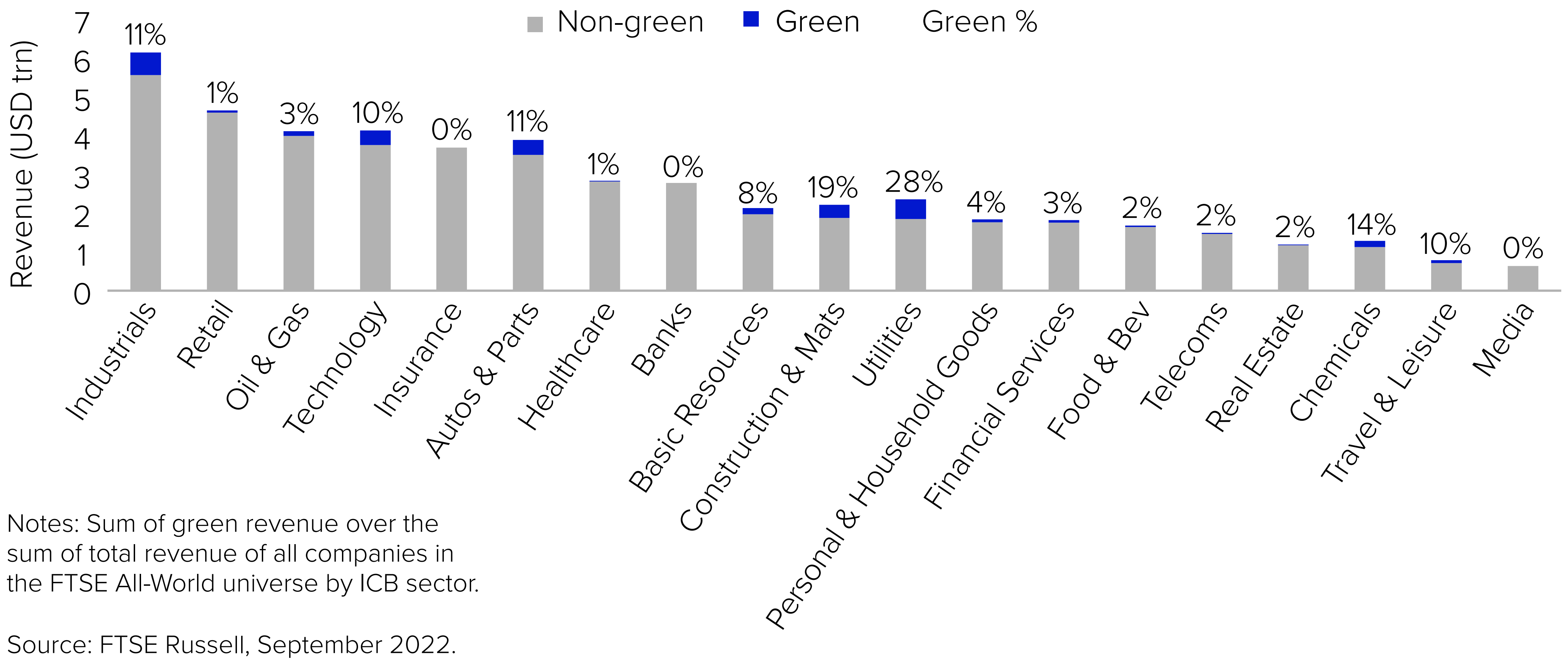
### Figure 5. Green economy exposure of the FTSE Russell EU Climate Benchmarks Indices (2021)




Notes: Green revenues are aggregated at the index level, calculated as the sum of the constituent weights (which are based on market cap for the FTSE All-World, and more for the FTSE PAB and FTSE CTB) multiplied by one plus the green revenues of each constituent; Green revenue levels the FTSE PAB and FTSE CTB indexes include only Tier 1 and 2 green revenue activities; GR2.0 data using the latest assessment available for each company (financial year 2020 or 2021); Revenues are as of September 2021; for more information, see FTSE Russell (2022), Ground Rules: FTSE EU Climate Benchmarks Index Series; Past performance is not a guarantee of future performance.

Source: FTSE Russell, September 2022.

## Figure 6. Green revenues of the equity market (FTSE All-World universe) by ICB sector




Notes: Sum of green revenue over the sum of total revenue of all companies in the FTSE All-World universe by ICB sector.

Source: FTSE Russell, September 2022.

Other metrics to measure green economy exposure of equities have also been proposed in the literature, including green patents or green capital expenditures, but they have their own drawbacks.[14] The value of patents (as opposed to their quantity) is difficult to assess systematically, and further confounded by the divergent patenting behaviour of firms in different regions. Companies also rarely provide granular breakdowns of their capital expenditures in a similar fashion to more standardised revenue reporting, making it difficult to identify ‘green capex’ systematically and reliably for larger universes of companies - a challenge that has been recognized by ESMA and others.[15]

In any case, there is good reason to expect that green revenues in equity benchmarks correlate closely with the economy-wide green investment measured in the macroeconomic studies reviewed above. In fact, green revenues may track it more reliably than the green capex of listed companies, even if capex could be identified systematically. Significant volumes of climate investment (e.g., in renewables) is likely to come from the public sector and private companies, and not reflected in the capital expenditures of listed companies. Nonetheless, these investments are likely to be translated into revenues of listed companies and subsequently captured as green revenues (e.g., those of wind turbine or solar panel makers).

Given this, what exactly should the green exposure of the equity market look like in 2030 and 2050, if 1.5°C and the technological development it requires are realised?

14 For instance, the EU TEG on Sustainable Finance suggests that green capex ‘gives a very good sense of a company’s direction of travel’, see P28 EU TEG on Sustainable Finance (2020), Taxonomy: Final report of the Technial Expert Group on Sustainable Finance; Many academic studies use green patents as a measure of firm-level greenness, for example see Kruse, T., Mohnen, M. and Misato, S. (2020), Are financial markets aligned with climate action? New evidence from the Paris Agreement.

15 In its advice for asset managers The European Securities and Markets Authority (ESMA) notes “the agreement by respondents that a turnover based weighted average is the preferred approach. ESMA agrees that data availability and comparability may hamper mandatory reporting of CapEx and OpEx figures and therefore, should be reported on a voluntary basis.”; see pages 84-85, ESMA (2021), Final Report: Advice on Article 8 of the Taxonomy Regulation.

# Section 4: Estimating future green economy exposure

This section outlines two approaches to estimate the trajectory of green revenue exposure of the equity market in a 1.5°C world, providing a yardstick to inform the construction of Paris-aligned listed equity portfolios. The top-down approach looks at the equity market as a whole, leveraging the macroeconomic studies reviewed in Section 2 to estimate its green economy exposure under a 1.5°C pathway. The bottom-up approach takes the equity market sector-by-sector, using the IEA's Net Zero Scenario to estimate the 'green penetration' of revenue in 1.5°C-aligned industries over time.

## 4.1 Top-down approach: investment need

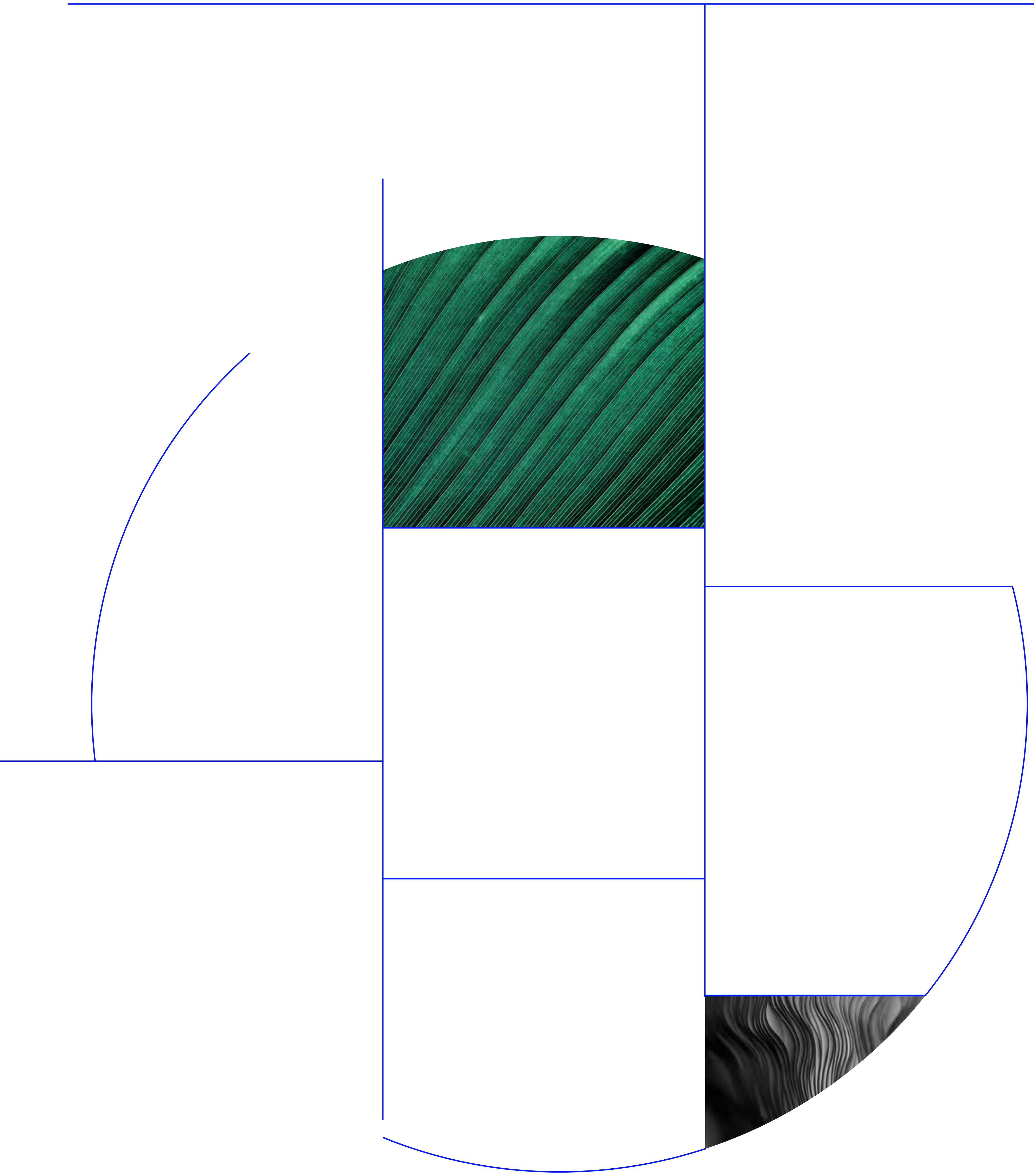
### Estimation

The top-down approach adds green revenues derived from climate investment estimates under the 1.5°C scenario to the current size of the green economy, providing an estimate of future green revenues at a point in time ($T_1$) for a diversified reference portfolio, given as:

$$\text{Future GR\% } T_1 = (\text{Green Revenues } T_0 + \text{Additional Investment } T_1 \times \text{Investment to Revenue Multiplier}) / (\text{Green Revenues } T_1 + \text{Non-green Revenues } T_1)$$

Where:

- **Green Revenues $T_0$** = aggregated green revenues of listed companies in the portfolio at $T_0$, calculated as $\Sigma_{i=1}^{n}$ *Company Green Renvenue*$_i$ / $\Sigma_{i=1}^{n}$, *Compnay Revenue*$_i$,
- **Additional Investment $T_1$** = additional climate investment required for reaching 1.5°C,
- **Investment to revenue multiplier** = revenues generated from each dollar of additional investment,
- **Green Revenues $T_1$** = Green Revenues $T_0$ + Additional Investment at $T_1$,
- **Non-green Revenues $T_1$** = aggregated non-green revenues (i.e., revenues from products and services that are not green) of listed companies in the portfolio at $T_1$, based on non-green revenues at $T_0$, calculated as $\Sigma_{i=1}^{n}$ *Company Non Green Renvenue*$_i$ / $\Sigma_{i=1}^{n}$, *Compnay Revenue*$_i$ with a constant growth rate.



## Assumptions

The complexity of estimating the green exposure of the equity market out to 2050 means assumptions need to be made in several areas.[16] One of the most important is the relationship between the **equity market and the real economy**, or whether growing investment in green equities leads to higher green technology development 'on the ground'. Our base case assumes this relationship remains stable, with the growth of the equity market broadly aligned with GDP, and growth in the green economy[17] driven by real economy investment in green technologies.

Another important assumption is the green investment required to achieve 1.5°C. Given the wide spread in estimates, the median of the macroeconomic studies outlined in Section 2 is used, which is USD 45 trillion by 2030 and USD 126 trillion by 2050, excluding fossil fuels.

Not all this investment will be additional each year, with a portion dedicated to maintaining existing green technologies. We assume 27% of the total investment to be **additional investment**, which contributes to the expansion of the green economy, with the remaining 73% of the investment maintaining the current size of the green economy. Additional investment is estimated using the difference between business-as-usual climate investment and the amount required to hit 1.5°C scenarios.

Our base case conservatively assumes a constant **investment to revenue** multiplier of 1. In reality, the multiplier for green technologies is likely to be larger than 1 and may vary both across technologies and over time.[18] There is also no differentiation between **private and public investment**, as both can flow to the equity market and generate GDP and revenue growth – in keeping with the IMF study, which holds the multiplier effect of capital expenditure agnostic to whether an investment is public or private.[19]

Additionally, there is a time component to consider; It takes time to generate revenues after capital spending, and assets have different lifespans. Some climate solutions, such as wind turbine manufacturing and environmental consultancies, can generate revenues in the same year when investment occurs, whereas others may take a few years, particularly capital-intensive infrastructure projects. For simplicity, our base case assumes that **revenues are generated synchronously with capital spending**. For example, if the additional green investment in 2030 is USD 5 trillion, then the additional green revenues in 2030 equals USD 5 trillion.

For comparison, using the same estimation strategy, we perform similar analysis on the green economy exposure of the equity market under the NDCs scenario, using relevant climate investment estimates.[20]

16 Appendix 2 lists the assumptions and rationales used in the top-down approach.

17 i.e., the green part of the equity market represented by green revenues.

18 IMF research suggests that every dollar spent on renewable energy can generate 1.1 dollars' worth of economic activity or real GDP in year 1, and 1.5 in year 5; sustainable land use can have a multiplier of -1.6 in year 1 and 6.7 in year 5. See International Monetary Fund (2021), Building Back Better: How big are Green Spending Multipliers?.

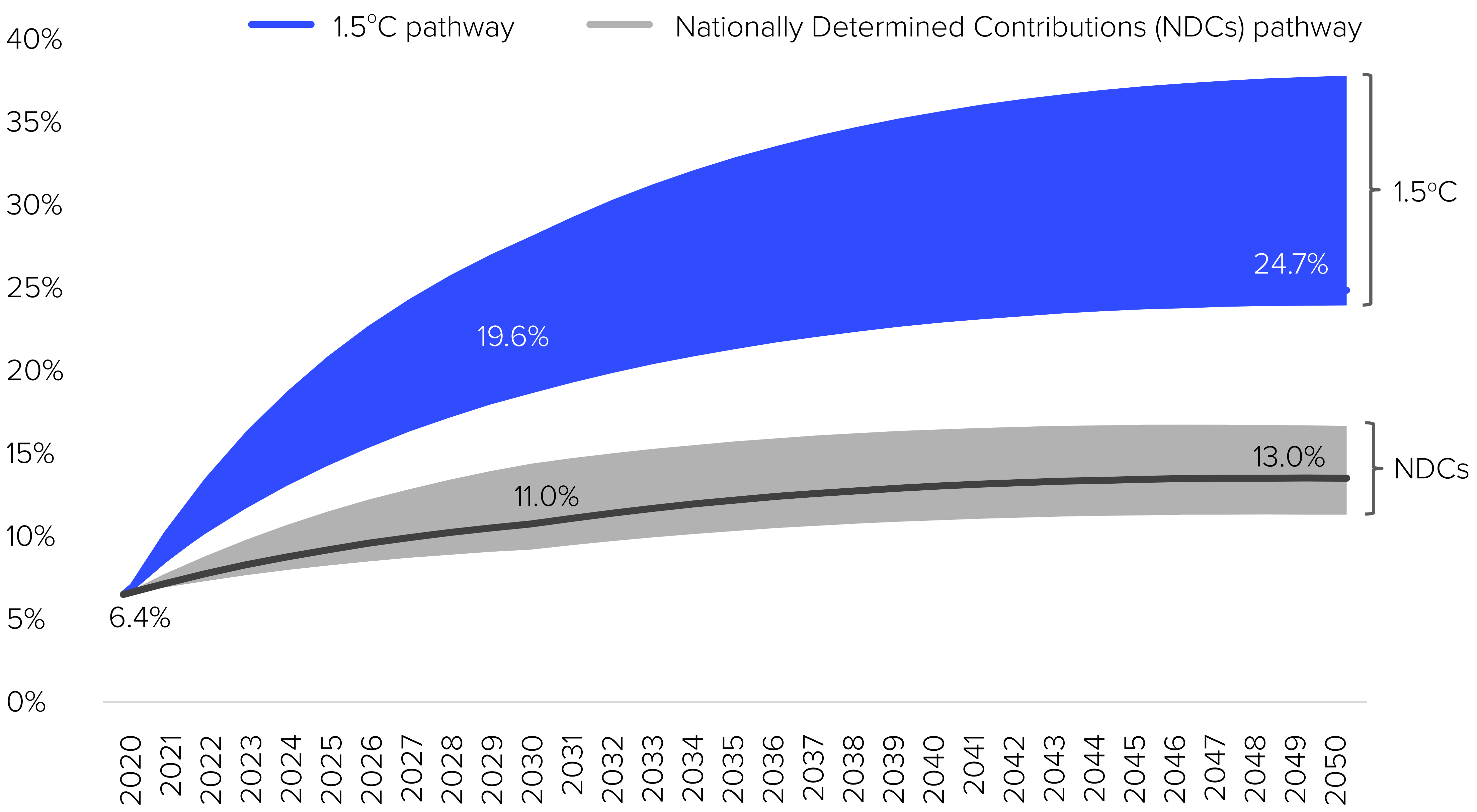
19 Ibid.

20 The Nationally Determined Contribution (NDC) scenario and its upper and lower bounds are triangulated against business-as-usual scenarios that publish detailed data, using estimates from the IEA, NGFS and IRENA.

## Results

Figure 7 shows the resulting estimated green economy exposure path of the FTSE All-World universe under two scenarios – 1.5°C and NDCs.

### Figure 7. Green economy exposure under different climate scenarios




Notes: The 1.5°C scenario line is based on this analysis' base-case assumptions, and the ranges are triangulated against existing studies' estimates of total and additional investment; Similarly, the Nationally Determined Contribution (NDC) scenario and its upper and lower bounds are triangulated against business-as-usual scenarios that publish detailed data, including the IEA, NGFS and IRENA; See Section 2 for the review of existing studies; 1.5°C upper (lower) bound total additional investment is USD 68 trillion (USD 32 trillion), and the NDC upper (lower) bound total investment is USD 19 trillion (USD 11 trillion).

Source: FTSE Russell, September 2022.

Generally, the lower the temperature goal, the higher the green exposure of the equity market needs to be in 2030 and 2050, and the faster it needs to grow upfront. Under the 1.5°C scenario, the green economy exposure of the market is expected to reach 20% in 2030 and 25% in 2050 - up from 6% in 2020 and roughly double the level for the nationally determined contributions (NDC) scenario. During 2020-2030, the green economy exposure will grow by more than three times, with an increase of 1.4 percentage points p.a. – a much larger upfront investment compared to the 2.6°C scenario (0.5% p.a.). After 2030, growth in green economy exposure is more gradual in both scenarios, but still much faster in the 1.5°C scenario, increasing 0.3% p.a. as opposed to 0.1%. In fact, the current growth of the green economy (5% CAGR) is aligned with the NDC scenario, which is leading to approximately 2.6°C.[21]

These results are consistent with the findings of other studies[22], that substantial upfront investment and deep carbon emissions cuts by 2030 are required to reduce the risk of missing 1.5°C, as each unit of carbon emitted now will continue to warm the globe for decades and increase abatement cost.[23]

21 The CAGR of the absolute size of the green economy (2020 – 2050) under the NDC scenario is 6.1% vs. 8.7% for the 1.5°C scenario; The Nationally Determined Contribution (NDC) scenario is derived from IEA's Stated Policies scenario (2.6°C), NGFS' NDCs scenario (2.5°C) and IRENA's Planned Energy scenario (the carbon budget suggests the temperature alignment of 2.7°C).

22 NGFS describes its Below 2°C (1.7°C) scenario as 'orderly', because it assumes policies begin reducing emissions immediately (an orderly transition), requiring lower cumulative investment; In contrast, its 'disorderly' Delayed Transition (1.8°C) scenario assumes policies delay deeply cutting emissions until after 2030; for more information, see NGFS (2021), NGFS Climate Scenarios Database Technical Documentation v2.2.

23 Generation Investment Management (2021), The Time Value of Carbon.

# 4.2 Bottom-up approach: sectoral technology mix

### Estimation and assumptions

To estimate sector-level green revenues exposure,[24] the paper first examines the sectoral 'green penetration' required by 2050 under the IEA Net Zero scenario, such as:

- 88% of electricity generation comes from renewable sources
- EVs account for 100% car sales
- More than 85% of buildings are zero-carbon ready

These green penetration targets are then allocated to different industries[25] such as utilities and autos, based on their current green revenues. For example, currently in the green economy, 94% of the green revenues from renewable power generation come from utilities. Therefore, utilities need to deliver 94% of the 88% green penetration required for the electricity generation, which means the green revenues exposure for utilities will be 82% (= 94% × 88%) in 2050.[26]

For sectors without a clear green penetration target, such as industrial goods and services and technology, assumptions on their future green revenues have been made based on the top-level company green revenue percentages in the relevant sector under the current green economy.

To calculate the absolute size of industries and the economy by 2050, each industry is assumed to grow at a rate based on its future green revenues exposure, growth of the green economy (currently 5%) and growth of the non-green revenues (3% based on GDP growth).[27] By aggregating revenues across sectors, the overall green economy exposure for the whole market is about 27% by 2050, which is close to 25% under the top-down approach.

### Results

Figure 8 shows the green economy exposures at the sector level, taking utilities, autos and construction as examples.[28] Utilities' green revenues will grow from 28% in 2020 to 82% in 2050, meaning most power generation should come from renewables rather than fossil fuels. Autos increase green revenues from 11% in 2020 to 88% in 2050, driven by a pivot to electric vehicles instead of internal combustion engines using fossil fuels.[29] The construction sector is more diversified, providing a variety of green products or services for different sectors in the downstream value chain, including green buildings, railway construction and water infrastructure. It is challenging to estimate a single green revenue exposure figure that reflects all the sector's green activities. We use the IEA's target of zero-carbon ready buildings to proximate the green penetration in the construction sector, which suggests that 43% of its revenue will be green, through the construction of green buildings.

The results suggest that under the 1.5°C climate scenario, the green economy is expected to boom similarly to the technology sector – like e-commerce in retail and fintech in banking, green products and services need to become embedded throughout industries and markets if the world is to achieve its climate goals.

24 Appendix 3 provides further details on the assumptions and calculations.
25 FTSE Russell ICB Super sector.
26 It is assumed that the size of the green economy will follow a linear growth over the whole period.
27 In the example of utilities, its growth rate will be 5.46% (=82%×6%+18%×3%), and its size grows from USD1.9trn in 2020 to USD9.2trn in 2050 (=1.9× (1+5.46%).
28 Appendix 4 provides estimated green economy exposures of other sectors.
29 Note that autos companies may not be 100% green just because all car sales should be EVs; companies classified as autos may have revenues from activities other than manufacturing vehicles.

## Figure 8. Green economy exposures at the sector level

Figure 8.1 Green economy exposures of all sectors

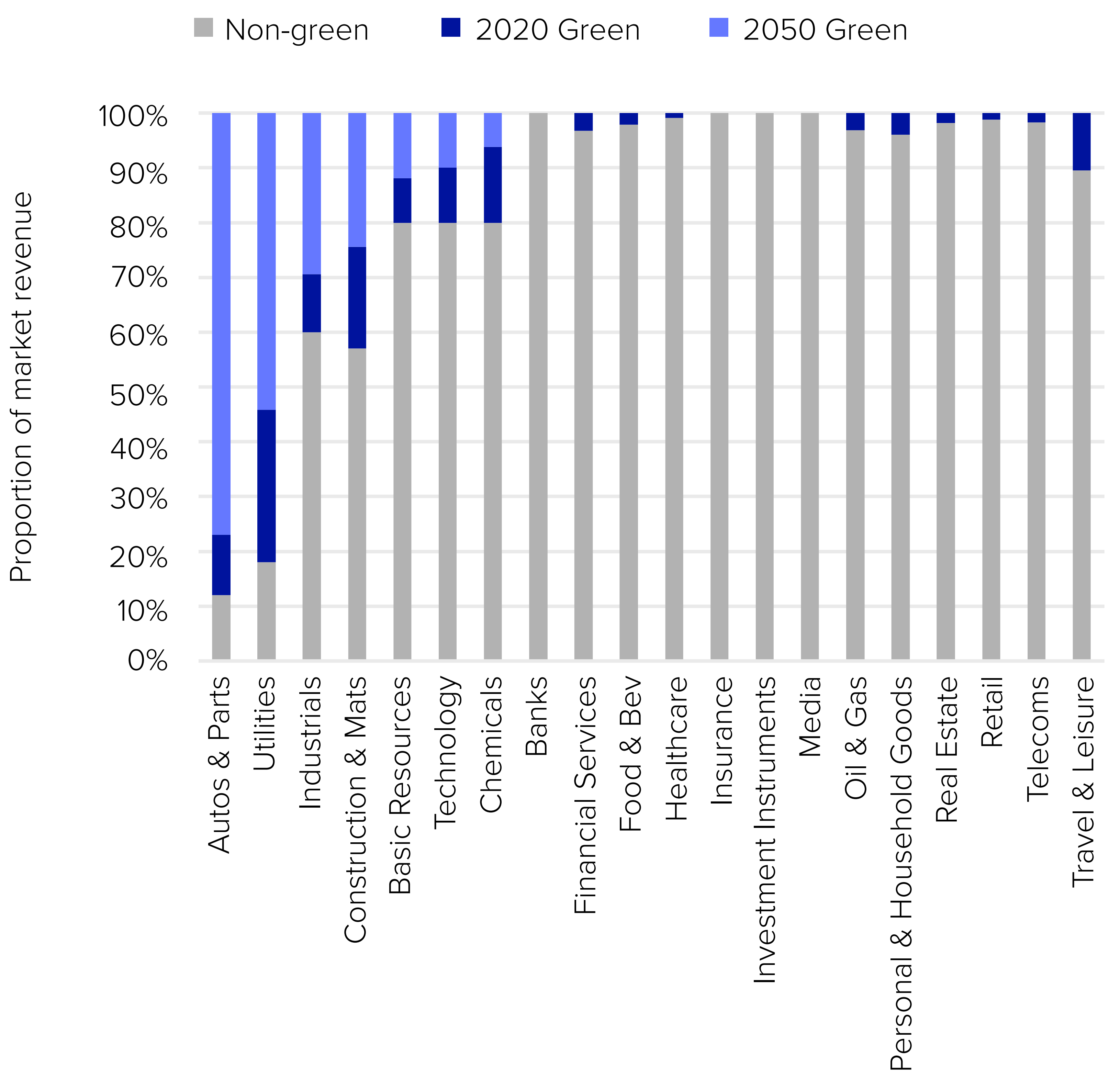



Figure 8.2 Green economy exposure of autos

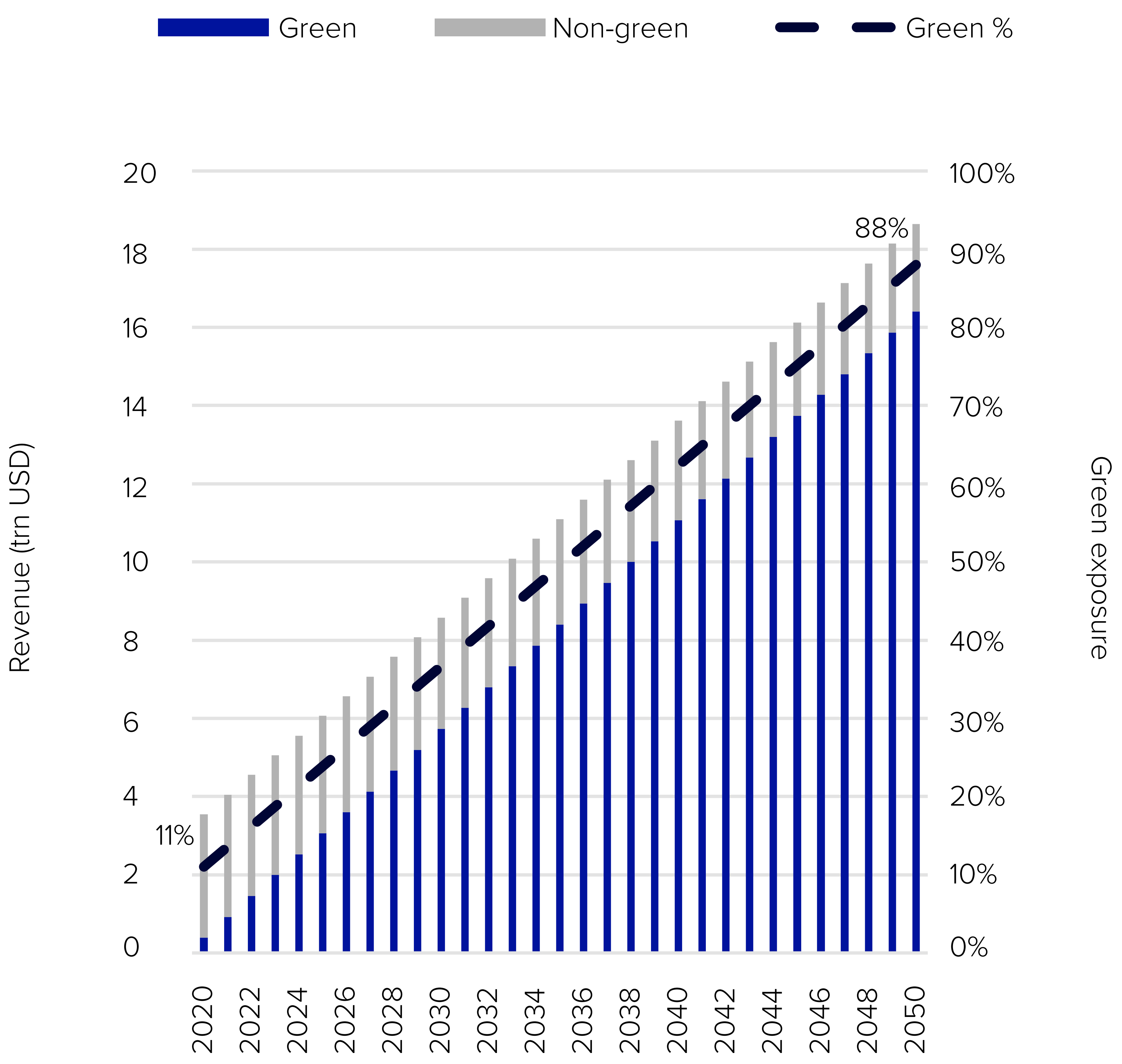


Figure 8.3 Green economy exposure of utilities

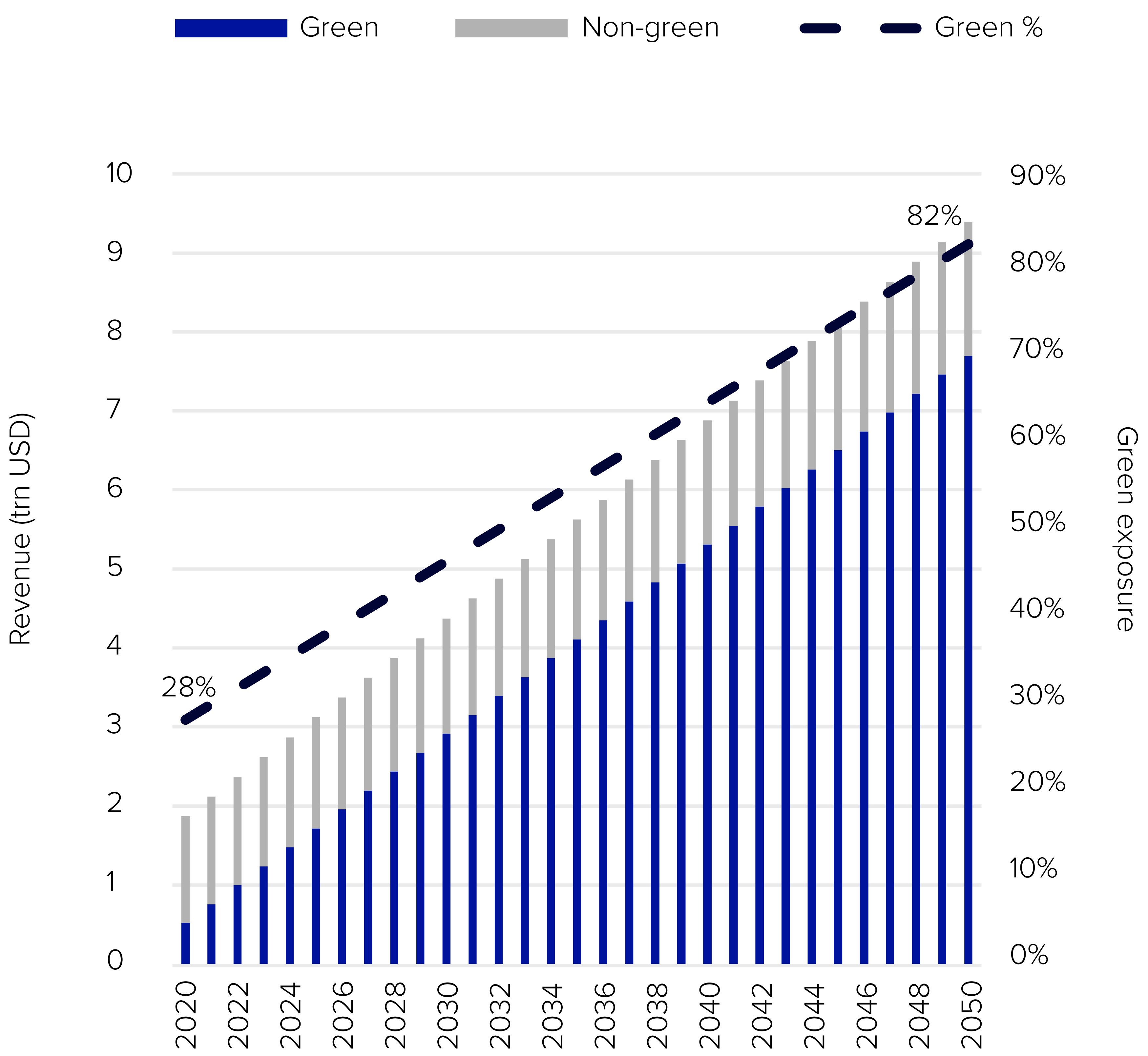
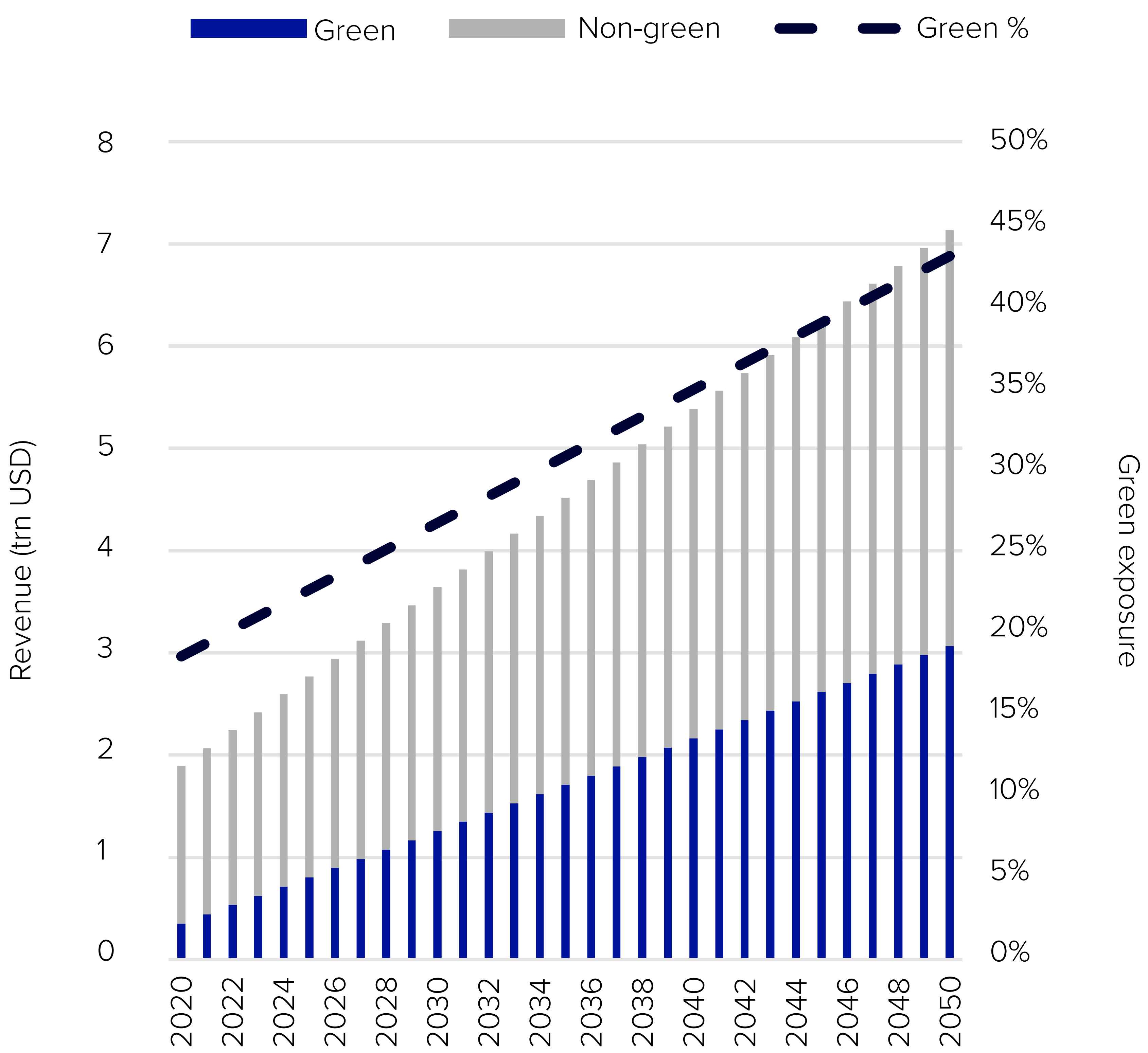



Figure 8.4 Green economy exposure of construction




Notes: The top right graph shows the green exposure by ICB sector for the FTSE All-World universe, in 2020 and the required green exposure in 2050 under a 1.5oC scenario; The other graphs show the green exposure of the FTSE All-World universe in 2020, and estimated green exposure path required in a 1.5oC scenario; Past performance is not a guarantee of future performance.

Source: FTSE Russell, September 2022.

# 4.3 Sensitivity analysis and limitations

To test the sensitivity of the assumptions, we varied each assumption (discussed in section 4.1) by 25% to produce green economy exposures of 12% to 27% by 2030, and 16% to 33% by 2050. Appendix 6 provides more information on how the 2050 green economy exposure varies with changes in each assumption.

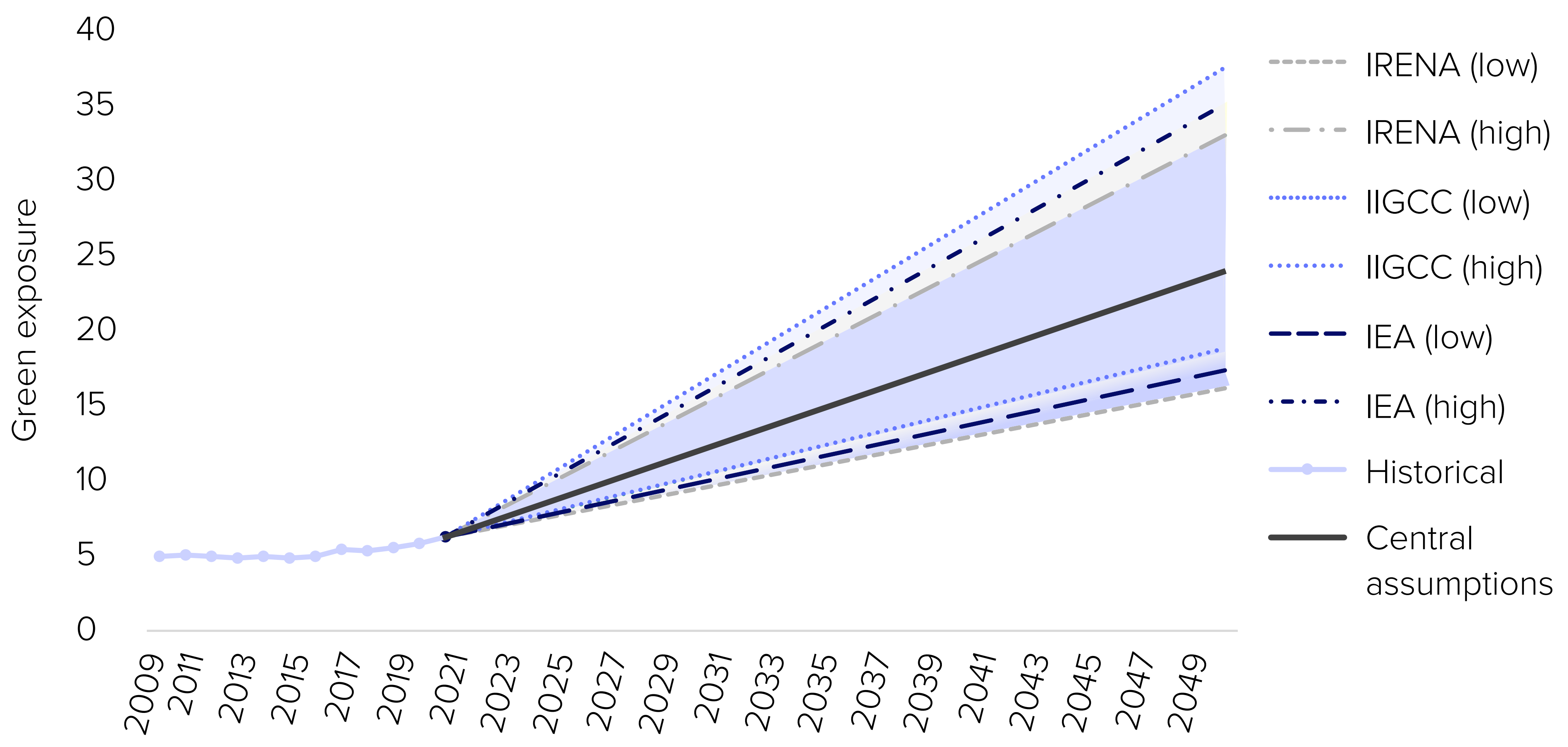
Replacing the base-case assumptions with 'upper and lower bound' investment estimates (from the studies examined in Section 2) acts as an additional sensitivity check (Figure 9). For instance, using upper bound values for total investment and additional investment – which are USD 142 trillion by 2050 and 48% of total investment – produces a 2050 green economy exposure of 39% by 2050. The analysis shows that values of 2050 green economy exposure can vary between 17% and 39%, and the base case estimate of 24.7% is reassuringly near the middle of this range.

Several uncertainties in the top-down approach are worth highlighting. Estimating revenues in the equity market over a 30-year timeframe assumes its long-term trajectory holds, which may not be true. The same is true for the assumed relationship between GDP growth and equity market growth. Further, the climate investment estimates vary among different sources, where divergences can reach over USD 180 trillion – reflecting the uncertainties inherent in climate scenario modelling, baked into forecasts of population change, energy demand, abatement cost, technology maturity and policy preferences. Combatting these issues, the assumptions on additional investment and the investment to revenue multiplier are conservative.

For the bottom-up approach, the green exposure targets may not perfectly reflect the structure of different sectors in practice. For example, it is relatively straightforward to apply the EV penetration target to autos, where most business activities are more or less related to car manufacturing. In contrast, sectors like the industrial goods and services cover diversified green business activities covering transport equipment, industrial energy efficiency and recycling. While it is not possible to accurately represent every sector through green penetration targets, conservative assumptions on sectoral green revenue growth have been used throughout.

Given the paper's focus on listed equities, from an investment management point of view it might make more sense to look at the green economy exposure through the lens of market capitalisation rather than revenue. However, the market cap approach requires further assumptions, such as price-to-sales ratios, which can be volatile (see Appendix 5). To reduce further uncertainty, this paper uses revenues as the only metric. Although the analysis focuses only on listed equities, investment need could also be applied to private companies, which are an integral part of the economy and could be the focus of future work.

**Figure 9. Sensitivity of green economy exposure to climate investment estimates**




Notes: This shows the future green revenues based on the response of three analyses' total investment estimates (excluding fossil fuels and the highest and lowest investment need estimates) to selected 'upper and lower bound' estimates for additional investment (labelled 'high' and 'low' in the legend); 'High' = 48%, which is an average of the increase in annual investment required compared to current level from across several scenarios; 'Low' = 17%, which is the average of the lowest estimates of total additional investment.

Source: FTSE Russell, September 2022.

# Appendix 1: Sectors and technologies covered by climate investment estimates

| Source | Sector | Technology |
|---|---|---|
| GFANZ | AFOLU, Buildings, Electricity, Industry, Low Emissions Fuels, Transport | NA |
| IEA | Buildings, Electricity Generation, Fuel Production, Industry, Infrastructure, Transport | Bioenergy<br>CCUS<br>Efficiency<br>Electricity system<br>Electrification<br>Fossil fuels<br>Hydrogen<br>Other renewables |
| IIGCC | AFOLU | Diet<br>Nature restoration<br>Agriculture<br>Food waste<br>Direct air capture |
| | Buildings | Buildings retrofitting<br>Heating unit investments<br>Energy-efficient appliances |
| | Electricity | Generation by technology<br>Storage<br>Networks |
| | Fossil Fuel Supply | Oil<br>Natural gas |
| | Industry | Steel by route<br>Chemicals by route<br>Cement by route<br>Non-heavy industry |

| Source | Sector | Technology |
|---|---|---|
| | Low Emission Fuels | Hydrogen by route<br>Hydrogen infrastructure<br>Biofuels |
| | Transport | Road Mobility (BEVs/PHEVs/FCEVs, energy efficiency)<br>EV charging infrastructure<br>EV batteries factories<br>Mining for EV-required minerals<br>Shipping<br>Aviation |
| IRENA | Power Generation Capacity | Hydro<br>Biomass<br>Solar PV<br>CSP<br>Wind onshore<br>Wind offshore<br>Geothermal<br>Marine |
| | Grids and Flexibility | Electricity network<br>Flexibility measures (e.g., storage) |
| | Renewables End Uses and District Heat | Biofuels supply<br>Renewables direct uses and district heat |
| | Energy Efficiency | Buildings<br>Industry<br>Transport |
| | Electrification | Charging infrastructure for electric vehicles<br>Heat pumps |

| Source | Sector | Technology |
|---|---|---|
| | Innovation | Hydrogen - electrolysers and infrastructure<br>Hydrogen-based ammonia and methanol<br>Bio-based ammonia<br>Bio-based methanol |
| | Carbon Removals | Carbon removals (CCS, BECCS) |
| | Circular Economy | Recycling and biobased products |
| | Fossil Fuel and Nuclear | |
| McKinsey | Agriculture | Efficient farming<br>Diet and others |
| | Buildings | Energy efficiency<br>Low carbon heating |
| | Forestry | |
| | Fossil fuel/hydrogen/biofuels | Heat supply/biofuel/hydrogen<br>Oil, gas and coal |
| | Industry | Steel<br>Cement |
| | Mobility | Vehicles<br>Charging and fuelling infrastructure |
| | Power | Power generation<br>Power grid<br>Energy storage |

| Source | Sector | Technology |
|---|---|---|
| NGFS | Energy supply (General) | Biomass<br>Carbon capture and storage<br>$CO^2$ transport and storage<br>Heat |
| | Electricity | Fossil/Fossil with CCS (Gas, Coal, Oil)<br>Biomass<br>Transmission and distribution (T&D); T&D storage<br>Electricity Storage<br>Low carbon (wind, solar, ocean, geothermal)<br>Nuclear<br>Other |
| | Extraction | Bioenergy<br>Gas<br>Coal<br>Oil<br>Fossil<br>Uranium |
| | Liquids | Coal and gas<br>Oil<br>Biomass<br>Fossil / Biomass T&D |
| | Hydrogen | Fossil<br>Non-fossil<br>Other |

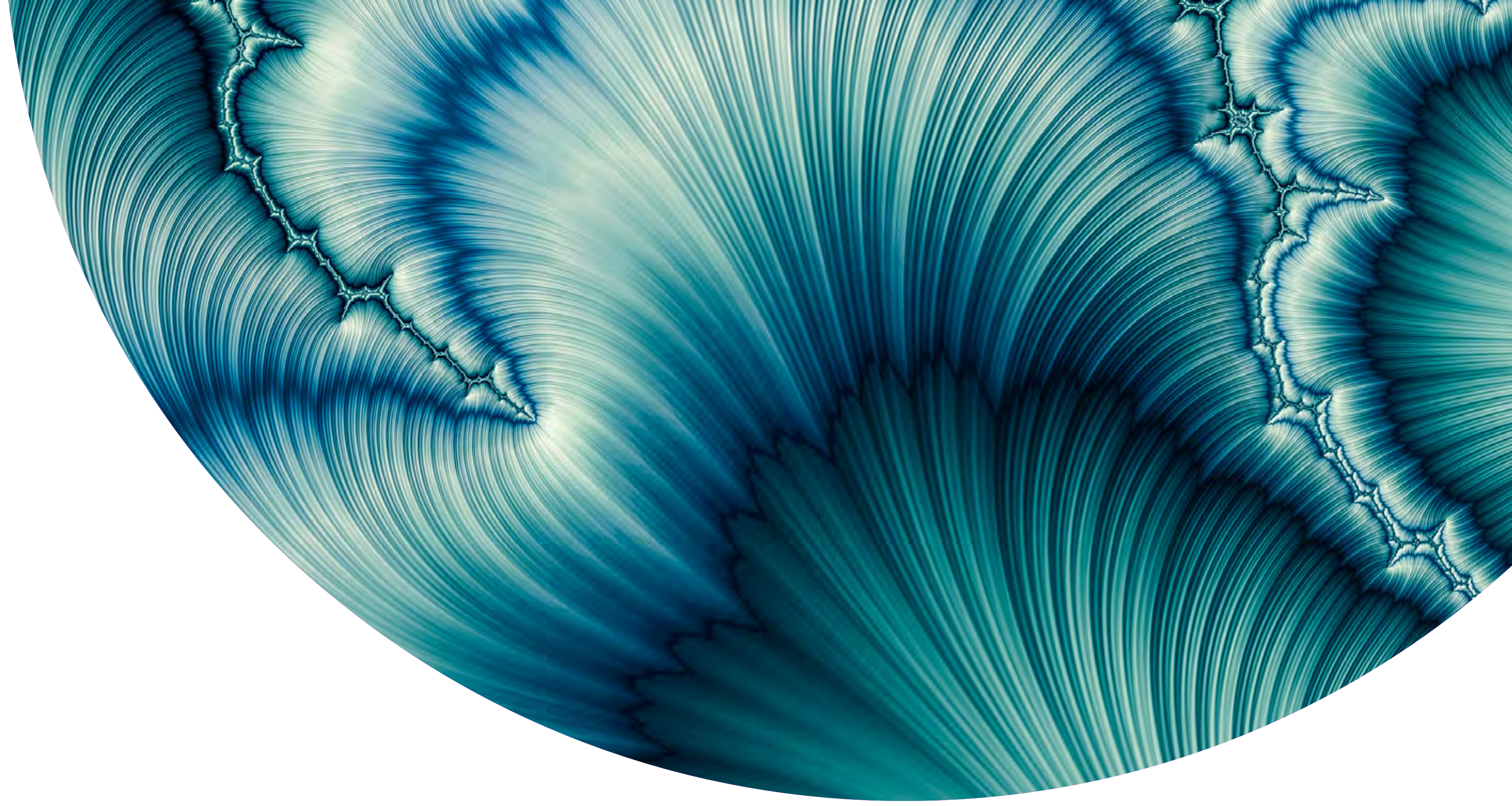
# Appendix 2: Top-down approach assumptions

| Variables | Assumption | Rationale |
|---|---|---|
| Growth of the equity market | 3.7% p.a. during 2020 – 2030 and 3% p.a. during 2031 – 2050. | The relationship between the equity market and the real economy is assumed to remain stable. The growth of the equity market is aligned with the GDP growth. |
| Total investment by 2030 | USD 45 trillion | This is the median of climate investment estimates from McKinsey (USD73trn), IIGCC (USD47trn), IEA (USD44trn), IRENA (USD49trn), GFANZ (USD32trn) and NGFS (USD29trn), excluding fossil fuels. |
| Total investment by 2050 | USD126 trillion | This is the median of climate investment estimates from McKinsey (USD256trn), IIGCC (USD142trn), IEA (USD 127trn), IRENA (USD115trn), GFANZ (USD125trn) and NGFS (USD91trn), excluding fossil fuels. |
| Additional investment | Out of total investment, 27% is additional, which drives the growth of the green economy. The remaining 73% is business-as-usual (BAU) investment, which maintains the size of the existing green economy. | This is derived by comparing total climate investment under NDC scenarios to the required climate investment under 1.5°C scenarios.<br>An average of the estimated additional investment is used from sources that have both appropriate scenarios and public data, including the IEA (35%), IRENA (25%) and NGFS (21%). |
| Investment to revenue multiplier | Every dollar invested in the green economy generates one dollar of revenue – an investment to revenue multiplier of 1. All investment, either private or public capital, flows to the equity market and creates GDP and revenue growth. | IMF research shows that the multiplier for green technologies can be greater than 1 and different green technologies are likely to have different multipliers[30], although there is insufficient data for all climate solutions. The research also holds the assumption that the multiplier effect of capital expenditure is agnostic to whether an investment is public or private.<br>For simplicity and to be conservative, this paper assumes the investment to revenue multiplier as 1 for all green technologies. |
| The timing between investment and revenue generation | Revenues are generated at the same time when the capital is spent. | It is acknowledged that it takes time to implement investment and generate revenues, and assets have different lifespans and probably various multipliers at any point in time. To avoid complicated modelling of the relationship between investment and revenues and reduce further uncertainty, it is assumed that investment and revenues are spent and generated synchronously over the 30-year period. |

30 IMF research suggests that every dollar (private and public) spent on renewable energy can generate 1.1-1.5 dollars' worth of insufficient data on multipliers for all of them economic activity or GDP (for fossil fuel it is 0.5-0.6).

# Appendix 3: Bottom-up approach assumptions and calculations

| ICB Super Sector | Total revenue in 2020 (USD trillion) | GR% in 2020 | Future GR% in 2050 | Explanations of the GR% in 2050 | Growth Rate[1] | Total revenue in 2050 (USD trillion)[2] |
|---|---|---|---|---|---|---|
| Autos & Parts | 3.5 | 11% | 88% | EVs account for 100% car sales by 2050, according to the IEA. FTSE Russell data shows that currently 88% of the green revenues from EVs comes from autos. Assuming autos need to deliver 88% of the 100% green penetration required in vehicles, the future green revenue is 88% (=100%×88%). | 6% | 18.6 |
| Banks | 2.8 | 0% | 0% | Keep stable. | 3% | 7.7 |
| Basic Resources | 2.0 | 8% | 20% | Green revenues of greenest companies (3rd quartile) in the current green economy based on FTSE Russell data. | 4% | 6.3 |
| Chemicals | 1.1 | 14% | 20% | Green revenues of greenest companies (3rd quartile) in the current green economy based on FTSE Russell data. | 4% | 3.6 |
| Construction & Materials | 1.9 | 19% | 43% | More than 85% of buildings are zero-carbon ready by 2050, according to the IEA. FTSE Russell data shows that currently 50% of the green revenues from green buildings comes from Construction & Materials sector. Assuming the sector needs to deliver 50% of the 85% green penetration in buildings, the future green revenue is c.43% (=50%×85%). | 5% | 7.1 |
| Financial Services | 1.8 | 3% | 3% | Keep stable. | 3% | 5.0 |
| Food & Beverages | 1.7 | 2% | 2% | Keep stable. | 3% | 4.6 |
| Healthcare | 2.8 | 1% | 1% | Keep stable. | 3% | 7.8 |



| ICB Super Sector | Total revenue in 2020 (USD trillion) | GR% in 2020 | Future GR% in 2050 | Explanations of the GR% in 2050 | Growth Rate[1] | Total revenue in 2050 (USD trillion)[2] |
|---|---|---|---|---|---|---|
| Industrials | 5.6 | 11% | 40% | Green revenues of greenest companies (3rd quartile) in the current green economy based on FTSE Russell data. | 4% | 20.7 |
| Insurance | 3.7 | 0% | 0% | Keep stable. | 3% | 10.2 |
| Media | 0.6 | 0% | 0% | Keep stable. | 3% | 1.8 |
| Oil & Gas | 4.0 | 3% | 3% | Keep stable. | 3% | 11.3 |
| Personal & Household Goods | 1.8 | 4% | 4% | Keep stable. | 4% | 5.0 |
| Real Estate | 1.2 | 2% | 2% | Keep stable. | 3% | 3.3 |
| Retail | 4.6 | 1% | 1% | Keep stable. | 3% | 12.8 |
| Technology | 3.8 | 10% | 20% | Green revenues of greenest companies (3rd quartile) in the current green economy based on FTSE Russell data. Conservative assumption using 3rd quartile green revenues during 2016-2020. | 4% | 12.1 |
| Telecoms | 1.5 | 2% | 2% | Keep stable. | 3% | 4.1 |
| Travel & Leisure | 0.7 | 10% | 10% | Keep stable. | 4% | 2.1 |
| Utilities | 1.9 | 28% | 82% | 88% of electricity generation should come from renewable sources by 2050 according to the IEA. FTSE Russell data shows that currently 94% of the green revenues from renewable power generation comes from utilities. Assuming utilities need to deliver 94% of the 88% green penetration required in the electricity generation, the future green revenue is 82% (=94%×88%). | 6% | 9.4 |

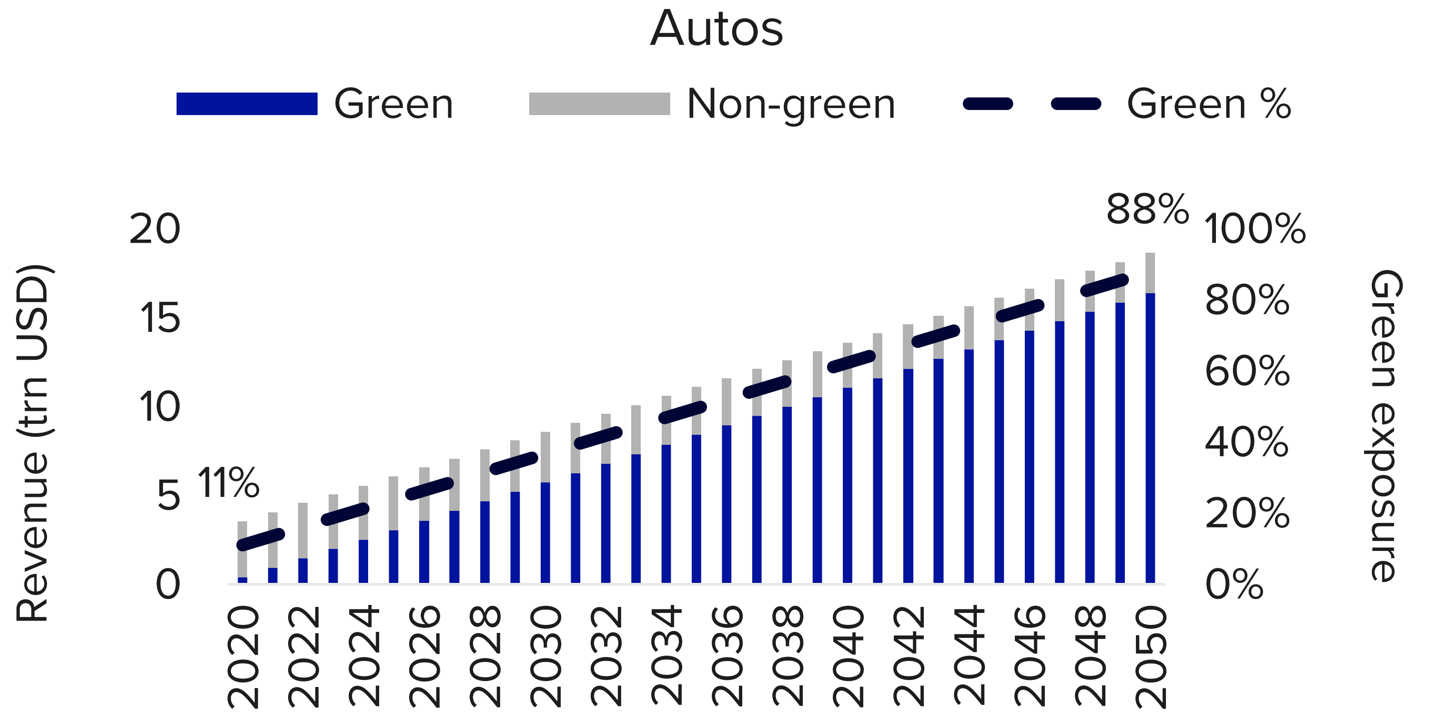
Notes:

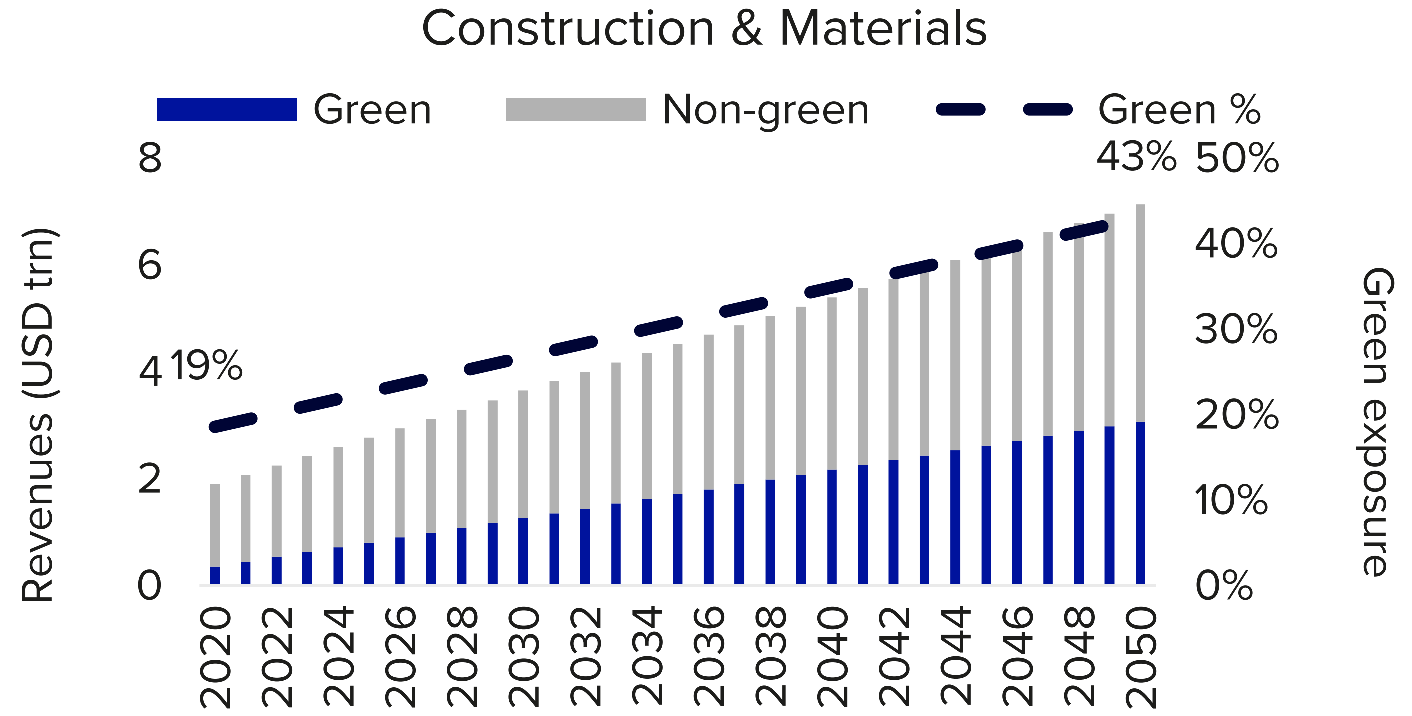
1. Assuming green economy grows at 6% p.a. (according to historical data) and the non-green economy grows at 3.4% (based on the average of the GDP growth between 2020-2030, which is 3%, and between 2030-2050, which is 3.7%[31]), the growth rate of the sector equals to: future GR% × growth rate of the green economy + (100% - future GR%) × growth rate of the non-green economy. For example, the growth rate of Autos & Parts is c. 5.6% (=88%×6%+(100%-88%)×3.4%).
2. The total revenue in 2050 equals to: total revenue in 2020 × $(1+\text{growth rate})^{30\ (\text{years})}$. For example, the total revenue of Autos & Parts is USD 18.6 trillion in 2050 $(=3.5\times(1+5.6\%)^{30})$.

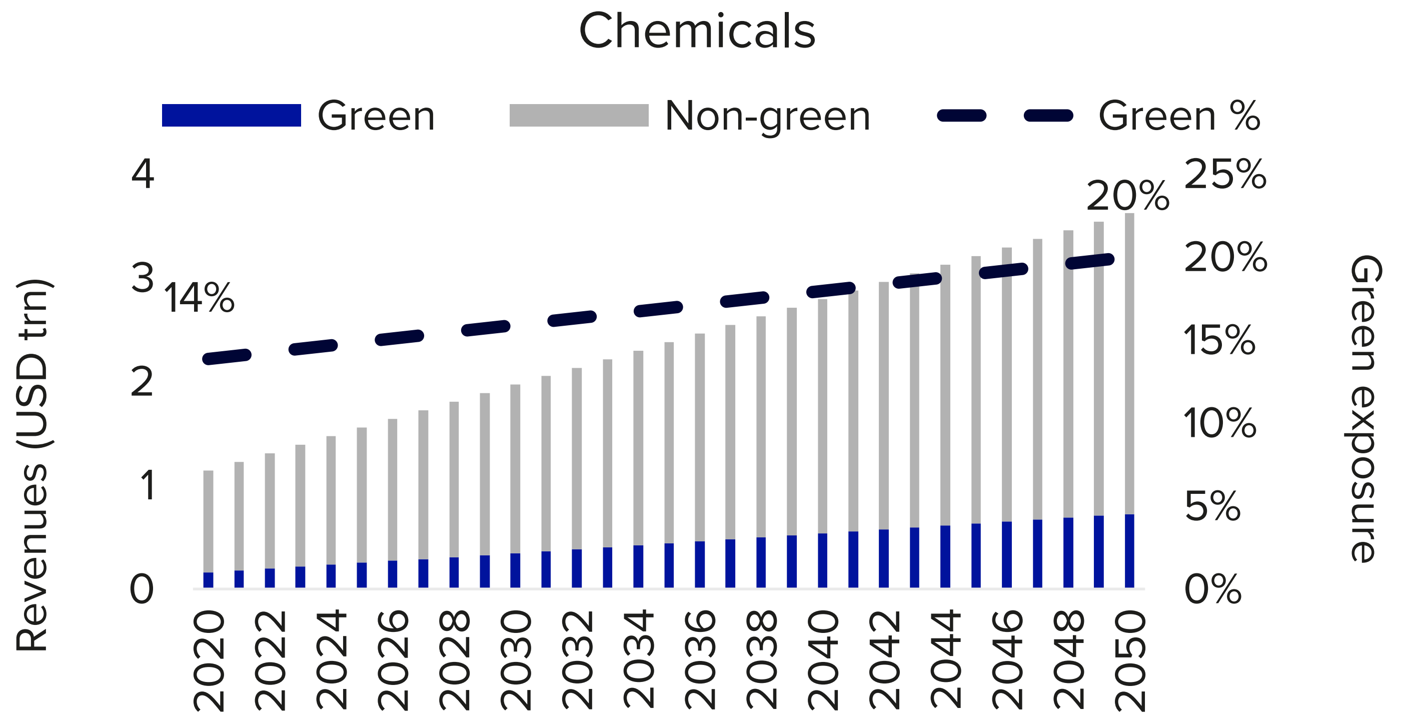
   After aggregation, total revenue in 2050 is USD 151.2trillion, and the green revenues in 2050 is USD 40.8 trillion. Therefore, the overall green economy exposure is c.27%, which is close to the result based on the top- down approach.

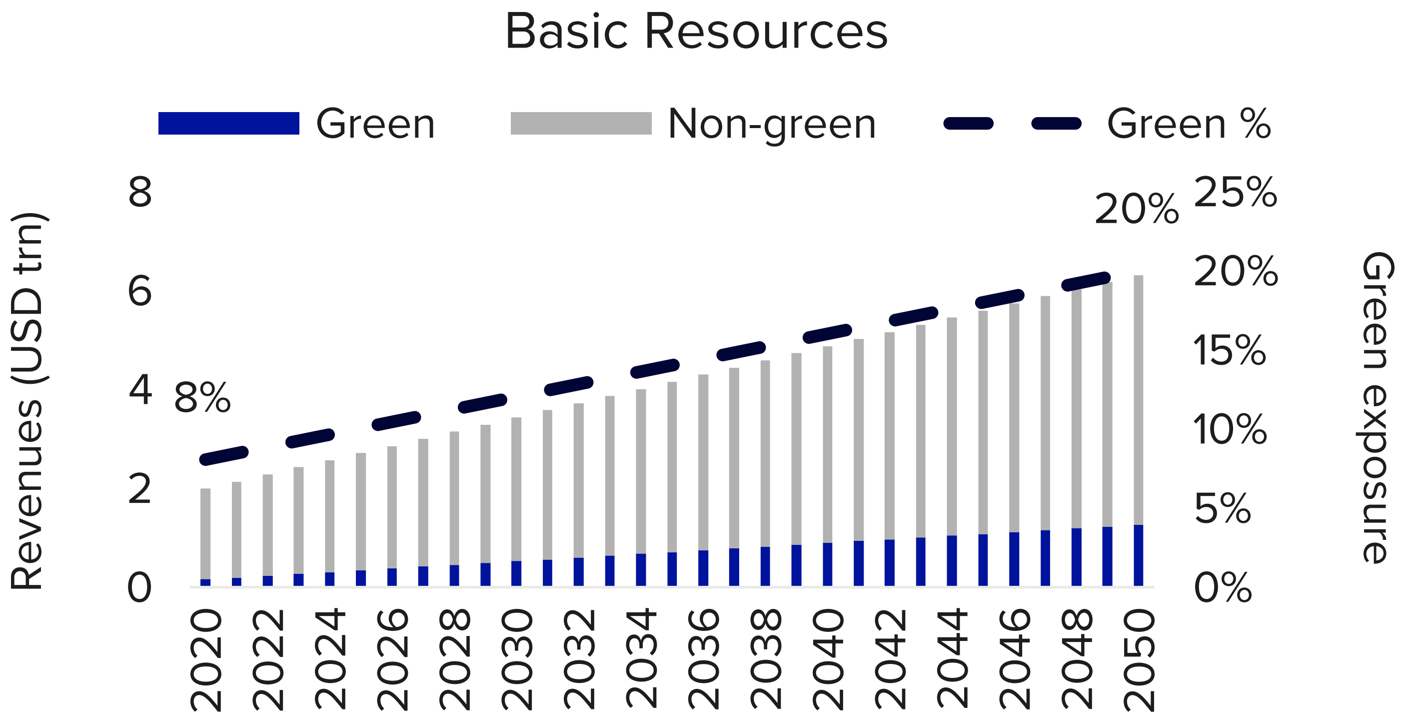
31 International Energy Agency (2021), World Energy Outlook 2021, P96.

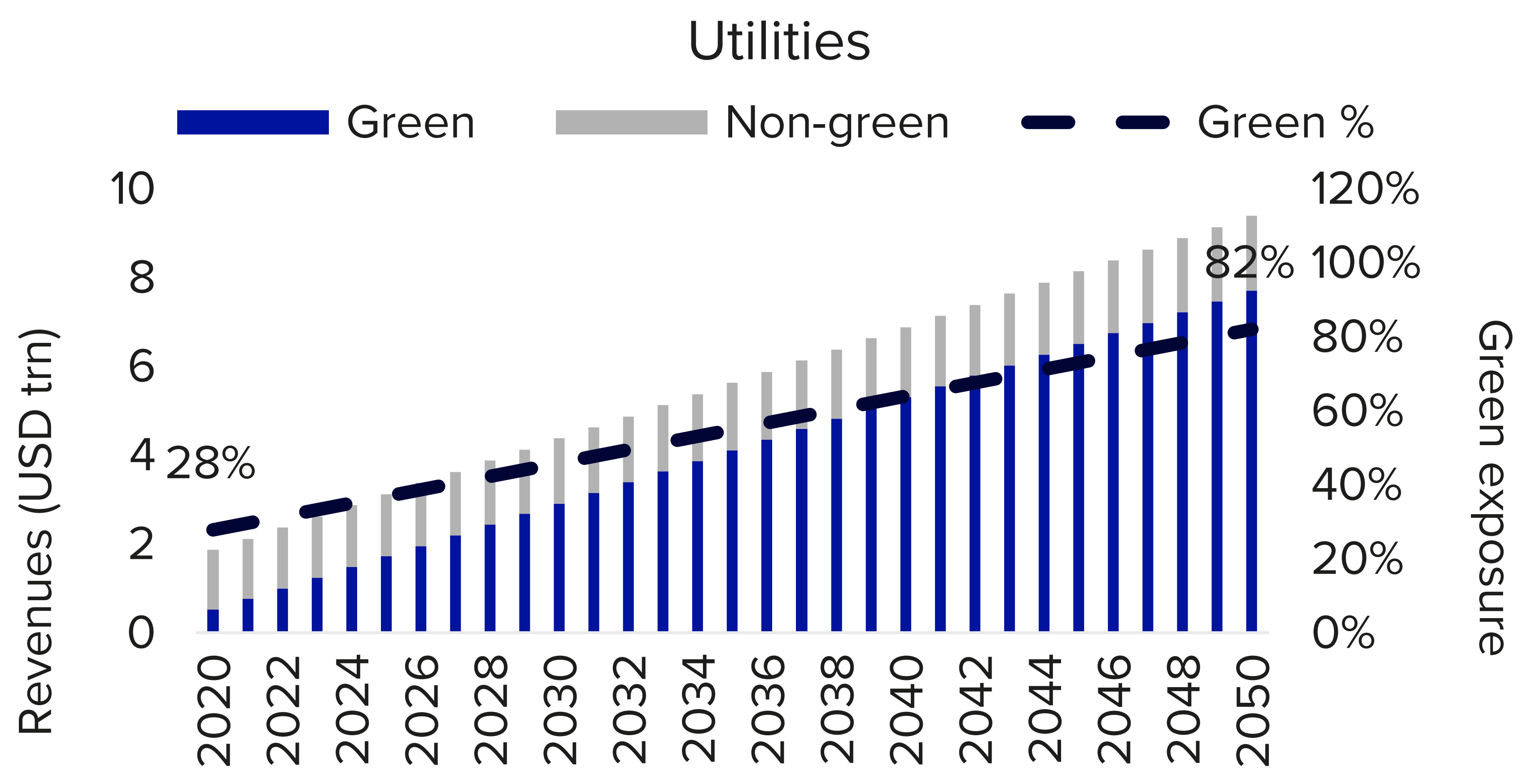
# Appendix 4: Bottom-up approach: green economy exposure at the sector level

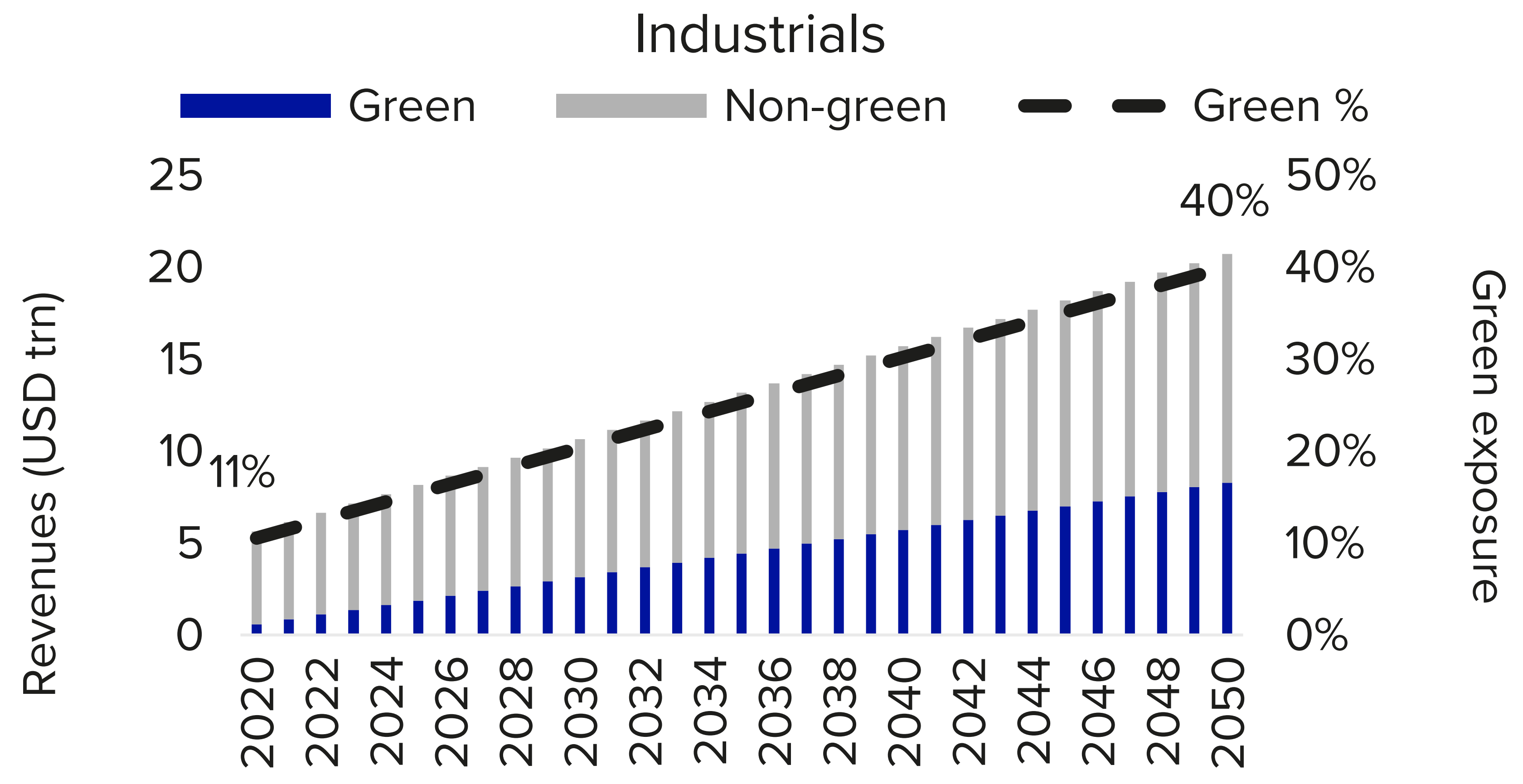


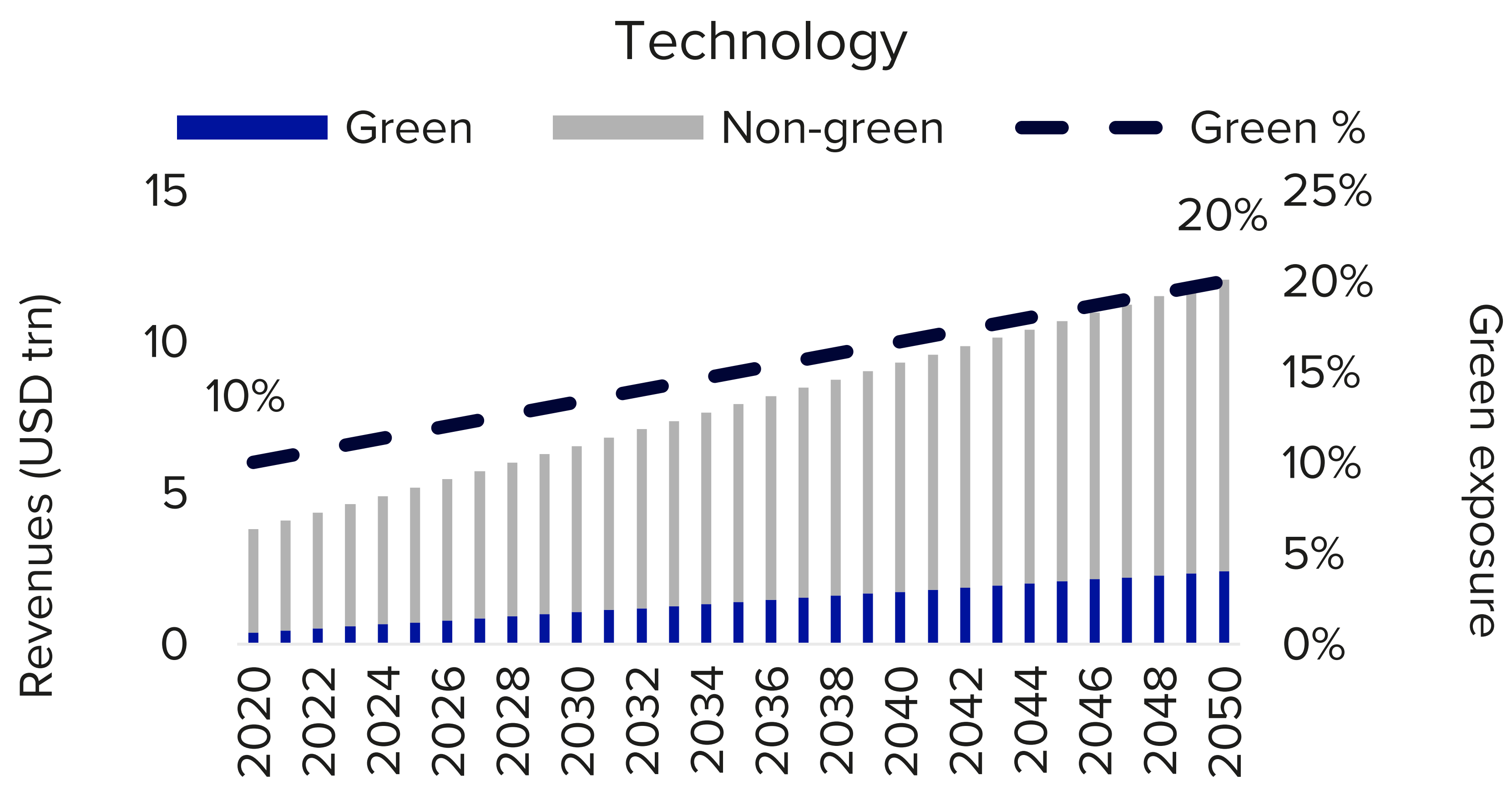






Note: Sectors without any green revenue or where the future green revenues remain at the same level are not shown here. These sectors are Banks, Financial Services, Food & Beverage, Healthcare, Insurance, Investment Instruments, Media, Oil & Gas, Personal & Household Goods, Real Estate, Retail, Telecoms and Travel & Leisure. The other graphs show the green exposure of the FTSE All-World universe in 2020, and estimated green exposure path required in a 1.5°C scenario. Past performance is not a guarantee of future performance.

Source: FTSE Russell, September 2022.

# Appendix 5: Top-down approach with market capitalisation

As discussed in section 4, estimating green economy exposure through the market capitalisation, rather than revenues, requires further assumptions such as price-to-sales ratios, which can be volatile. For a diversified equity portfolio, building on the green revenues, green economy exposure using market capitalisation can be calculated as below:

Market Cap of Green Economy

Future GR% $T_1$ = ( Green Revenues $T_1$ × Price to Sales (Green) $T_1$ ) / ( Market Cap of Green Economy + Non-green Revenues $T_1$ × Price to Sales (Non-green) $T_1$ )

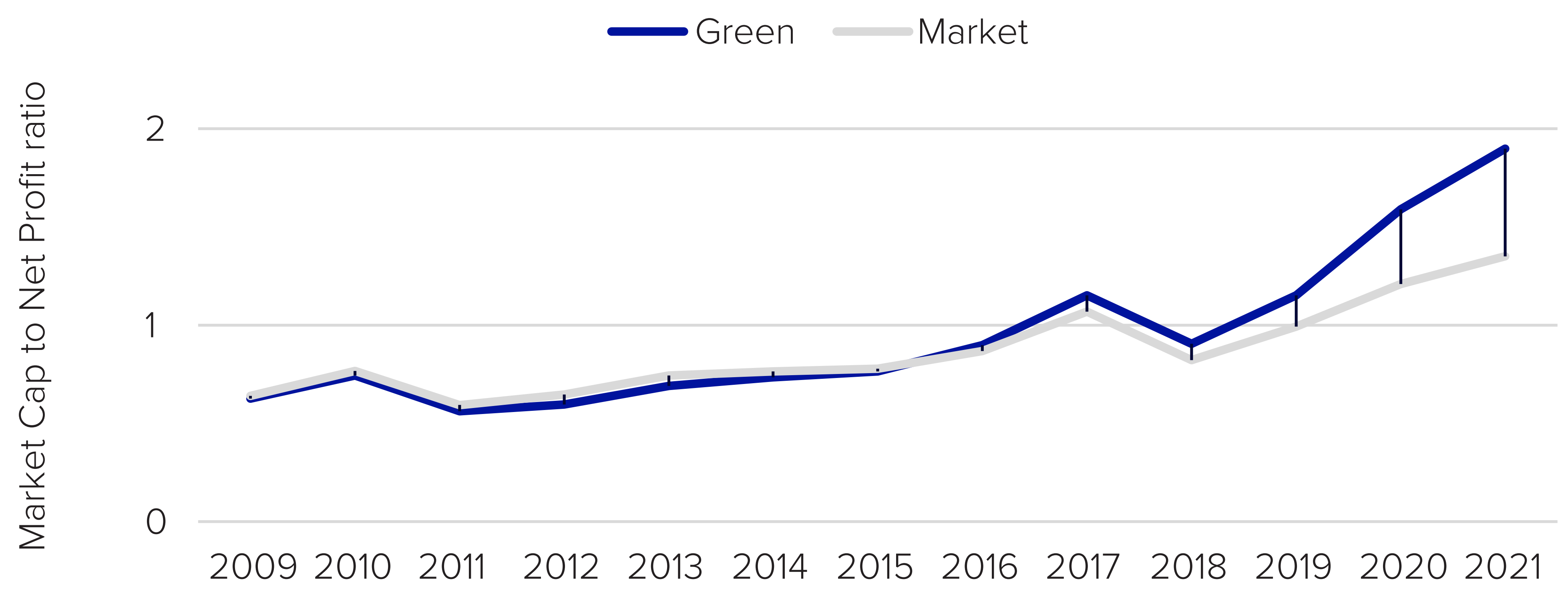
Market Cap of Non-green Economy

Where:

- **Green Revenues $T_1$** = Green Revenues $T_0$ + Additional Investment at $T_1$, whereas Green Revenues $T_0$ = aggregated green revenues of listed companies in the portfolio at $T_0$, calculated as $\Sigma_{i=1}^{n}$ *Company Green Renvenue*$_i$ / $\Sigma_{i=1}^{n}$ *Company Renvenue*$_i$ (as discussed in section 4),
- **Non-green Revenues $T_1$** = aggregated non-green revenues (i.e., revenues from products and services that are not green) of listed companies in the portfolio at $T_1$, based on non-green revenues at $T_0$, calculated as $\Sigma_{i=1}^{n}$ *Company Non green Renvenue*$_i$ / $\Sigma_{i=1}^{n}$ *Company Renvenue*$_i$, and a constant growth rate (as discussed in section 4),
- **Price to Sales** ratio can be estimated using historical data.

Figure 11 shows the historical price-to-sales ratios for both green and non-green economy, which are increasing over time and can be unstable for both the green economy and the overall market. To reduce further uncertainty from making assumptions on market capitalisation versus revenues, this paper uses revenues as the only metric.

**Figure 11. Market capitalization to revenue ratio**



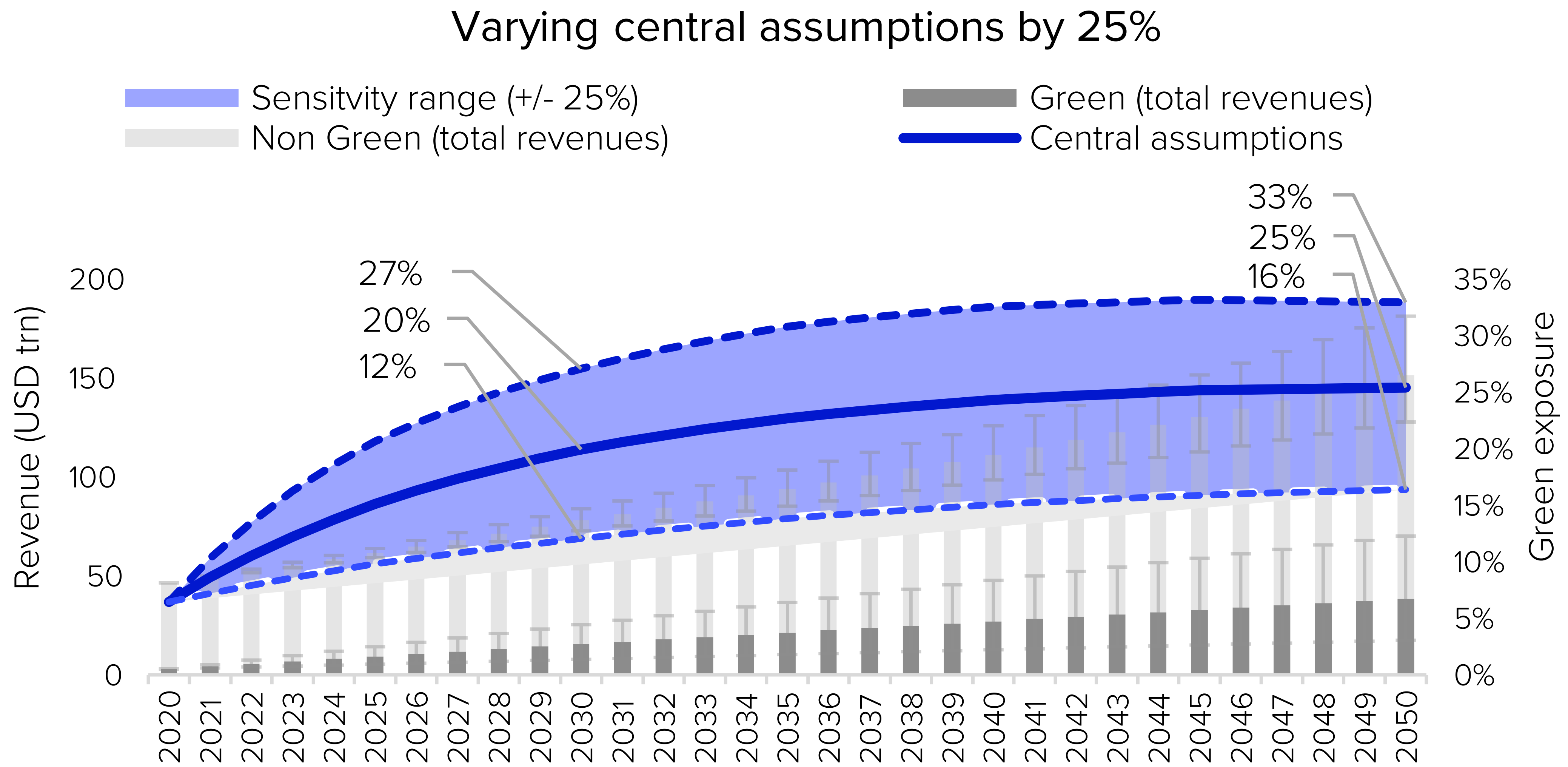

Notes: End-of-year Investable market capitalization divided by the relevant financial year's revenue; for the green economy, market capitalization and revenue are weighted by the green revenue percentage of constituents; Past performance is not a guarantee of future performance.

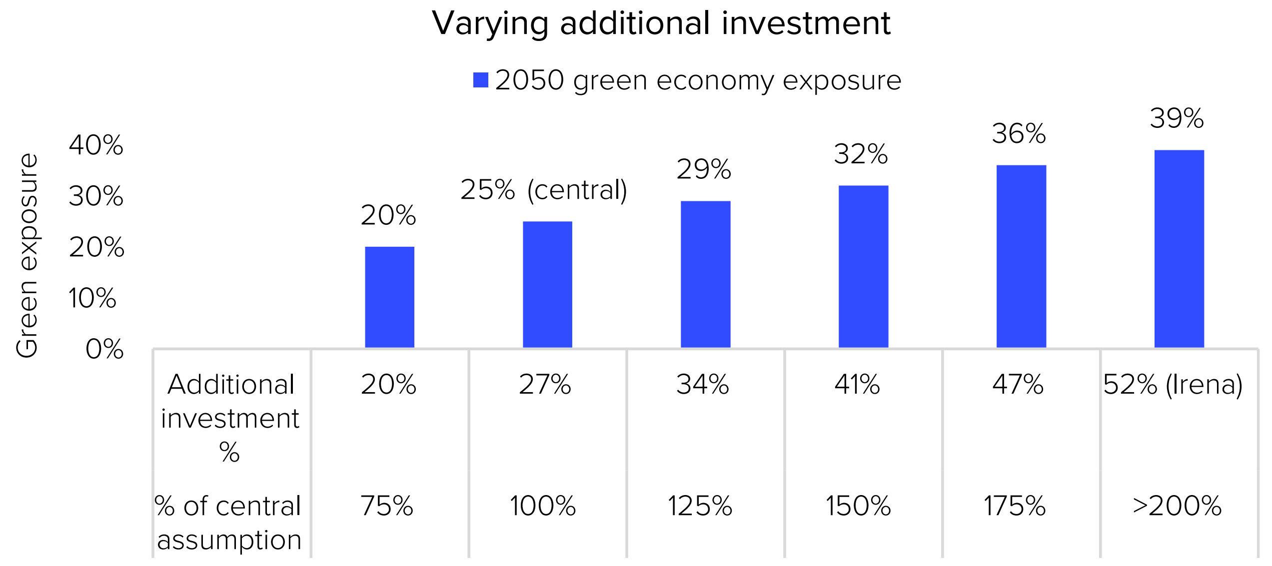
Source: FTSE Russell, September 2022.

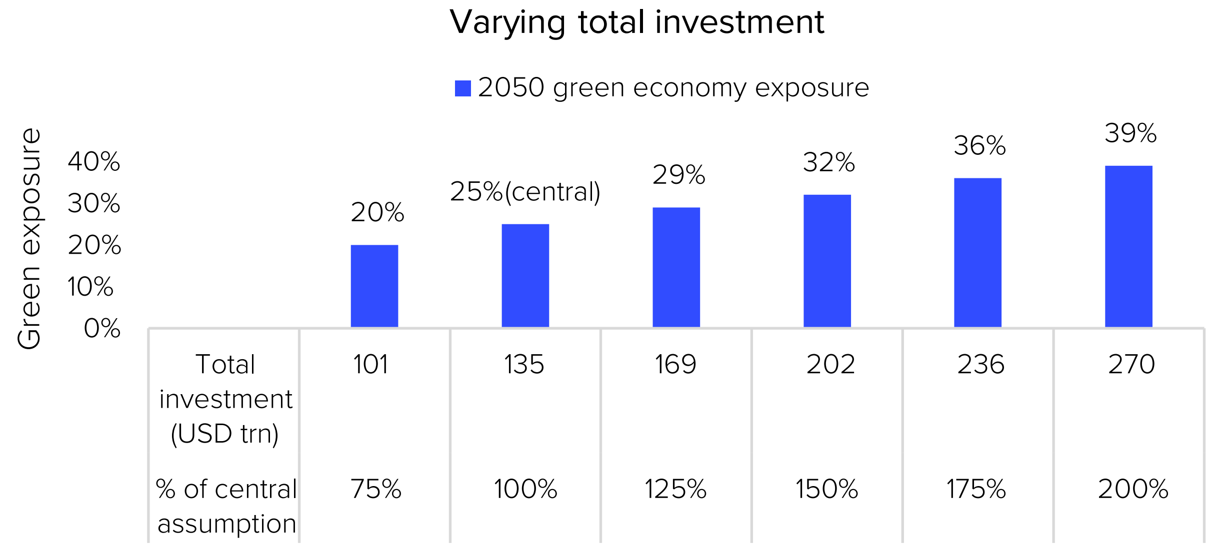
# Appendix 6: Sensitivity analysis

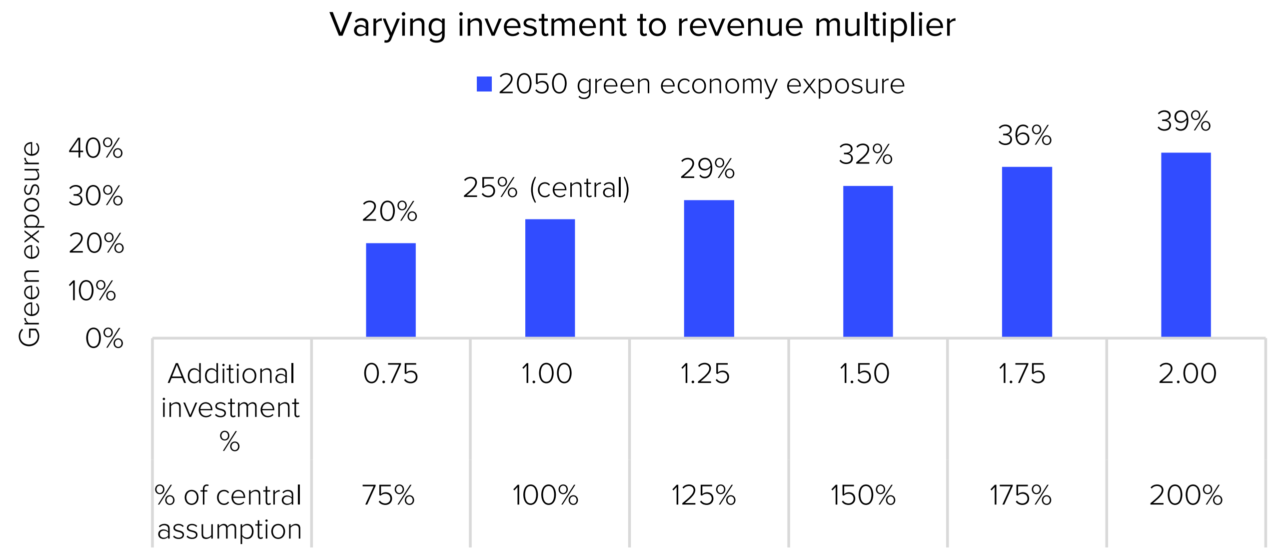
This section summaries the sensitivity analysis. The top left graph shows the green revenue exposure when varying all the assumptions simultaneously by plus or minus 25%.[32] The other three graphs show the results when varying the assumptions individually between -25% and around 200%, with all other assumptions remaining constant.

## Figure 12. Results of the sensitivity analysis




32 The assumptions varied in the top left graph include total investment need, investment to revenue multiplier, GDP growth, and growth vs. maintenance ratio; The black bars reflect the upper and lower bounds of total green and non-green revenues when the assumptions are varied by +/- 25%, in line with the upper and lower bound scenarios of the shaded green area.

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FR2872579/07-23