WORLD TRAVEL & TOURISM COUNCIL

In partnership with:

وزارة السياحة
Ministry of Tourism
Kingdom of Saudi Arabia

THE ENVIRONMENTAL IMPACT OF GLOBAL TOURISM

October 2023

CONTENTS

Introductory letter | H.E. Ahmed Al Khateeb

Minister of Tourism, Kingdom of Saudi Arabia

Climate change is the defining crisis of our time. No place and no community is immune to its devastating consequences.

Rising temperatures are fuelling environmental degradation. And biodiversity is reducing at an unprecedented rate. Coral reefs are dying. Oceans are acidifying. And sea levels continue to rise. Natural disasters, and extreme weather events are also increasing both in frequency and their impact.

Yet change is not happening fast enough, despite increased awareness and many global and Travel & Tourism sector-specific commitments.

Sustainability is at the heart of Saudi Arabia's Vision 2030, at the heart of the Kingdom's future. Our goal is to achieve net zero by 2060. To achieve this, we are ingraining sustainability in everything the Kingdom does. From policy and investment to planning and infrastructure our goal is to accelerate the energy transition and achieve our sustainability goals.

By 2030 we plan to generate 50% of our electricity from renewables. We are taking a holistic approach to sustainability. This approach is embedded into our projects, large and small, from NEOM to the Red Sea and Green Riyadh; as well as in all the work that we do at the Ministry of Tourism.

We believe in the potential of Travel & Tourism to truly make a difference to people's lives whilst being a force for good for the planet.

Globally, Travel & Tourism accounted for over 10% of global GDP and 1 in 10 jobs on the planet in 2019. And as the sector recovers from the pandemic it is fast on its way to surpassing this figure. The sector not only drives economic growth, but also poverty reduction, peace, and tolerance. Tourism has a positive impact on local communities and on people's livelihoods.

Yet, despite its tremendous value, Travel & Tourism has serious environmental impacts. It is responsible for 8% of carbon emissions globally. Travelers can consume two to three times more water than local residents.

Travel & Tourism does not just influence our climate and biodiversity. The sector is deeply affected by it as well. Deteriorating ecosystems put destinations at risk and overwhelm communities.

Our sector not only has the potential but the ability to be sustainable. We must be part of the solution. We must tackle the climate and biodiversity crises proactively. To do this, we need insights and data into the status quo to be able to set clear goals for the years to come. We must help our sector through actionable toolkits, good practices and data.

This is exactly what the Sustainable Tourism Global Center, initiated by Saudi Arabia will do. This unique multi-country, multi-stakeholder global coalition will lead, accelerate, and track the tourism industry's transition to net zero emissions, as well as drive action to protect nature and support communities.

Through this unique environmental impact research, we are undertaking in partnership with the World Travel & Tourism Council (WTTC), we are doing just that. We are enabling countries and industry sub-sectors to gain a clear understanding of where they stand. And this will enable meaningful change.

I am pleased to support this important effort. I believe this will be an invaluable resource for decision makers around the world.

H.E. Ahmed Al Khateeb
Minister of Tourism
Kingdom of Saudi Arabia

FOREWORD

For more than three decades, the World Travel and Tourism Council has published data about the contribution of travel to economies around the world. Ours is a growth sector, currently providing 1 in 11 jobs and more than 9% of the world's GDP. We are immensely proud of this value, knowing that our sector is a catalyst for development in some of the poorest and most remote places on earth, and provides experiences that people treasure.

But today, economic progress alone is not enough. **Travel & Tourism is deeply dependent on nature, and the climate crisis threatens not only vital resources, but the survival of some of earth's most prized travel destinations** - from its rainforests and tropical islands to coral reefs and arctic tundra. That's why, from this year onwards, the WTTC and Sustainable Tourism Global Center (STGC), incubated by the Ministry of Tourism of Saudi Arabia, are proud to publish annual data about not only our sector's economic impact, but its environmental footprint too. In partnership with Oxford Economics we will monitor and track Travel & Tourism's impact, every year, in five areas: **greenhouse gas emissions, energy consumption, water consumption, the production of air pollutants, and the extraction of raw materials**.

This report is the first of its kind and global in scope, drawing on data from 185 countries and territories. The numbers are revealing: **between 2010 and 2019, absolute greenhouse gas emissions[1] from Travel & Tourism have risen at an average rate of 2.5% a year**, reaching 4,131 billion kilos of CO_2 equivalent in 2019. This is around **8.1% of global emissions**. It is an immense challenge, and one that both our sector and global policymakers must take seriously.

The data also tells a hopeful story: over the course of the 2010s, the **emissions intensity of Travel & Tourism consistently declined**, despite rising GDP. In other words, the link between our sector's growth and its carbon footprint has been loosened. Between 2010 and 2019, **Travel & Tourism's GDP grew at an average of 4.3% per year, while emissions grew at 2.5%**. This was largely driven by a slowdown in Travel & Tourism's direct (scope 1) emissions, which rose at an average of just 1.7% per year. More than twenty countries in this study saw their absolute emissions decrease too, despite their expanding tourism economies.

Globally, however, Travel & Tourism is still heavily reliant on fossil fuels. Moving people around the world has always been energy-intensive. This is why WTTC is actively calling on governments to incentivise the production of sustainable aviation fuels (SAF), and set ambitious targets to produce adequate quantities to allow the sector to reach net zero by 2050. The sector has seen only a small shift towards renewable energy worldwide, and low carbon sources made up just 6% of Travel & Tourism's energy consumption in 2019. That said, some parts of the world have witnessed real success stories. Of the 185 countries studied, the Travel & Tourism sector in Kenya experienced by far the largest increase in its low-carbon energy share, owing to substantial growth in Kenya's renewable electricity capacity. The country's investments in wind, solar and geothermal power over the 2010s have helped to almost entirely remove fossil fuels from the grid, having already been considerably decarbonised in 2010.

The report also looks at trends in air pollution, water use and material extraction. These are all fields in which Travel & Tourism needs to go further and faster. In water, Travel & Tourism represented just 5.8% of global consumption in 2019, and there has been a sustained decline in the sector's water intensity over time. Even so, water use remains a key concern, with Travel & Tourism having a significant footprint in parts of the world where water is scarce. Finally, the material requirements of Travel & Tourism grew by 64% in the decade to 2019. This was driven by rising demand for construction materials, with new, tourism-linked capital investment in buildings, machinery, and other infrastructure in recent years. The sector's overall material footprint accounts for 5-8% of global material extraction.

For years, the Travel & Tourism sector has struggled to measure its carbon footprint. Now, for the first time, we not only have enough data to quantify our global emissions, but a framework to monitor them every year. The metrics in this report also link directly to the UN's Sustainable Development Goals, to help both the public and private sector track success over time. We have made good progress so far. But this is a time when partnership – business and government, together – can achieve remarkable things. **For the first time in our sector's history, we now have the data we need. Together, let's use it.**

Julia Simpson
President & CEO,
World Travel & Tourism Council

Gloria Guevara
Chief Special Advisor,
Ministry of Tourism of Saudi Arabia

1. EXECUTIVE SUMMARY

The Travel & Tourism sector is highly dependent on nature. Natural assets from mountains and beaches to coral reefs and savannahs are fundamental drivers of travel. While Travel & Tourism accounts for a significant share of all global economic activity, 10.4% of global GDP in 2019, it is also a contributor to the world's output of greenhouse gases (GHG) and other pollution. And the sector uses significant amounts of energy and natural resources, including water, crops, and construction materials. These dependencies show just how critical it is for Travel & Tourism to protect and conserve natural environments and to reduce humanity's carbon footprint.

But to make progress, we need data that can be tracked. This report estimates the global environmental footprint of Travel & Tourism. The analysis traces all tourism-linked expenditures across 185 geographies, quantifying how this demand affects the natural world. The data is broken into five categories: greenhouse gas emissions, energy consumption, fresh water demands, production of air pollutants, and extraction of raw materials. Estimates are produced for the years 2010 and 2019-21, to identify and explore trends over time. This project is an initial and broad-based assessment of the sector's environmental impact, with the intention that continued monitoring can help us better understand this footprint, and ultimately support efforts to reduce it.

1.1 GREENHOUSE GAS EMISSIONS

Between 2010 and 2019, Travel & Tourism's GHG emissions increased at an average annual rate of 2.5%, reaching 4,131 billion kg of CO_2e in 2019. This measure, broadly aligned to Scope 1-3 of the Greenhouse Gas Protocol, includes both direct emissions from tourism (including international tourists' flights) as well as those produced by suppliers across the value chain. This volume of GHG emissions amounted to around 8.1% of global emissions in 2019, with variance across regions, from 10.9% in Europe to 6.6% in Africa.

Despite this increase, the emissions intensity of Travel & Tourism has declined. While Travel & Tourism GDP rose 4.3% per year between 2010-2019, emissions rose at 2.5% per year over the same period. In other words, the rate of emissions produced per unit of Travel & Tourism GDP (adjusted for inflation) fell by 15% between 2010 and 2019, and then fell a further 10% during the two pandemic years to 2021. At the national level, there are many encouraging developments. 135 countries assessed in this study saw declining emissions intensity during the years 2010-19. Moreover, 15 of those countries saw their absolute Travel & Tourism GHG emissions decrease over the period, despite experiencing expansions of their tourism economy.

Given its reliance on oil-derived fuels, transport dominates Travel & Tourism's Scope 1 GHG footprint. Hospitality, retail and recreation comprise only a relatively small amount of the total. But across the full value chain, GHG emissions come from a much wider range of industries. As well as transport, large shares of Travel & Tourism's GHG footprint are linked to its indirect demands for energy, manufactured goods, agricultural output and construction activity.

Sector Emissions 2019

8.1%
of Global GHG emissions

Relative Growth 2010-2019

+4.3% Travel & Tourism GDP **vs.** **+2.5%** Travel & Tourism GHG emissions

1.2 **ENERGY USE**

Sector Energy use 2019

10.6%

T&T share of global energy consumption

Moving people around the world is energy-intensive. But the Travel & Tourism sector is still less emissions-intensive than the wider economy. While transport - particularly aviation - remains fossil fuel dependent, the primacy of oil-derived products such as petroleum, diesel, and kerosene in its energy mix means that the sector generates fewer GHGs per unit of energy than the rest of the economy (which is still relatively more reliant on coal). This accounts for the gap between the sector's share of global energy consumption (10.6% in 2019) and its share of global emissions (8.1%).

To date, reliance on these transportation fuels has limited the extent to which Travel & Tourism has taken advantage of low-carbon sources of energy. In 2019, low-carbon sources comprised just 6% of Travel & Transport's energy consumption. Combustion-based engines still dominate vehicle fleets, which account for most of Travel & Tourism's energy demand. This continued reliance on fossil fuels means that Travel & Tourism saw only a marginal increase in its low-carbon energy share between 2010 and 2019. This was followed by a slight increase during 2020-21, when steep reductions in global aviation meant that grid-supplied electricity formed a larger share of Travel & Tourism's energy use. Looking ahead, reducing Travel & Tourism's footprint will require both new sources of energy (substituting oil-derived fuel sources with more sustainable fuels and electricity) as well as further reductions in energy intensity.

1.3 **WATER USE**

Sector Water use 2019

5.8%

T&T share of global water use

Travel & Tourism's share of global water use, 5.8% in 2019, is smaller than its GHGs or energy footprint. Still, the sector's water requirements are an important aspect of its dependency on the natural world, from cleaning and cooking in tourism establishments, to cooling vehicle engines and industrial machinery, as well as growing food and textile crops that are ultimately for tourist consumption. Given that most of the world's water use is linked to agriculture, the sector's share of water use in each country is largely determined by how much local agricultural output is geared towards tourism. Indeed, almost three-quarters of the sector's water footprint is accounted for by agriculture and food production. Transportation and hospitality combined make up just 6% of water use.

The sector's water intensity has seen a sustained decline, falling by an average of 2.3% per year during 2010-19. Despite these reductions, much of Travel & Tourism's water footprint is linked to water-stressed regions of the world. These tend to be poorer and hotter countries, with less access to infrastructure that supports efficient water use.

1.4 **AIR POLLUTANT EMISSIONS**

The activities of Travel & Tourism generate air pollutants that have consequences for health and the environment. This report quantifies the sector's direct and indirect production across five measures of pollution, notably: carbon monoxide, nitrogen oxides, both coarse and fine particulate matter (PM10 and PM2.5), and non-methane volatile organic chemicals. Between 2010 and 2019, Travel & Tourism's emissions of air pollution increased across four of these categories**.** Only its carbon monoxide pollution decreased in volume, largely reflecting engine efficiency improvements over the decade. Nevertheless, the increases in Travel & Tourism's pollution were outpaced by growth in its GDP contributions, indicating sustained reductions in pollution-intensity across all five measures. The causes of this pollution range from vehicle combustion engines (which produce carbon monoxide and nitrogen oxides) to fertilizers for food (ammonia).

Country-by-country analysis shows that Travel & Tourism's air pollution footprint is disproportionately concentrated in countries whose populations are already exposed to high levels of air pollution. This trend is particularly pronounced in the case of nitrogen oxides, with 62% of such emissions from Travel & Tourism occurring in countries where exposure is known to be very high. This represents one area where mitigation of Travel & Tourism's pollution could have a substantial effect on alleviating overall levels of harmful exposure.

1.5 **MATERIAL EXTRACTION**

The material requirements of Travel & Tourism grew by 64% in the decade to 2019. This includes demand for things like crops, wood, ores, fossil fuels and other minerals – which may be non-renewable, limited or generated only by ecosystems in healthy conditions. The rise was driven predominantly by demand for construction minerals and materials, reflecting the growth in tourism-linked capital investment in buildings, machinery, and infrastructure during this time. The extraction of fossil fuels also increased markedly over this timeframe, reflecting a clearly unsustainable dependence on these sources of energy.

Travel & Tourism's material footprint accounts for 5-8% of global material extraction, depending on the type of material considered**.** The extent to which Travel & Tourism's material requirements contribute to the over-exploitation of nature depends on the regenerative capacity of each ecosystem. This report estimates that the sector's biomass footprint is divided roughly evenly between countries that are in biocapacity surplus (51%), and those that are in biocapacity deficit (47%).[2] However, this division is more uneven for different types of biomass: for instance, only 22% of Travel & Tourism-linked wild fish catch took place in countries whose fishing ground ecosystems are in biocapacity surplus. This highlights how the global food system can place extreme demands on ecological capacity.

Sector Material Footprint

5-8%

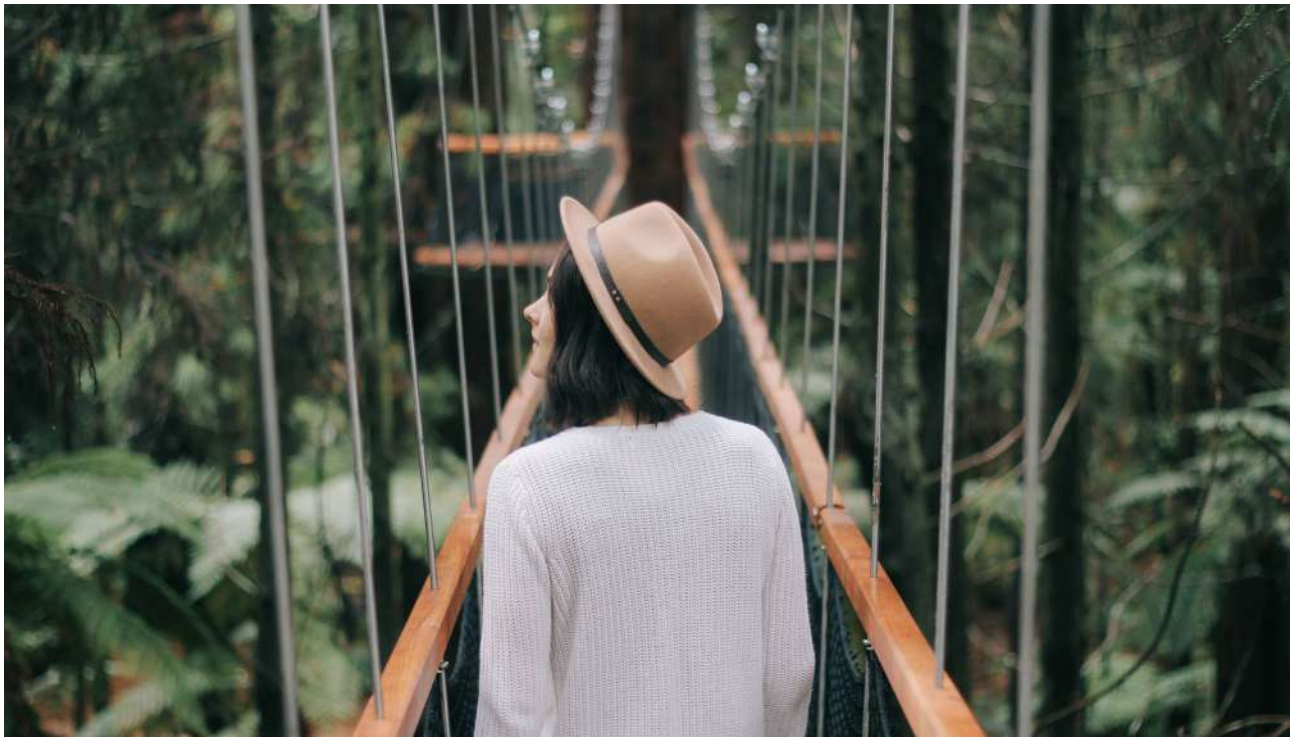
T&T share of global material extraction

Sector's Material needs

+64%

T&T material requirements 2009-2019

This report aims to construct a multifaceted picture of Travel & Tourism's environmental footprint. The framework has the advantage of being global in scope, identifying Travel & Tourism's place in an interconnected world economy, and measuring the associated consequences for the environment of Travel & Tourism activity. Yet, it cannot form a complete picture, as it does not attempt to quantify the significance, dangers or harms that arise from these impacts; nor does it capture all manner of important sub-national variations. In this context, this report provides a conservative appraisal of the scale and structure of challenges at hand, with a view to building greater awareness and consensus toward mitigation efforts in future.



2. INTRODUCTION

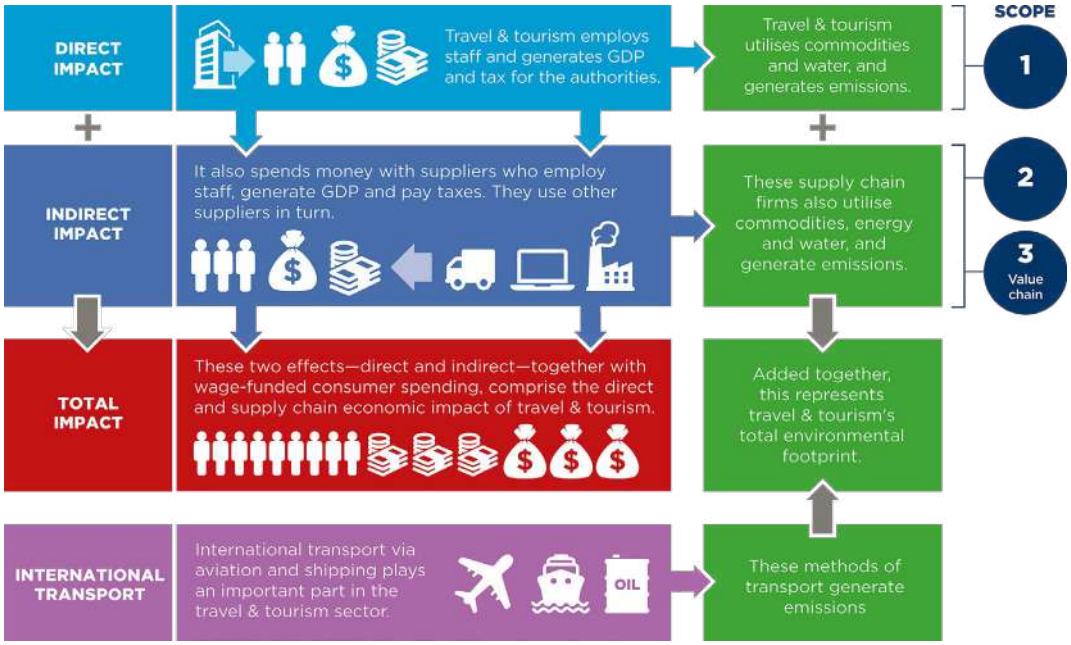
The global economy is deeply intertwined with nature, and dependent on natural resources. Yet the current climate and biodiversity crises created by our economic activity are altering life as we know it for millions of people around the world. Continuing with business-as-usual risks breaching environmental tipping points. Calls for serious and dramatic changes are getting louder, and steps – albeit tentative in places – are being taken to reverse course. But meaningful change will only happen with the right measurement: data that is accurate, global, and can be tracked over time.

The Travel & Tourism sector is more dependent than most on the natural world. In addition to relying on the resources provided by nature, nature itself is often the product being sold. Beaches, mountains, forests, deserts, savannahs and many more ecosystems attract millions of visitors a year. For Travel & Tourism, protecting the natural world is a matter of survival.

This report offers the first global assessment of Travel & Tourism's environmental footprint, spanning 185 countries and territories for the years 2010, 2019, 2020 and 2021. It examines the sector's greenhouse gas emissions (GHGs), energy use, air pollution, water use and material extraction. The timeframe selected includes the COVID-19 pandemic, which was devastating for the Travel & Tourism sector, resulting in a 49.4% fall in the sector's contribution to global GDP between 2019 and 2020.[3] While the relaxation of restrictions saw the activity supported rebound by 24.7% in 2021, this is still well below pre-pandemic levels. Despite the pandemic effects, insights can still be gained as to how the sector's environmental footprint has changed over the past decade. By focusing on the intensity of the environmental impact relative to Travel and Tourism's activity – for instance, emissions per dollar of GDP supported, or energy use per bed night – this research is able to look beyond the distortions of the pandemic.

2.1 MEASURING THE ENVIRONMENTAL IMPACT OF TRAVEL & TOURISM

Fig. 1. Measuring Travel & Tourism's environmental footprint using the GSM



This study uses Oxford Economics' *Global Sustainability Model* (GSM), an environmentally extended input-output model of the global economy. This framework enables the mapping of Travel & Tourism's economic footprint[4] into an associated environmental footprint. The overall framework of this mapping is illustrated in the diagram above.

The green boxes in the chart above represent the environmental impacts and dependencies that are measured in this study. Across each of these environmental domains, the report appraises Travel & Tourism in three categories:

- The sector's **direct impact**, created by sources owned or controlled by businesses and industries that directly serve tourists. These encompass the GHG emissions from vehicles in the transport sector, the water used by hotels and restaurants during their services, or the energy and materials consumed by manufacturers of goods for sale to tourists.
- The impacts in the Travel & Tourism **value chain** – notably, the environmental consequences of the industry's purchase of goods and services, such as electricity, raw materials, equipment and services. In the case of GHGs, this category is equivalent to Scope 2 and Scope 3 of the Greenhouse Gas Protocol.[5]
- The environmental implications of **international transport** (see following box).

The process of mapping Travel & Tourism's environmental footprint at a global level is complex. The starting point of the assessment was countries' tourism satellite accounts (TSAs), which detail the composition of the Travel & Tourism sector on an industry-by-industry basis, using the expenditure in each industry linked to Travel & Tourism. These expenditure values are mostly equivalent to the activity supported by the sector (for instance, expenditure on accommodation becomes the hotel's revenue). However, retail expenditure is an exception, being split between the value retained by the retailer and the value received by the manufacturer. For example, a $5 souvenir may earn the retailer $1, while the manufacturer receives $4. Breaking down the data in this way helps to map the environmental footprint of the sector more accurately, by avoiding duplication across industries.

Once all spending linked to Travel & Tourism is correctly allocated, the GSM uses environmental intensities to translate the revenue into categories (e.g. GHG emissions, or water use). These intensities are derived from global environmental datasets published by international organisations, along with national economic accounts.[6] They are calculated on an industry-by-industry and country-by-country basis.[7] Completing this process for all the direct revenue identified under the TSA enables the estimation of Travel & Tourism's direct environmental footprint.

However, to estimate Travel & Tourism's full environmental footprint, the sector's value chain must be mapped too. This is achieved with a combination of the modelling undertaken for the *Travel & Tourism: Economic Impact 2022* analysis and the GSM. Using these frameworks, all activity that is stimulated in the global supply chain of the Travel & Tourism sector in each country can be identified and disaggregated by industry sector. These revenue values can then be translated into environmental footprint values - the sum of which represents the total value chain footprint for Travel & Tourism.

Because the aggregate data can be broken down both by industry and by country, it is also possible to estimate the extent to which emissions are produced domestically or 'exported' abroad. This allows the tracking of emissions and supply chains across borders, and enabling greater accountability.

INTERNATIONAL TRANSPORT

This research includes a country-by-country allocation of the global GHG emissions and air pollutants linked to international flights and cruises. Given that these emissions occur above international waters, they are excluded from national inventories, and so are not captured in the modelling framework. As such, these have been allocated among the 185 geographies. The motivation for this allocation was not to assign *responsibility* for these emissions to individual nations, but rather to provide greater detail beyond global figures, and present a more comprehensive view of tourism's environmental footprint.

- This allocation method for aviation uses an origin-destination approach, with an adjustment to capture the role of hub airports. Drawing on the OECD's Air Transport CO_2 Emissions database, emissions from international passenger flights were divided into origin and destination countries. The assignation was based on detailed OAG flight data using individual journey legs, meaning that routes passing through a hub airport saw 50% of that leg's emissions attributed to the nation of the hub airport.

Estimates for total global cruise emissions were based on the Scope 1 reporting of major cruise ship companies. The analysis uses emissions data from major providers, along with their market share, to estimate the emissions for the entire international cruise industry. These emissions were then allocated among countries according to their share of global cruise passengers, drawn from Oxford Economics' Global Travel Service database.

2.2 STRUCTURE OF THIS REPORT

This report is split into five main chapters:

- **GHG Emissions** (chapter 3),
- **Energy Use** (chapter 4)
- **Water Use** (chapter 5)
- **Air Pollution** (chapter 6)
- **Materials Use** (chapter 7).

Each chapter sets out Travel & Tourism's footprint in both absolute and relative terms, explores recent trends and drivers, and compares the sector against the rest of the economy where possible. The analysis also examines how the footprint differs between regions and income groups, providing specific country examples.

3. TRAVEL & TOURISM'S GREENHOUSE GAS EMISSIONS

Greenhouse gas (GHG) emissions over the last century have created a climate crisis. Average temperatures have increased by 1.1°C, and the Intergovernmental Panel on Climate Change's (IPCC) most recent report warns that the world will hit 3.2°C of warming by the end of the century if action is not taken to drastically, and rapidly, change course.[8] Climate change is already significantly harming human health, the economy, and global security. Further increases in warming will only worsen these effects and increase the risk of breaching tipping points in the climate system.

Alongside other sectors, Travel & Tourism emits greenhouse gases that contribute to climate change. This chapter explores the extent of those emissions. While travel activities produce a range of gases, this report will analyse emissions in kilograms (kg) of carbon-dioxide equivalent (CO_2e) as this metric is commonly used to compare gases based on their warming potential.[9]

Travel & Tourism's GHG footprint is categorised in accordance with the Greenhouse Gas Protocol, providing a comprehensive international standard for measuring and managing GHGs,[10] and a framework for companies or industries to assess their carbon footprint:

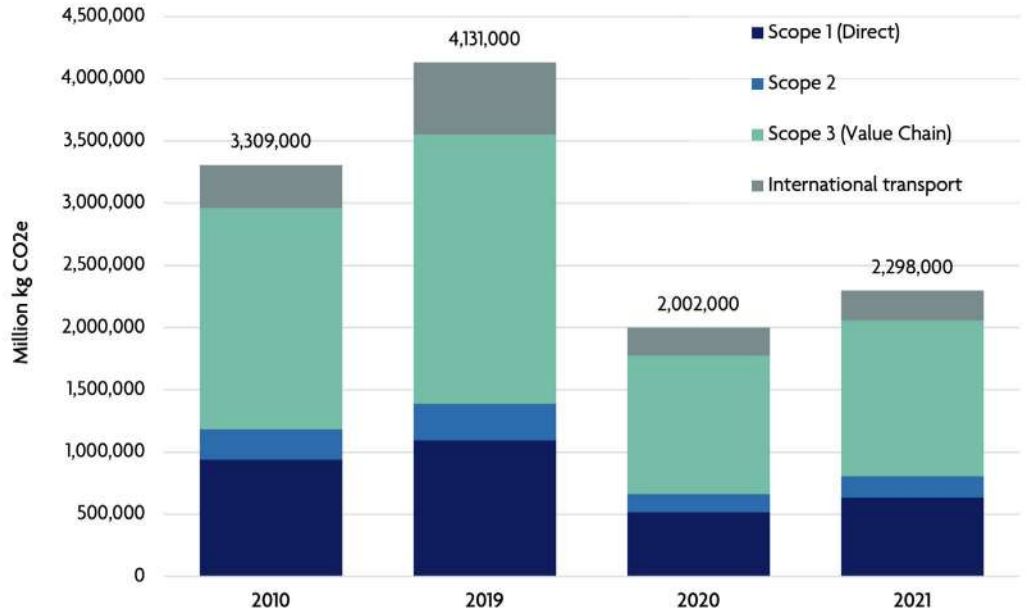
- **Scope 1** emissions include the direct emissions from Travel & Tourism providers. Emissions related to international transport are reported separately.
- **Scope 2** emissions describe the indirect emissions of Travel & Tourism, resulting from the energy the sector uses which is produced off-site, mainly electricity. These emissions depend both on the amount of energy used by the tourism sector, and the types of fuels used.
- **Scope 3** emissions are the indirect emissions that occur along tourism's wider value chain. This can include for instance the use of fossil fuels or fossil-fuel based electricity in the production of inputs, the use of fossil fuel-based modes of transportation to move inputs around the value chain, and emissions in the production of food products.[11]

3.1 TOTAL GHG EMISSIONS LINKED TO TRAVEL & TOURISM

Between 2010 and 2019, Travel & Tourism's GHG emissions increased at an average annual rate of 2.5%. This broad measure of Travel & Tourism's GHG footprint, encompassing its combined Scope 1, 2 and 3 as well as emissions from international transport, reached 4,131 billion kg of CO_2e in 2019.

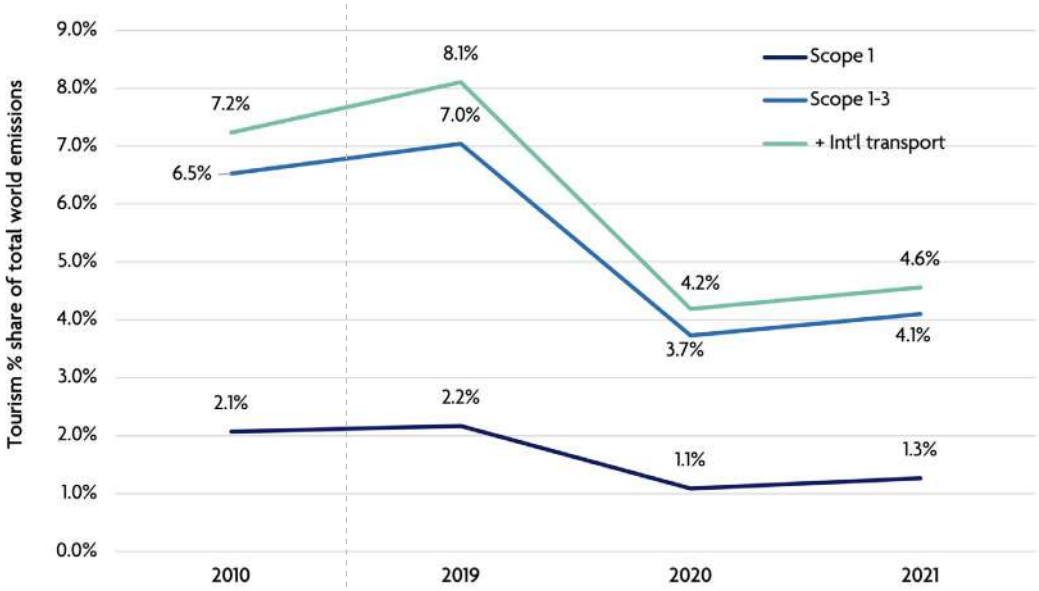
Travel & Tourism emissions decreased significantly during the pandemic, by slightly more than half in 2020, before the removal of restrictions in 2021 saw total emissions increase by 15%, to 2,298 billion kg of CO_2e. This was equivalent to around 56% of its 2019 levels. The emissions pattern from 2019-21 mirrors the dramatic changes in the sector's overall economic footprint: Travel & Tourism's GDP footprint in 2021 was around 62% of its 2019 level.[12]

Fig. 2. Travel and Tourism's Scope 1, 2 and 3 emissions



The contraction in Travel & Tourism during 2020 was far sharper than the downturn in the global economy. As such, the broadest measure of Travel and Tourism's emissions (including Scopes 1-3 and international transport) accounted for 8.1% of global greenhouse gas emissions in 2019. During the pandemic this fell to 4.2% in 2020, rising slightly to 4.6% in 2021 – well below its 2019 share.

Fig. 3. Travel & Tourism's share of total global GHG emissions, by scope



Given the unique circumstances of recent years, it is important to look beyond dramatic annual swings to identify the sector's environmental performance. Over the course of the 2010s, the sector saw a 'decoupling' between its output and emissions, with Travel & Tourism GDP rising by an average of 4.3% per year, while emissions rose at 2.5% per year.[13] This was largely driven by relatively lower growth in Travel & Tourism's direct (scope 1) emissions, at an average rate of 1.7% per year. Meanwhile, emissions related to international transport grew by 5.9% per year over the same period.

The extent of this decoupling is fundamentally connected to the underlying emissions intensity of Travel & Tourism, which declined consistently over the years 2010-21 across the 185 nations measured (see Fig. 4). This illustrates how the sector's kilograms of CO_2-equivalent emitted per unit of GDP declined across all scopes during the decade, and the pandemic period. This was driven by both decreases in the emissions intensity of tourism's own direct (Scope 1) activities, as well as a decline in the emissions intensity of the wider global economy supporting the Travel & Tourism value chain (Scope 1-3). The emissions intensity of Travel and Tourism's own activities fell by an average of 2.4% per year from 2010 to 2019, while the emissions intensity along its value chain fell by a comparable 2.1% per year over the same period.

Fig. 4. Emissions intensity of Travel & Tourism over time

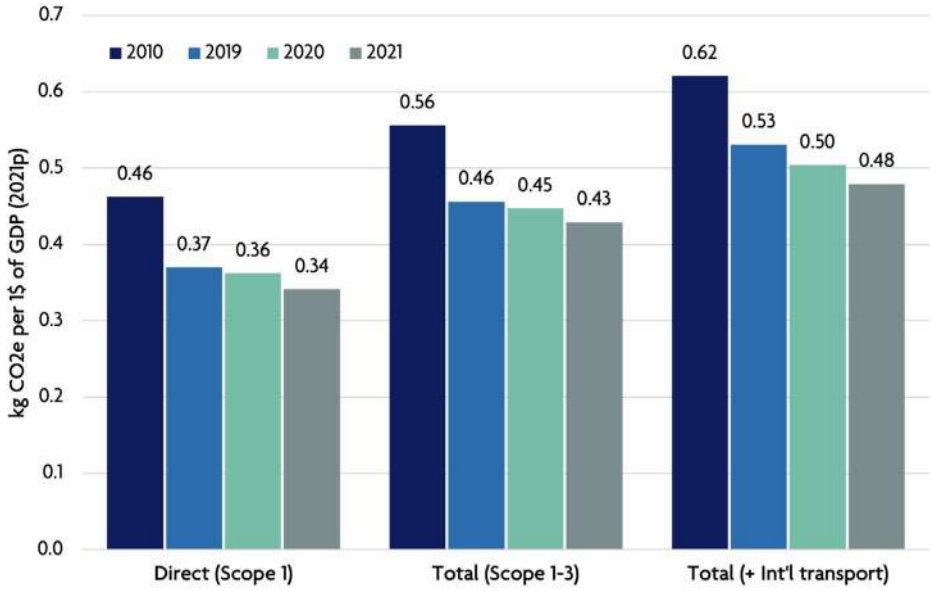


Fig. 5. Average growth in Travel & Tourism GDP and emissions by country, 2010-19 14

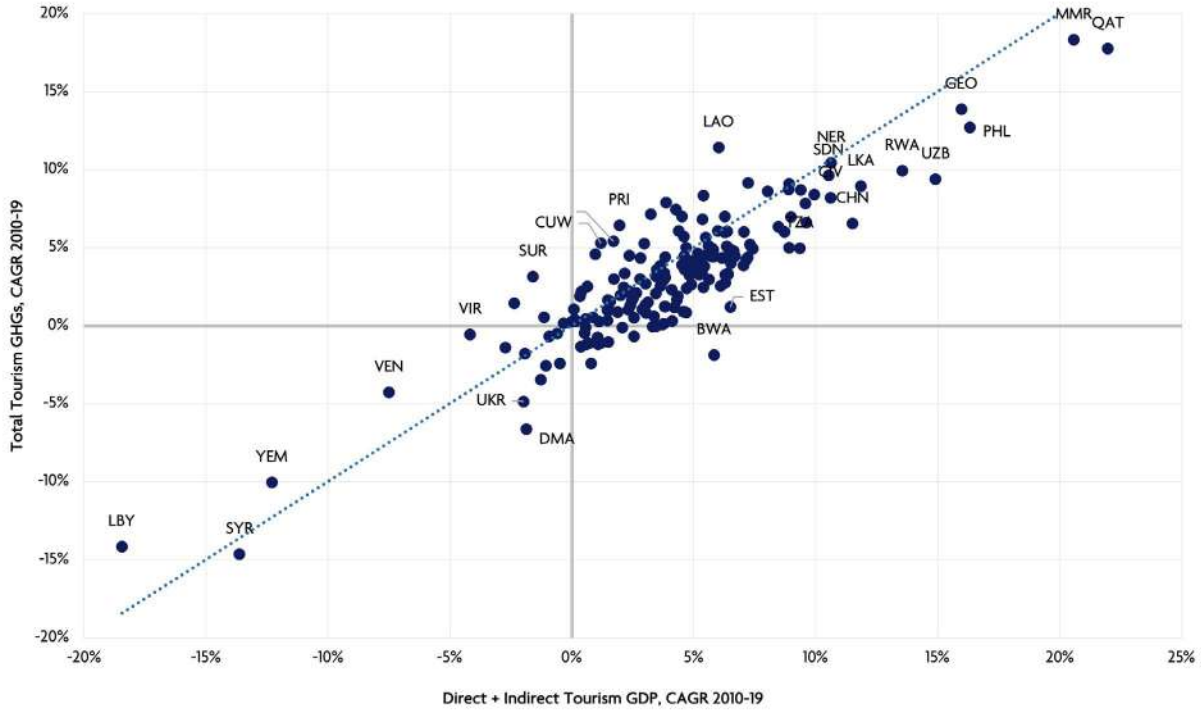
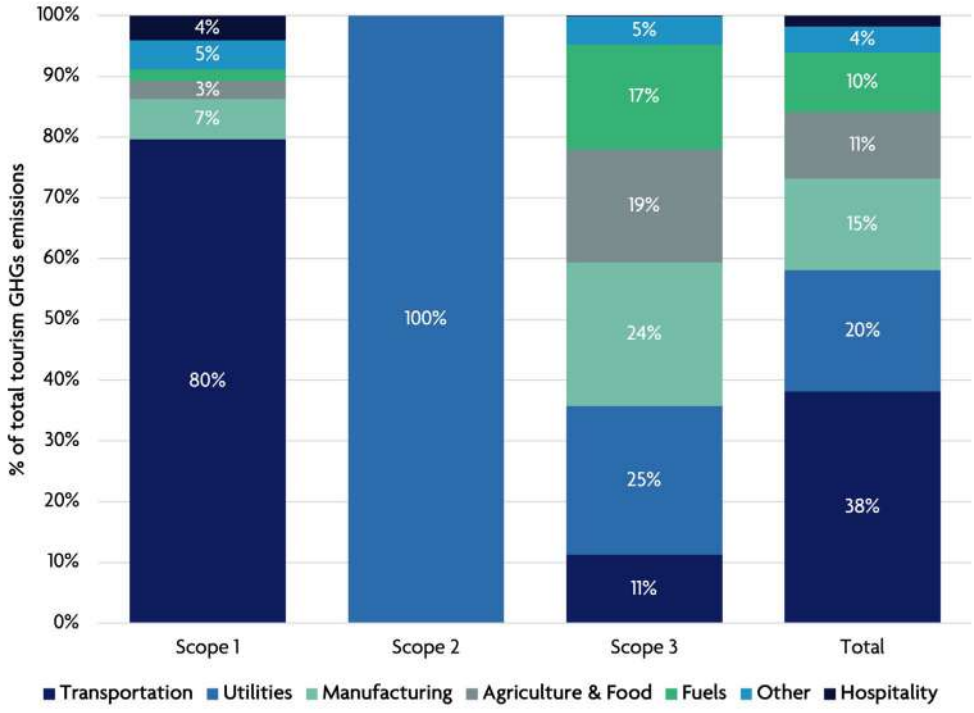


Fig. 5 charts country-level changes in Travel & Tourism GDP against emissions growth for each of these geographies. Looking at Travel & Tourism in the countries below and to the right of the red line, the decoupling can be seen to some extent: either their Travel & Tourism GDP grew at a faster rate than GHG emissions, or their tourism GDP fell at a slower pace than tourism emissions. 135 of the 185 countries in this study fell into this bracket, accounting for 94% of Travel and Tourism's total GDP contribution in 2010.

Variation in country-level measures of Travel & Tourism's emissions intensity is closely related to two key factors: energy sources available to the sector, and the sectoral composition of Travel & Tourism (and its value chain) in each country. While transport emissions dominate the sector's Scope 1 GHG footprint, wider measures reveal the diverse mix of industries contributing to Travel & Tourism's emissions. Fig. 6 shows the global sectoral breakdown of Travel and Tourism's Scope 1, 2, and 3 emissions (including those generated by international transport). This breakdown reveals that its GHG emissions are linked to all forms of tourism-related expenditures. Scope 2 emissions are contributed by the utilities sector, but the rest of the sector's value chain (captured in its Scope 3) presents a far more dispersed selection of industries.[15]

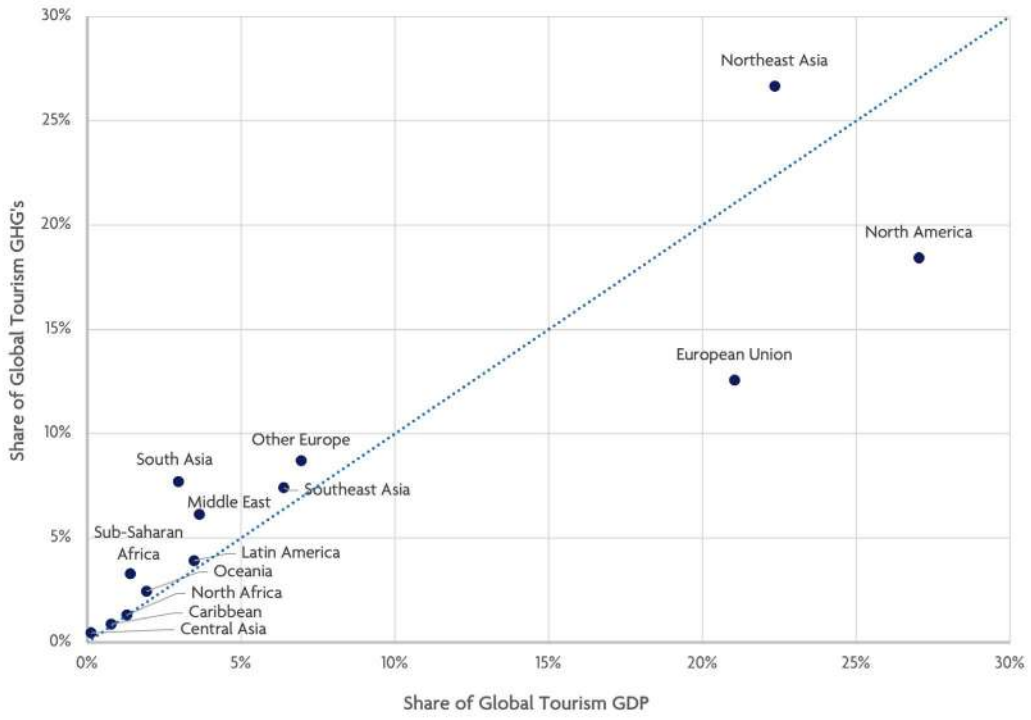
Fig. 6. Sectoral breakdown of Travel & Tourism's Scope 1, 2, and 3 emissions, 2019[16]



3.2 **BREAKDOWN BY REGION**

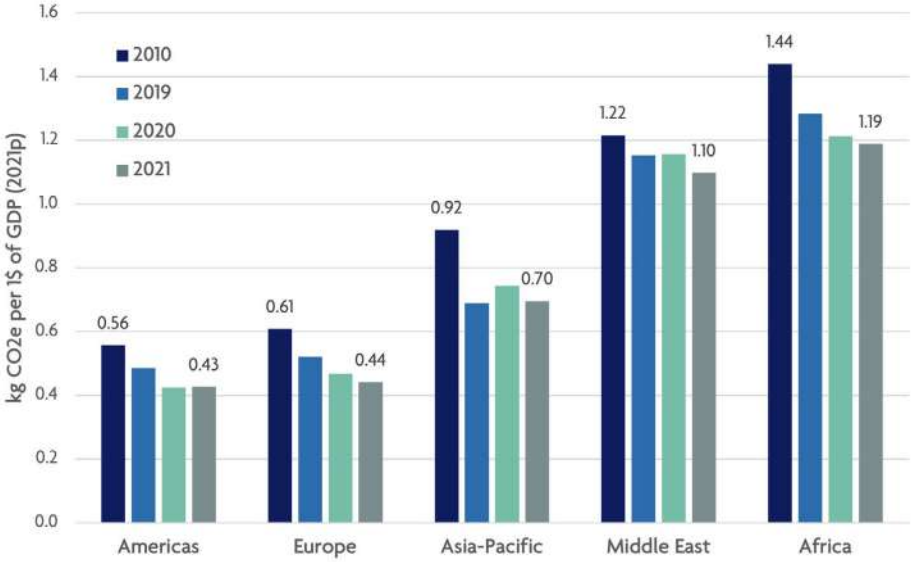
The Travel & Tourism sector has significant variation in its structure and footprint across regions and income groups. The analysis attributes GHG emissions to the country whose tourism is being supported, whether those emissions occur within that country itself, or are exported along international value chains. As such, patterns in the absolute emissions of Travel & Tourism largely follow patterns of where tourism itself is concentrated. But this relationship is not one-to-one, as shown in Fig. 7, with some regions having notable differences between their shares of tourism GDP and emissions. These deviations reveal underlying differences in environmental performance across regions.

Fig. 7. Share of travel and tourism GDP and emissions by sub-region, 2019[17]



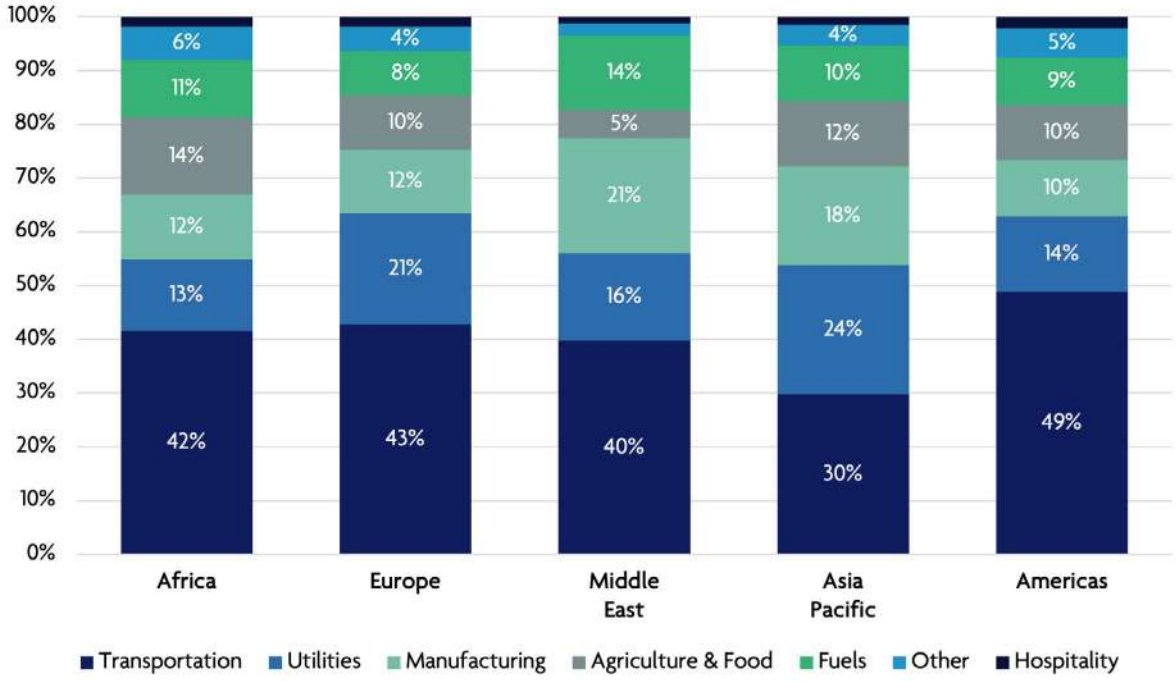
The trend of declining emissions-intensity is observed broadly across regions. Fig. 8 illustrates GHG emissions per unit of GDP across five regions, with longer-term reductions in each. In 2021, emissions-intensities were highest in the Middle East and Africa and lowest in Europe and the Americas. These differences also provide insight into the regional patterns plotted in Fig. 7.

Fig. 8. Emissions-intensity of travel and tourism by region[18]



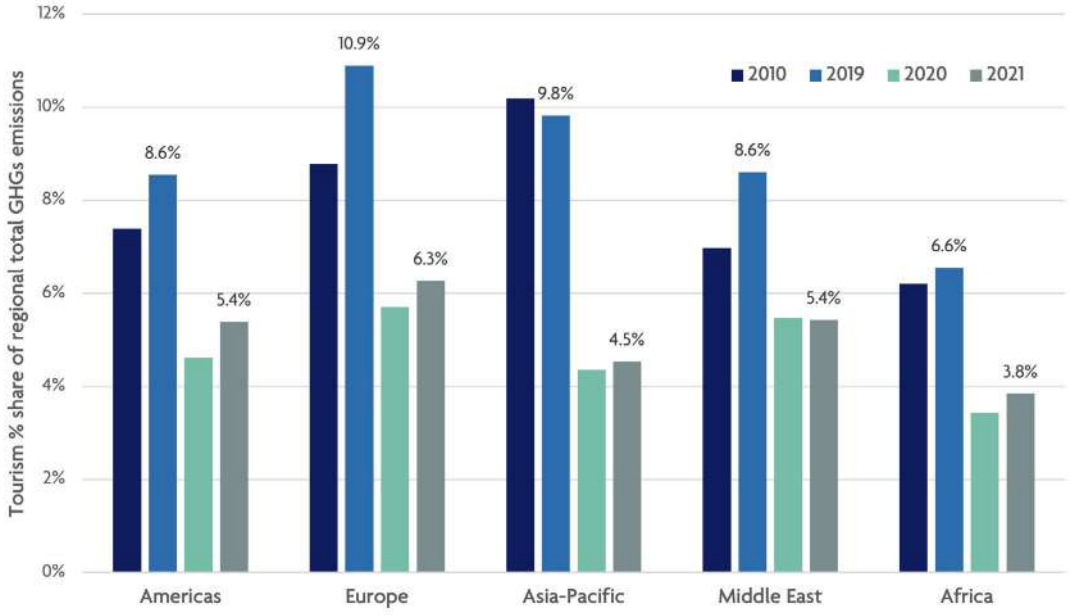
A key driver of regional variation in emissions intensities is the balance of industries within the overall Travel & Tourism sector. Visitors to different regions consume a slightly different mix of products and services, delivered via different industrial supply chains, each with their own unique patterns of GHG emissions. These differences are shown in Fig. 9.

Fig. 9. Sectoral breakdown of travel and tourism emissions, by region[19]



It is important to consider Travel & Tourism's significance within overall GHG emissions on a regional and country basis. The scale of this significance depends on the share of the economy accounted for by the sector, as well as the patterns of emissions seen in the non-tourism economy. Fig. 10 illustrates how Travel & Tourism contributed to regional emissions over time.

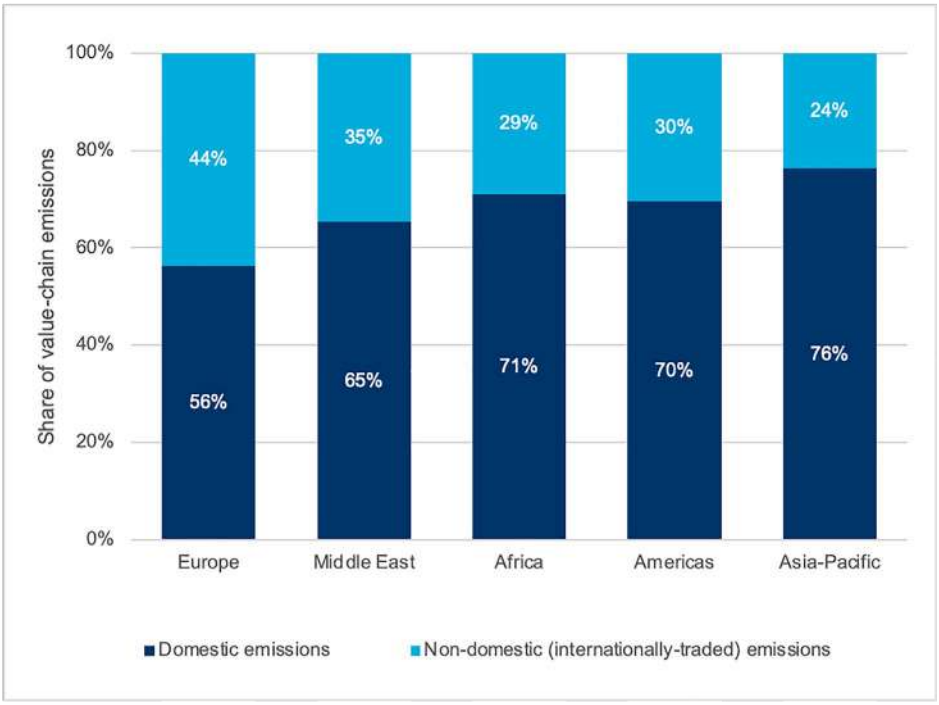
Fig. 10. Travel and tourism's share of regional emissions [20]



Despite having the highest emissions intensity on a per-dollar basis, Travel & Tourism in Africa contributed the least to overall regional emissions. Its 6.6% share in 2019 was well below the global share of 8.1%, which reflects the relatively smaller scale of tourism in the region, as well as a non-tourism economy that is relatively more carbon intensive. Travel & Tourism in Europe saw the highest contribution to regional emissions, at 10.9% in 2019. It is important to note that the report's regional and country comparisons[21] only include domestic impacts, exclusive of the international supply chain aspect of the footprint. This is to facilitate comparisons of Travel & Tourism to the domestic economy's environmental inventories, which reflect only the country's direct (i.e. Scope 1) environmental footprint, not GHGs embedded via global value chains[22].

There are significant GHGs embedded within imported goods in each Travel & Tourism market, meaning some emissions are always 'exported' to other countries. Fig. 11 shows the average share of Travel & Tourism's value chain (Scope 2 & 3) GHGs which are 'exported'. This share is lowest in Asia-Pacific at 24% and highest in Europe at 44%. These patterns partially reflect the structure of global trade and supply chains, with production centres in countries across Asia-Pacific connected to end-consumers in Europe and the Americas.

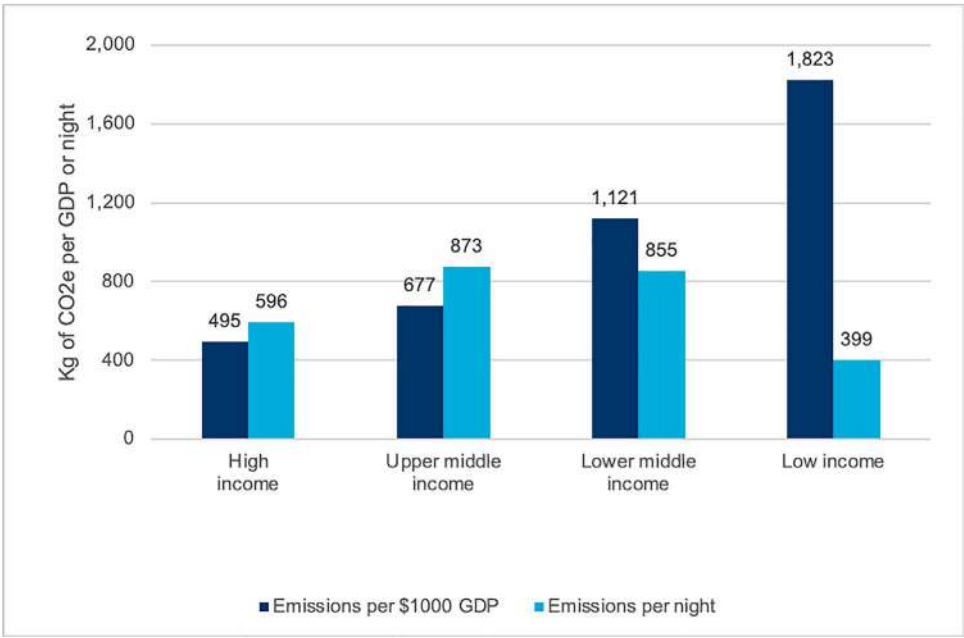
Fig. 11. Average share of Travel & Tourism Scope 3 emissions exported in 2019, by region[23]



3.3 BREAKDOWN BY INCOME CATEGORY

Variations in 'dollar-based' intensities should be interpreted carefully when comparing countries, regions, and income categories. Such variations are partially explained by the energy and sectoral mix involved in Travel & Tourism in each geography. However, disparities in the purchasing power of a dollar between different parts of the world are also important. A dollar of GDP in a low-income country typically represents a much greater volume of tourism goods and services than a dollar of GDP in a high-income country. The effect of this distortion can be seen in a comparison of Travel & Tourism GHG intensities across the World Bank's income categories**.** Low-income countries see the most emissions-intensive Travel & Tourism when measured in GDP terms, but are comfortably the least emissions-intensive in 'volume' terms, i.e. total overnight tourist stays in every country. This does not account for any qualitative differences in experiences, but remains a helpful method to roughly equalise price levels across the world.

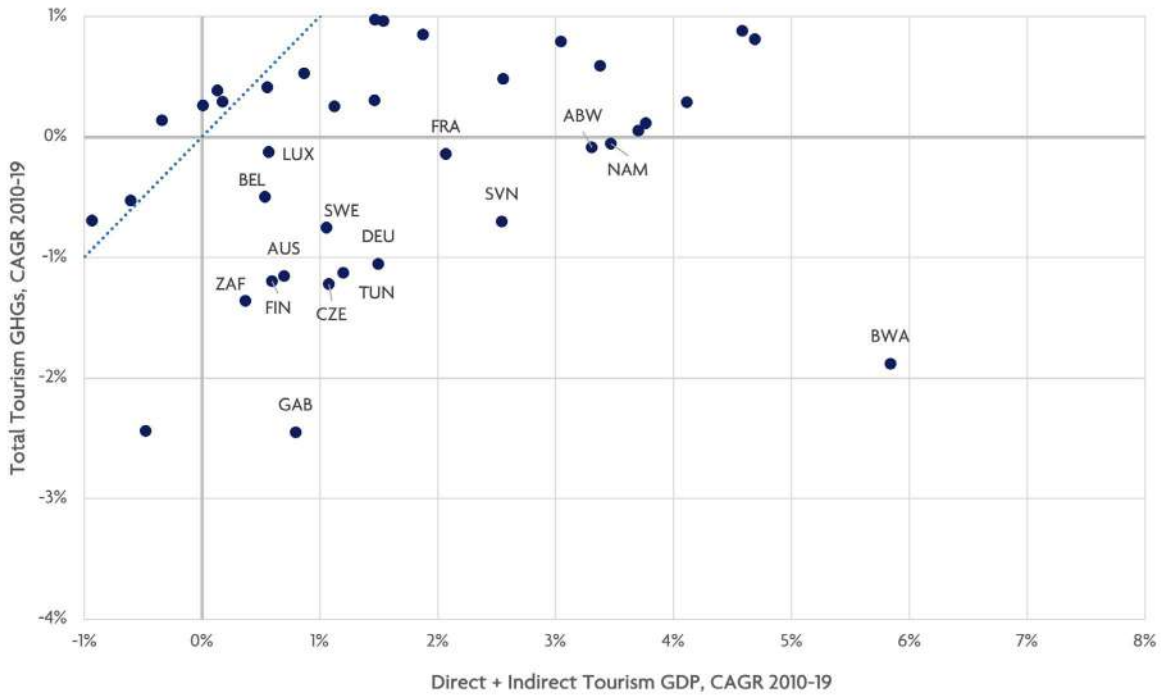
Fig. 12. Travel & Tourism emissions-intensity in 2019, by income groups [24]



3.4 **COUNTRY LEVEL FINDINGS**

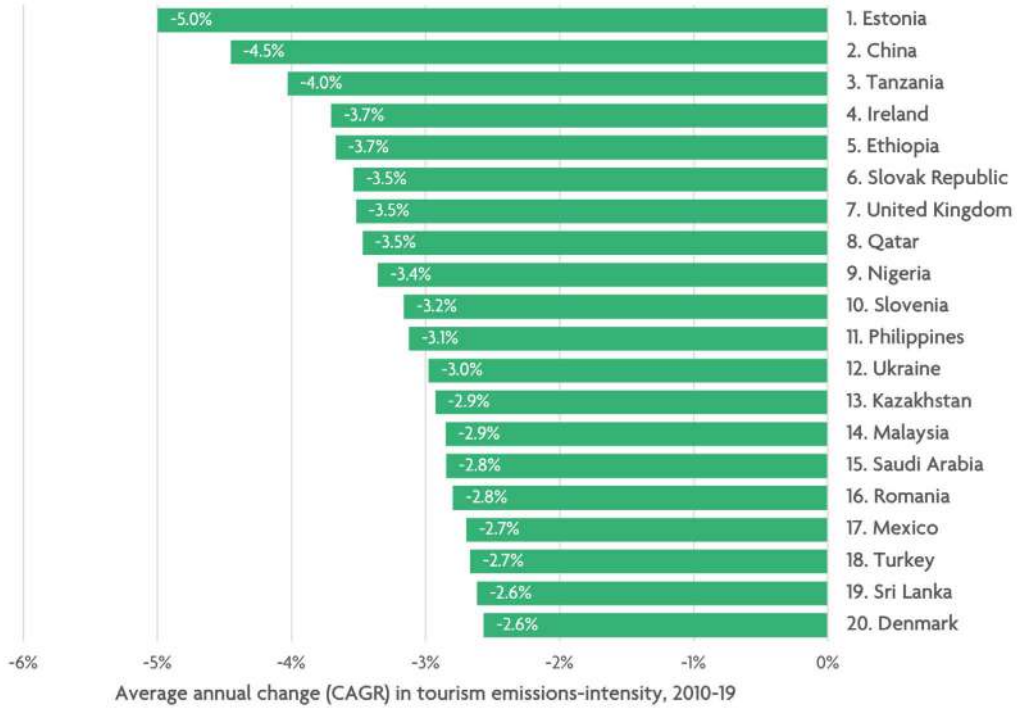
29 countries reduced their Travel & Tourism GHG emissions over 2010-19 (Fig. 5), with the lower-right quadrant, or 15 countries, representing those markets where Travel & Tourism GDP increased over the same period; i.e. the nations that saw the most notable decoupling. Fig. 13 below represents a 'zoomed-in' view of this quadrant, highlighting the 21 countries.

Fig. 13. Countries experiencing Travel & Tourism GDP growth alongside GHG emissions reductions, 2010-19



Looking at the major tourism markets in this grouping, Estonia saw the largest decoupling of Travel & Tourism GDP and GHGs during 2010-19. Its Travel & Tourism GDP grew an average of 6.5% per year in real terms, while associated emissions grew at only 1.2% per year.[25] As with the global trend, slowed growth in Travel & Tourism's direct emissions was a key driver behind the slowed growth in overall emissions.

Fig. 14. Countries with the largest decline in emission-intensity of Travel & Tourism, 2010-19 [26]



This chapter highlights several factors playing a role in the composition of Travel & Tourism's GHG footprint, and its reductions in GHG-intensity since 2010, notably the energy mix available in each country and geography around the world. The next chapter considers the scale and composition of energy demands that are generated by Travel & Tourism.

4. TRAVEL & TOURISM'S ENERGY USE

The Travel & Tourism sector encompasses numerous activities which use energy both directly and indirectly via their value chains. This energy comes from different sources and fulfils different needs: airplanes rely on carbon-derived jet fuel, hotels may use solar panels for off-grid power and manufacturers may require significant heat to produce components for a myriad of things such as souvenirs purchased by tourists.

The use of energy is fundamentally tied to the extraction of resources. Fossil fuel-based energy requires extractive infrastructure, which can cause damage to ecosystems, and their use emits GHGs. While renewable and other low-carbon energies emit fewer GHGs, their construction and operation still rely on minerals and land use which leave a footprint on the surrounding environment.

This chapter estimates the extent of Travel & Tourism's energy use. The measure discussed is terajoules (TJ) of energy which are consumed as part of economic processes that directly or indirectly serve the demands of the Travel & Tourism economy. The estimates are derived from modelling of the industrial structure of Travel & Tourism, and the energy-intensity of each country's and industry's economic activity. The assessment includes 11 fuel types, grouped into the following three categories:

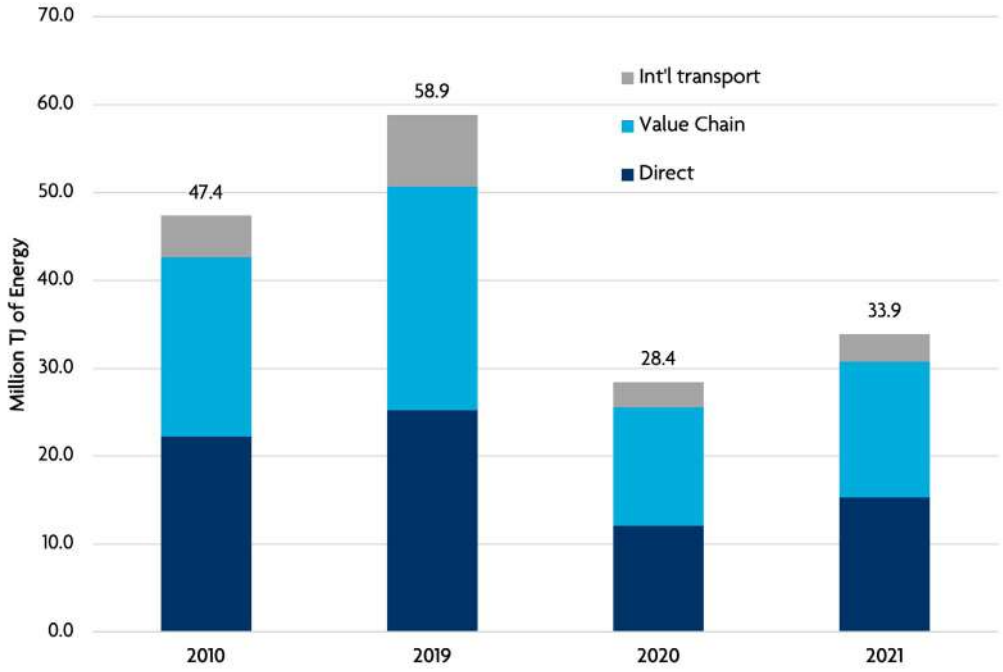
- **Fossil fuels** include coal, oil, and natural gas which, in the context of Travel & Tourism, are burned by power plants to produce electricity or to power modes of transportation.
- **Low-carbon energy** includes renewables such as solar, wind, wave, and geothermal, as well as traditional hydroelectricity and nuclear. In the context of Travel & Tourism, these fuels are mostly used in the production of electricity.
- **Biofuels and waste** are presented separately as they describe different activities in different regions and income levels. In lower-income regions, they predominantly involve wood and charcoal fires, and domestic and industrial waste burning. In higher-income areas, there is a higher prevalence of bio-additives to gasoline and diesel, such as crop-derived ethanol.

4.1 TOTAL ENERGY USE LINKED TO TRAVEL & TOURISM

From a consumption of over 25.2 million TJ in 2019, the sector's direct energy use dropped by 52% in 2020 as a result of the pandemic. As travel reopened in 2021, energy requirements increased by 27% to some 15.3 million TJ – still 39% below 2019 levels. To put this into broader context, energy use for the global economy as a whole fell by 4% in 2020, then rebounded by 4% in 2021.[27]

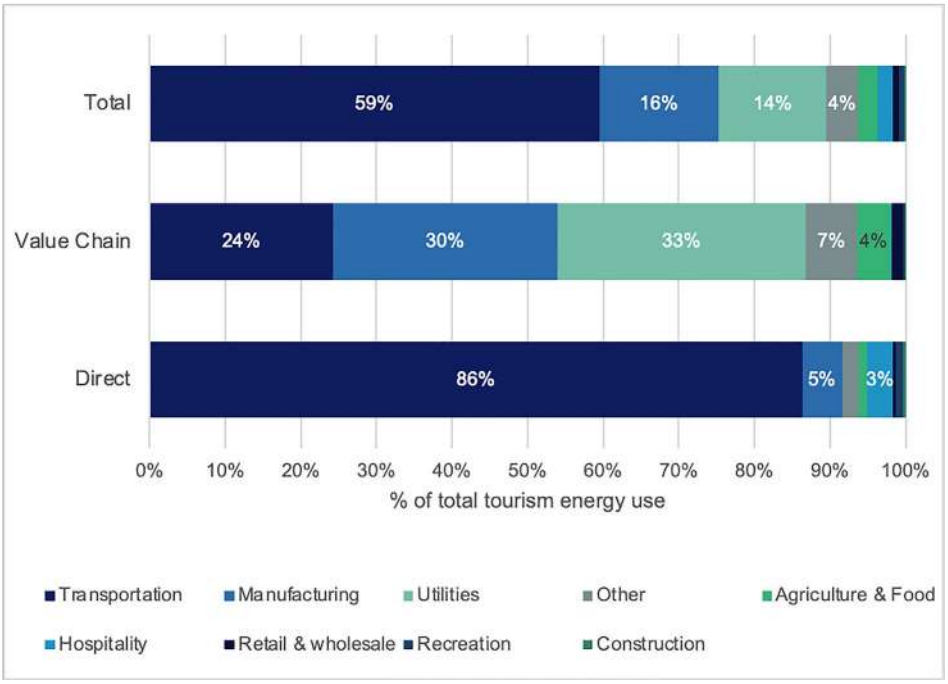
The mix of Travel & Tourism's energy consumption was also affected by the pandemic. By 2021, the energy consumed by the Travel & Tourism sector itself and within its supply chains reached approximately 60% of its 2019 level. But the energy demand of international flights and cruises only recovered to approximately 40% of pre-pandemic levels, reflecting the restrictions on international travel in place for most of 2020 and 2021, coupled with a shift towards more domestic tourism in that time.

Fig. 15. Travel and tourism's direct and value chain energy use



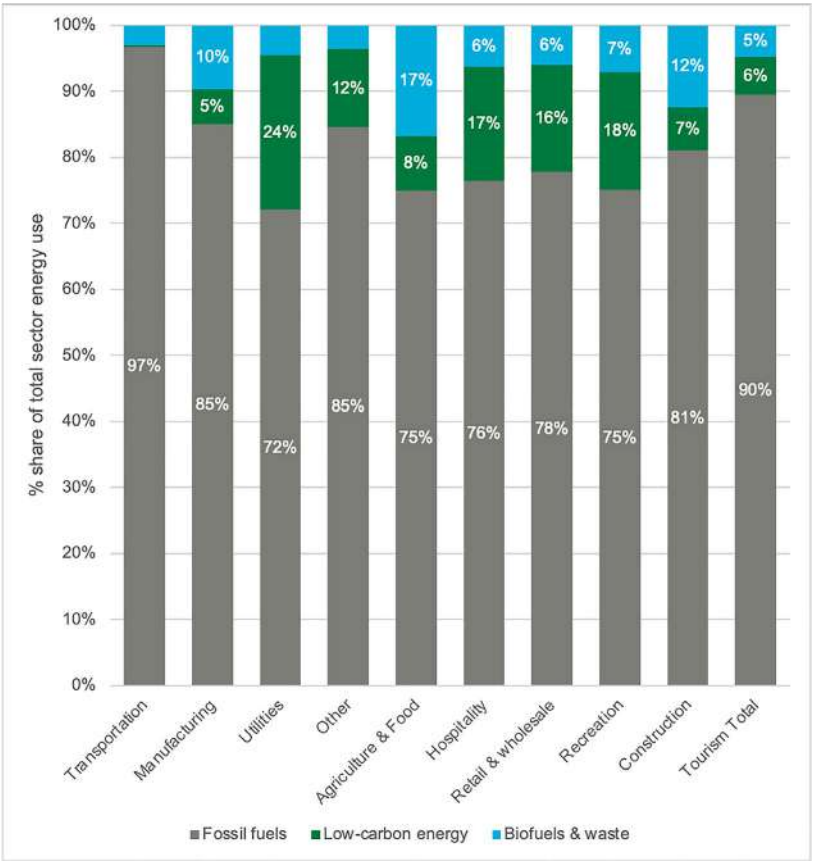
The transport industry, including international travel, accounts for 86% of Travel & Tourism's direct energy use. This leading share, illustrated in Fig. 16, reflects the considerable energy content of the fuels used to transport travellers around the world. But when looking at Travel & Tourism's value chain, the energy content is more diverse in terms of industries.

Fig. 16. Industry shares of Travel & Tourism energy use, 2019 [28]



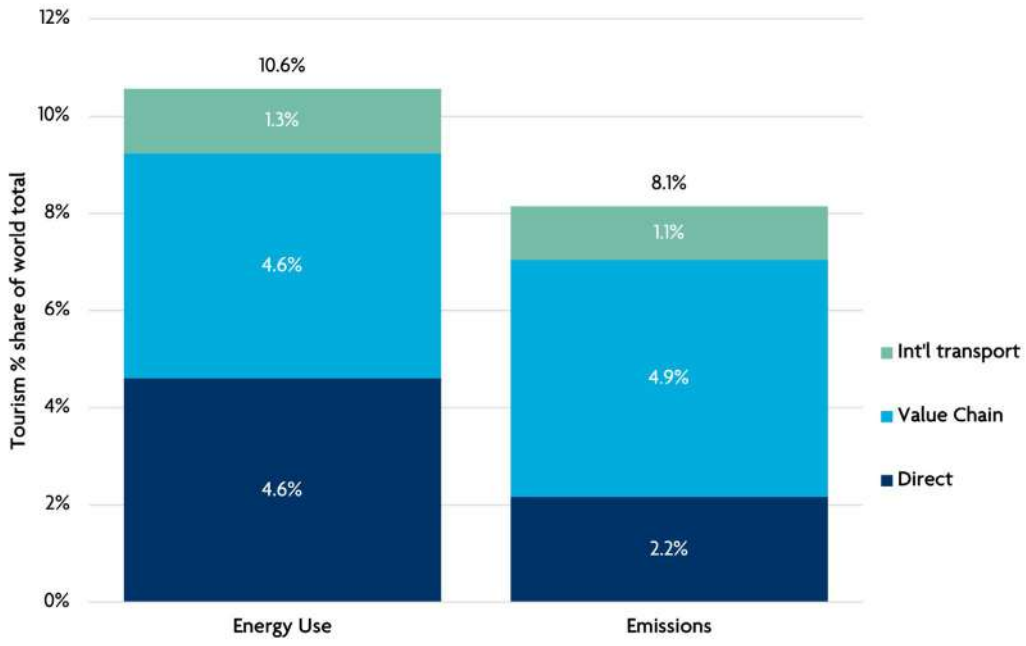
The scale and composition of energy use by Travel & Tourism is driven by the nature and production processes of each activity. Some industries necessarily rely more on some energy sources than others. This is seen most starkly in transport, as fleets remain dominated by combustion-based engines requiring fossil fuels. For activities that rely mainly on electricity to access energy, their energy mix is determined by the prevailing fuel sources for that country's electricity production. Fig. 17 shows the average energy mix employed by each industry within Travel & Tourism, including the sector itself, its value chain, and international flights.

Fig. 17. The energy use of Travel & Tourism's industry sectors, by energy source, 2019



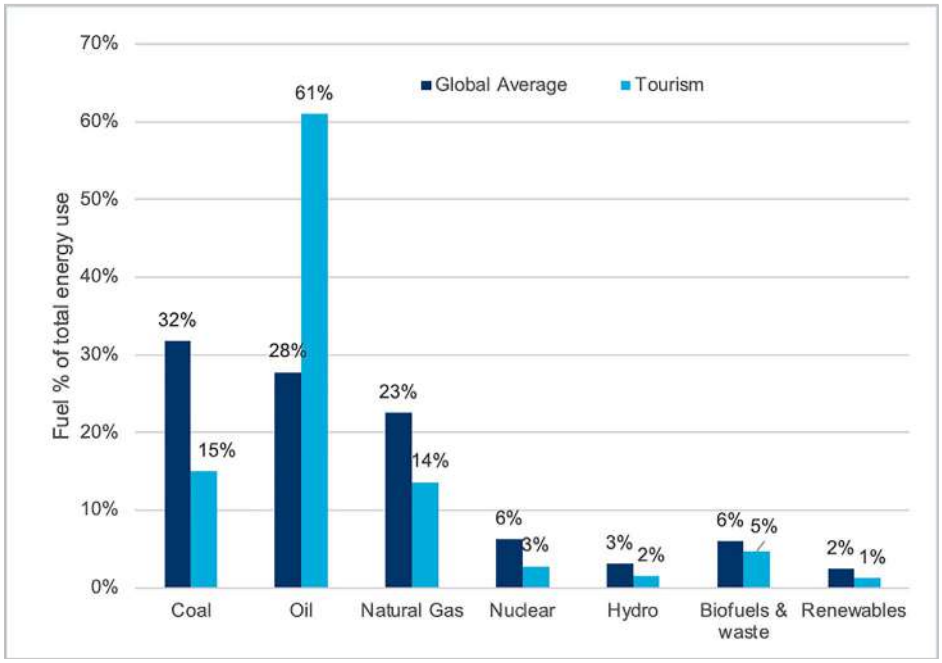
On average, Travel & Tourism uses relatively less emissions-intensive energy sources than the global economy. Travel & Tourism's energy demands are the driving force behind its GHG emissions, and Fig. 18 compares the sector's share of global energy consumption and global GHG emissions in 2019. As shown, the widest measure of Travel & Tourism's energy use (including direct, value chain, and international transport) accounted for 10.6% of global energy use. However, its share of global GHG emissions was only 8.1%.

Fig. 18. Travel & Tourism's share of global energy use and emissions, 2019



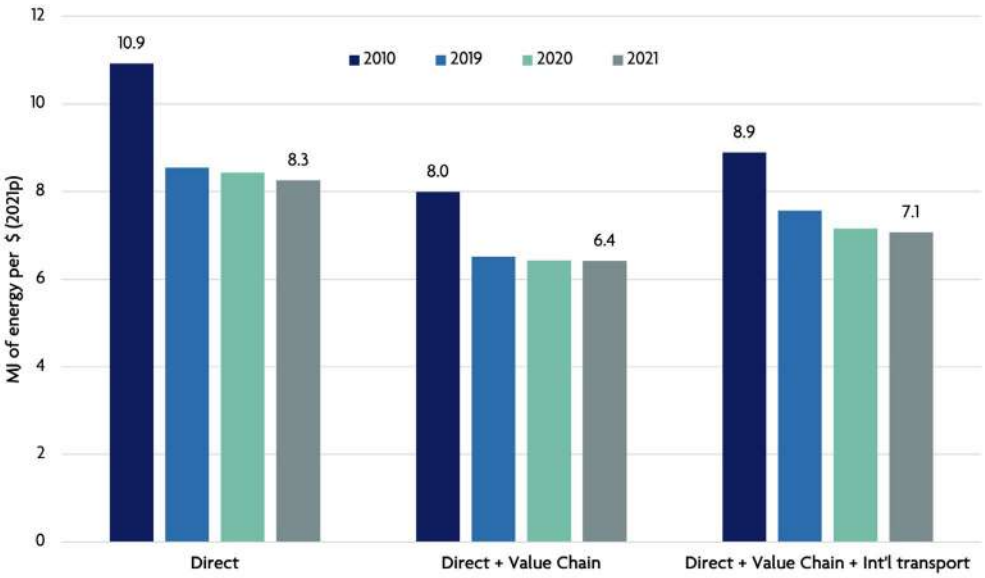
While fossil fuels supply a greater share of Travel & Tourism's energy than the global economy, 90% vs 82% respectively, the much lower prevalence of coal energy in tourism means it accounts for a lower share of world GHGs emissions. Energy derived from coal produces significantly more GHG emissions than an equivalent amount of energy generated from natural gas.[29] Fig. 19 illustrates the energy sources for Travel & Tourism in 2019, encompassing its direct, value chain energy use and international transport, and compares this with the global average energy sources. This chart reveals how changes in the mix of energies used by the sector are a key driver of changes in its GHG emissions.

Fig. 19. Global energy use by source fuel, 2019



While Travel & Tourism's GHG emissions rose in absolute terms over the 2010s, there was a decoupling between output and emissions, reflecting the decline in the overall emissions intensity. Emissions linked to Travel & Tourism's energy requirements are a significant contributor to the sector's total – some 68% of the sector's GHG emissions stemmed from the utilities, fuel, and transportation sectors.[30] As such, reductions in energy intensity would help reduce the sector's carbon footprint. Fig. 19 shows the average energy intensity of Travel & Tourism since 2010, illustrating its decline across measures, with a slight levelling out during the pandemic. Similar to GHGs, this decrease in energy intensity was linked to both the sector's direct and indirect activities.

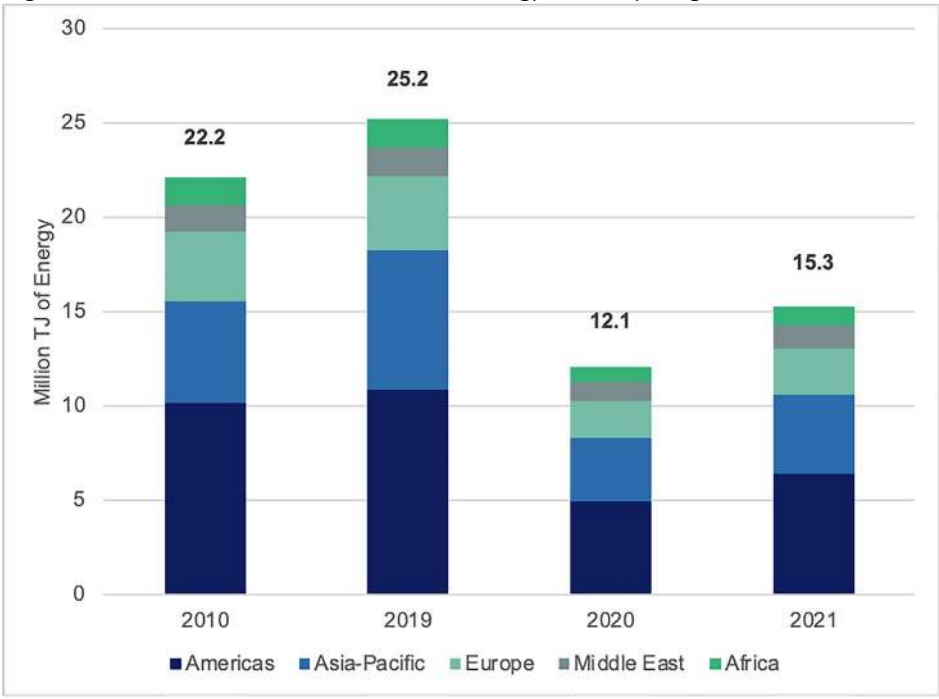
Fig. 20. Energy intensity of Travel & Tourism over time



4.2 **BREAKDOWN BY REGION**

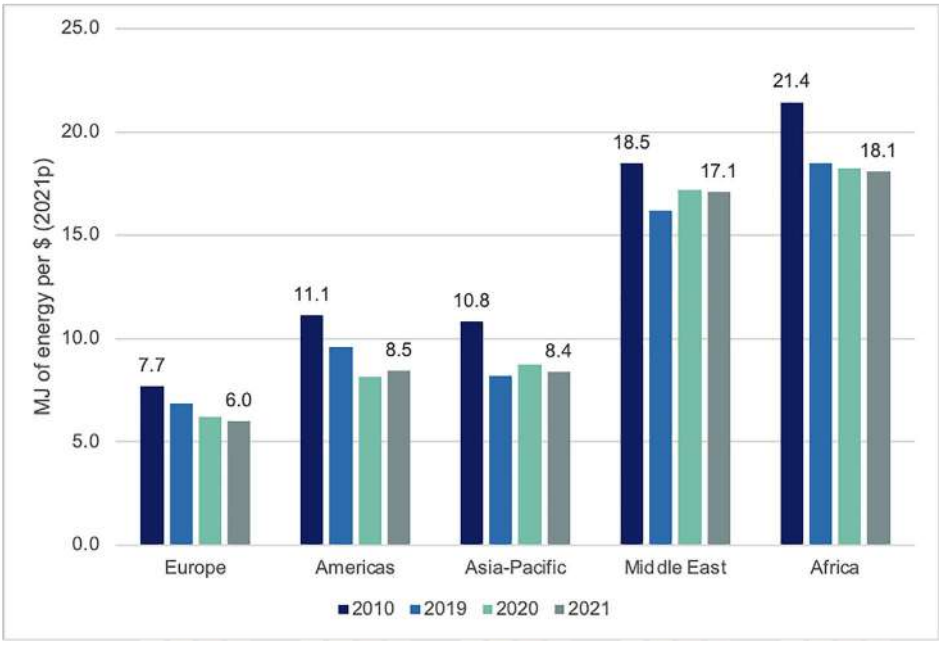
The energy demands of Travel & Tourism are shaped by the physical location of tourism markets across the different regions. As such, the regional pattern of total energy use by the sector will be driven in large part by regional distribution of tourism activity itself. This can be seen in Fig. 21 below.

Fig. 21. Travel and tourism's direct energy use, by region



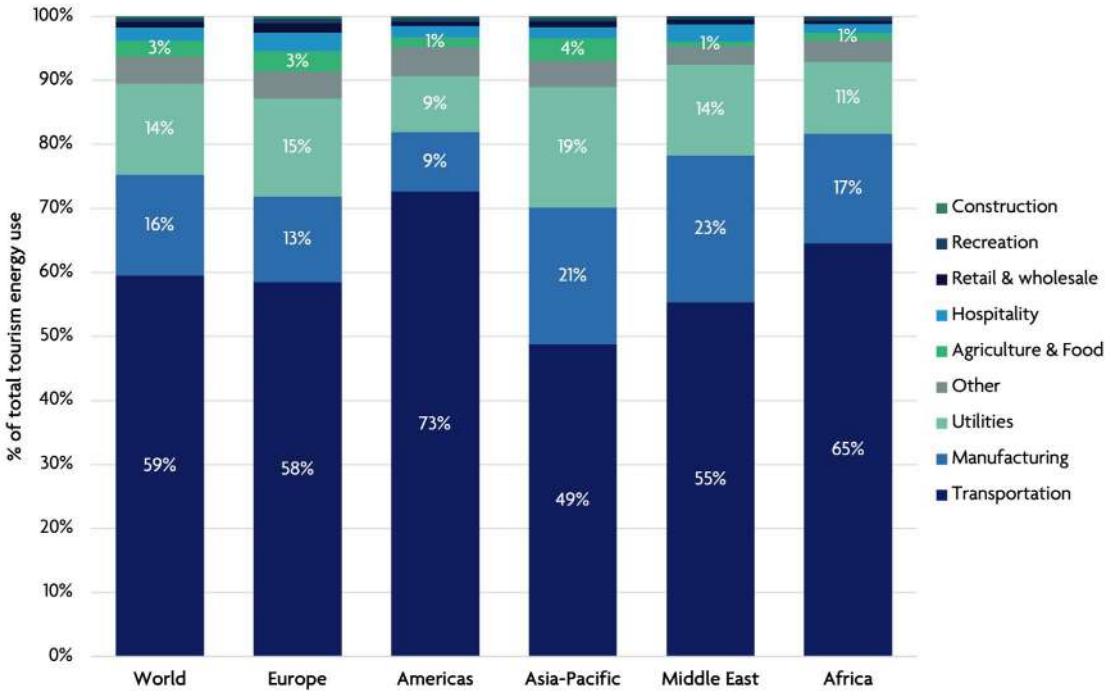
The amount of energy used per unit of Travel & Tourism activity varies across the world's tourism markets. The precise mix of activities of tourists in each country[31] differs slightly, and each market draws on different value chains. Fig. 22 illustrates these differences, revealing that while energy intensities vary across the world, they are well below 2010 levels across all regions.

Fig. 22. Energy intensity of Travel & Tourism, by region[32]



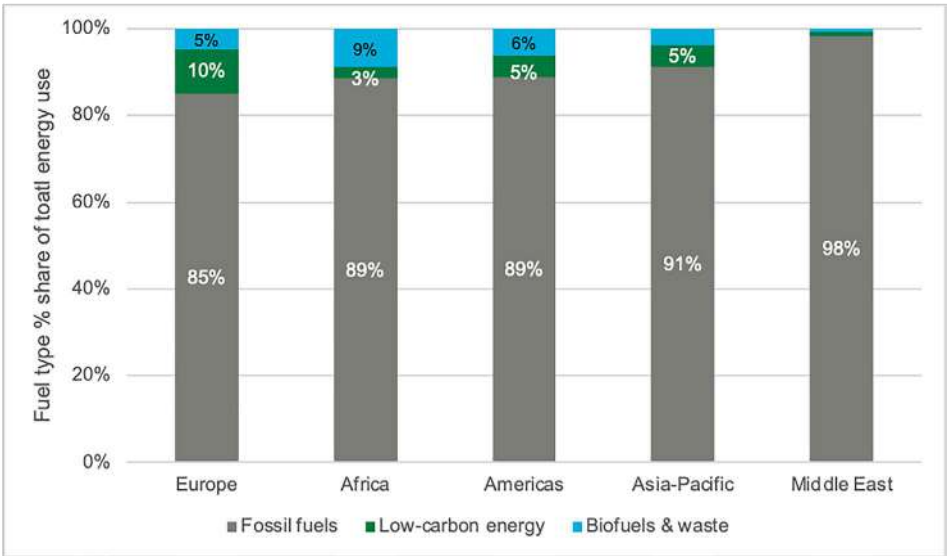
Regional differences in the industrial structure of Travel & Tourism also shape its energy consumption in different parts of the world. As shown in Fig. 23, the mix of industries that make up Travel & Tourism's total energy use varies between regions. These differences are a key driver of regional variations in energy-intensities, along with the relative purchasing power of a dollar.

Fig. 23. Sectoral breakdown of Travel & Tourism energy, by region[33]



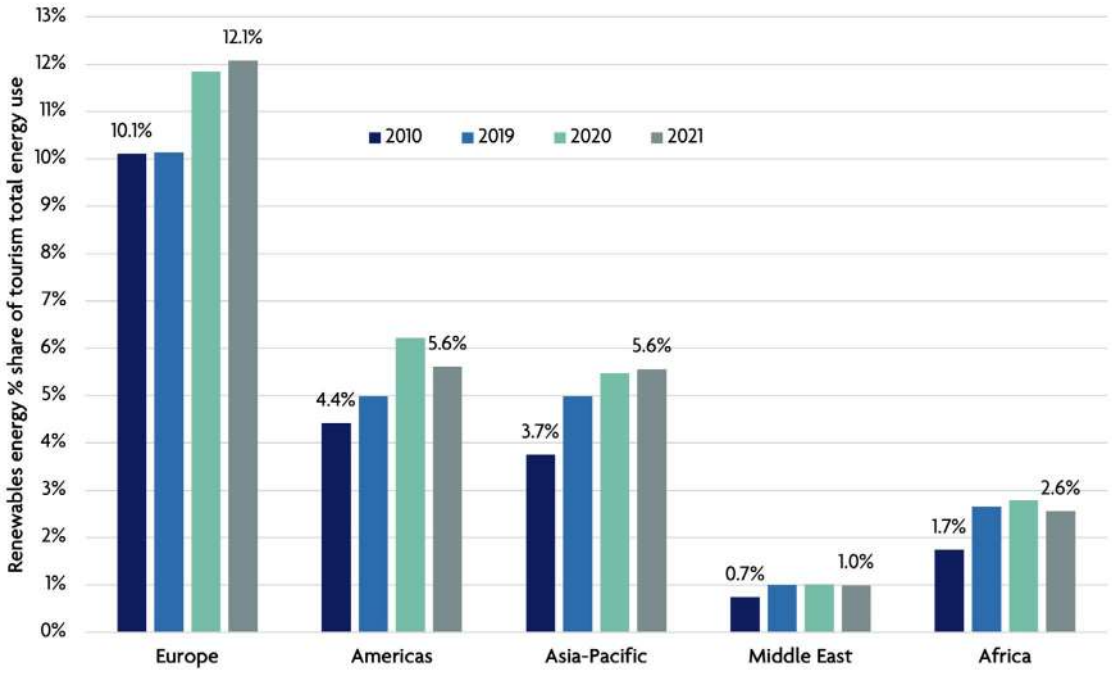
The relationship between Travel & Tourism's energy use and its emissions footprint is linked to the mix of energy sources used. This varies greatly across regions, as shown in Fig. 24, which shows the different fuel sources used to meet the energy requirements of Travel & Tourism around the world. To date, fossil fuels are the dominant energy source globally, underlining the dependence of the sector on hydrocarbons – particularly for transport fuels. It is still important to consider the fuel sources used in each country's electricity generation, as these drive the observed regional variation in Travel & Tourism's low-carbon energy sources. The fossil fuel share is highest in the Middle East (98%) and is the lowest in Europe (85%). These differences in energy composition are a key driver of the relatively lower emissions intensity of Travel & Tourism in Europe.

Fig. 24. Regional differences in the fuel composition of Travel & Tourism's energy consumption, 2019[34]



Between 2010 and 2019, Travel & Tourism globally experienced a marginal increase in the share of its energy from low-carbon sources, a trend consistent across regions (Fig. 25). Still, a more significant increase was seen in Europe and Asia-Pacific. An appreciable jump in the low-carbon energy shares of the total was seen in 2020 and 2021, linked to the very steep reductions in global aviation during the pandemic. In this period, grid-supplied electricity (and its low-carbon components) formed a more significant part of Travel & Tourism's overall energy demand.

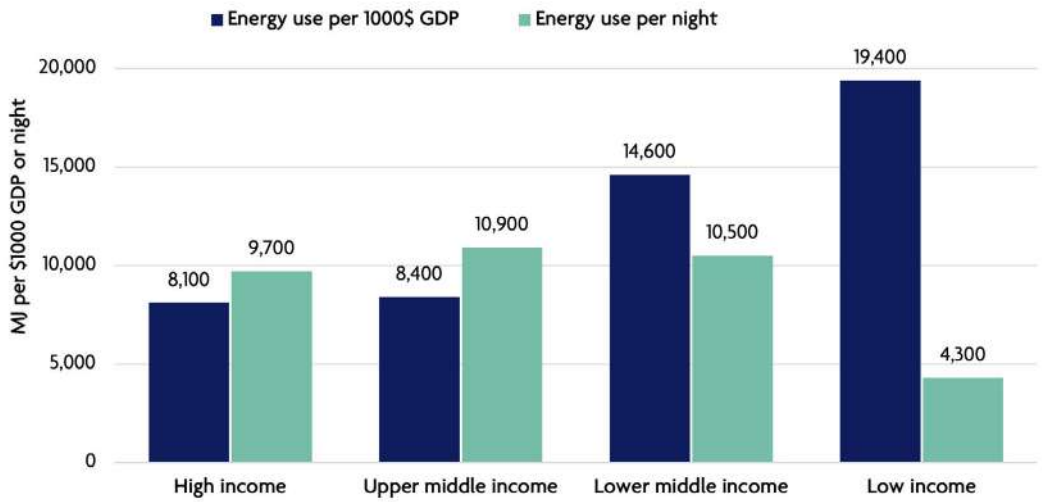
Fig. 25. The low-carbon share of Travel & Tourism energy use, by region [35]



4.3 BREAKDOWN BY INCOME CATEGORY

Comparisons of energy intensities across regions and countries are susceptible to GDP-linked distortions. This distortion can arise from the fact that one dollar of economic value means different things in different countries at different income levels. To control for this, intensities are compared based on energy consumption per tourist overnight stay. While Travel & Tourism in low-income countries has the highest energy intensity per unit of GDP, the opposite is true when measured per bed-night.

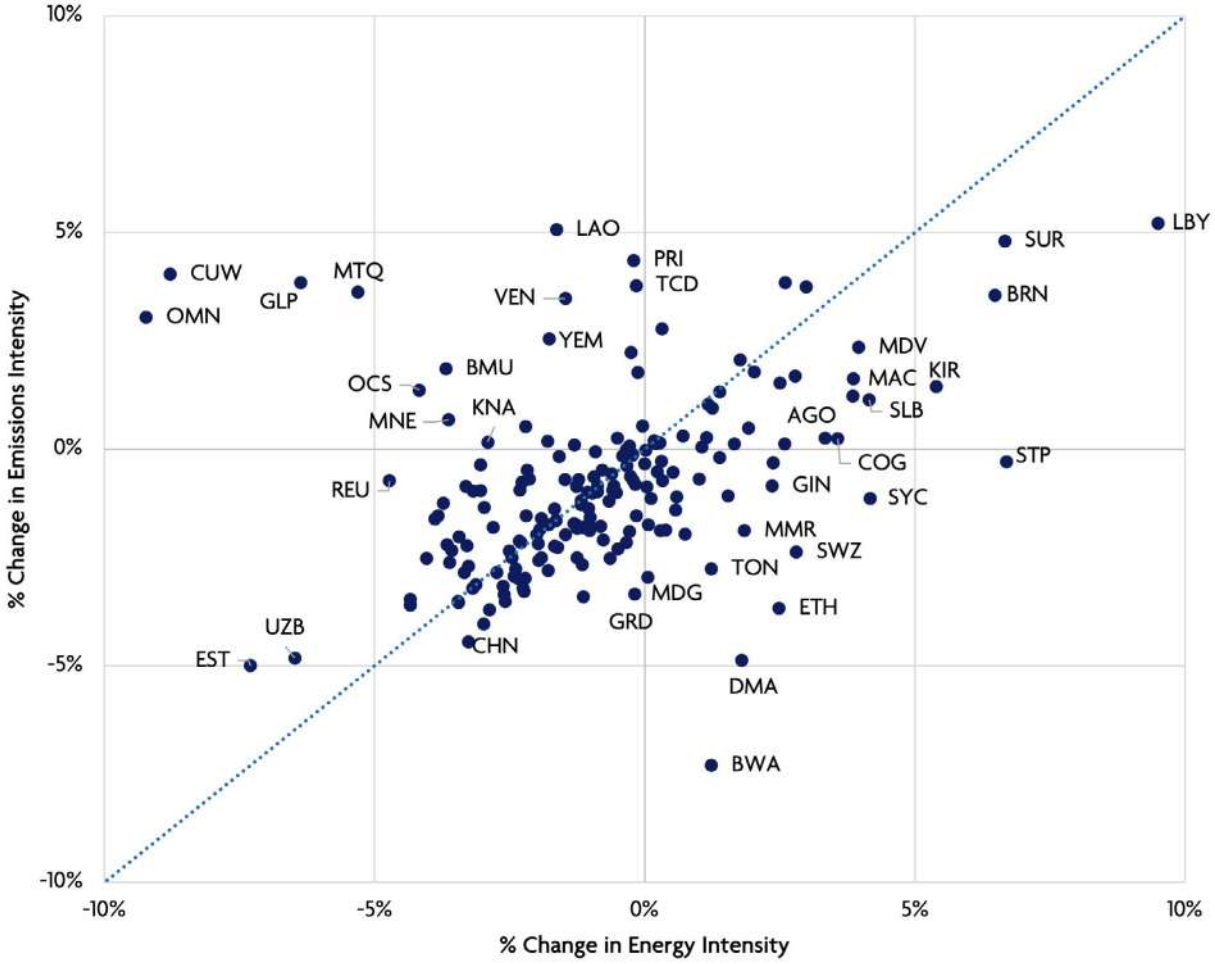
Fig. 26. Travel & Tourism's energy intensity across income groups, 2019 [36]



4.4 COUNTRY LEVEL FINDINGS

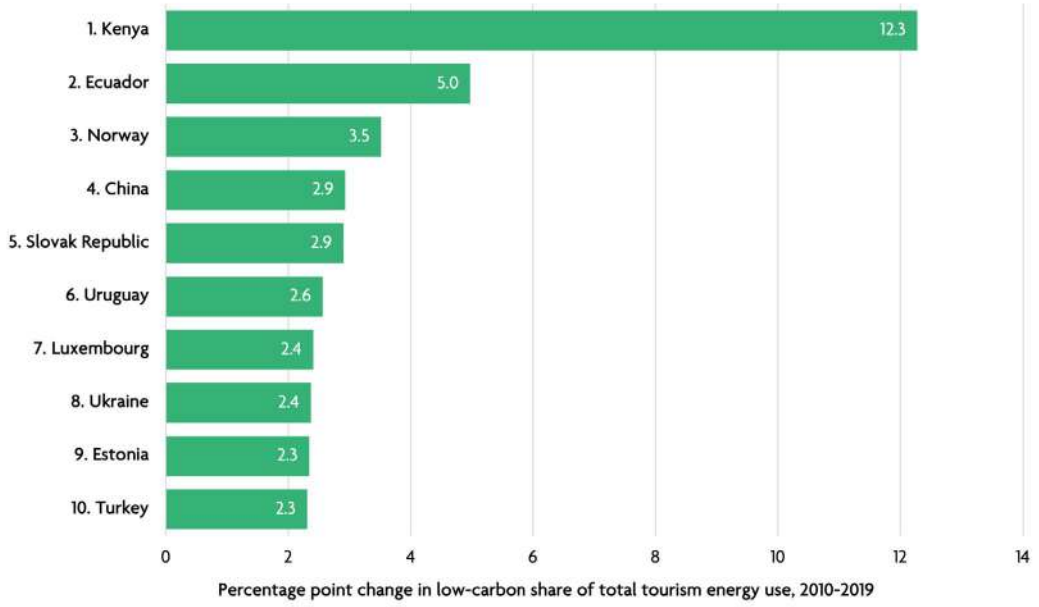
Reductions in the energy intensity of Travel & Tourism helped to decrease the sector's emissions intensity throughout the 2010s. Figure 27 shows the average annual change in energy and emissions intensities for the Travel & Tourism sector in each of the 185 geographies studied. As expected, a strong relationship can be seen between energy intensities and emissions intensities: the closer a country is to the red line, the stronger that relationship is. Still, some countries fall away from the line, indicating that energy intensity alone does not explain all changes in the emissions intensity of Travel & Tourism.

Fig. 27. Comparing changes in energy intensities and emissions intensities, 2010-19 [37]



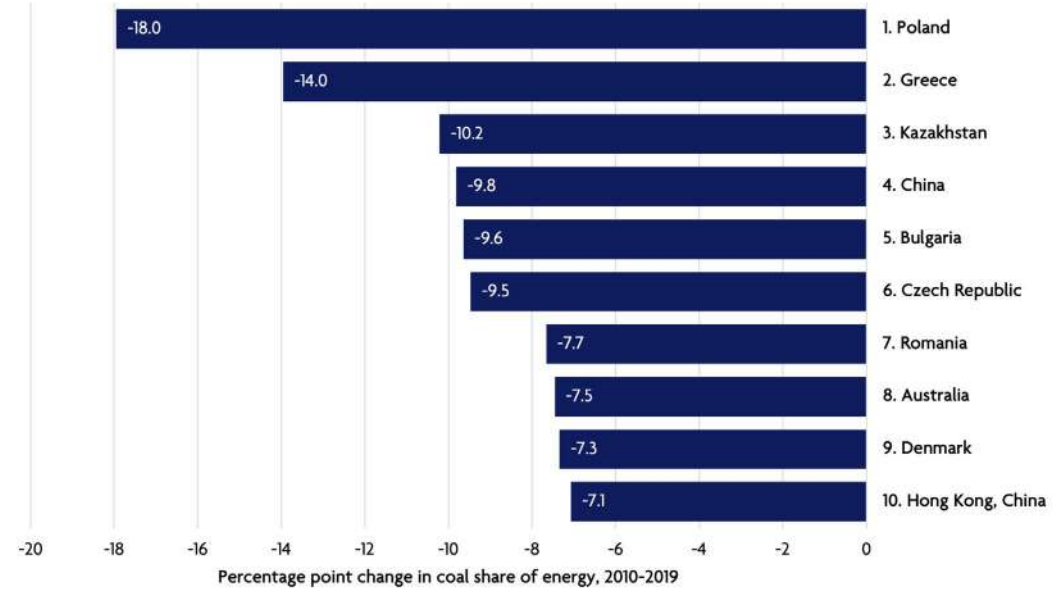
While the shift in the energy mix of Travel & Tourism was marginal at a global level, it was far more pronounced within certain countries. Of the 185 countries studied, 115 saw an increase in the low-carbon share of Travel & Tourism's energy footprint from 2010 to 2019. 87 of these 115 countries also witnessed a decline in the emissions-intensity of Travel & Tourism over the same period. Fig. 28 reveals the countries with the largest increase in the low-carbon share of Travel & Tourism energy use, with Kenya experiencing by far the largest increase in Travel & Tourism's low-carbon energy share, owing to substantial growth in its renewable electricity capacity. Its investments in geothermal, wind and solar power over the decade helped to almost entirely remove fossil fuels from an electricity grid that was already considerably decarbonised in 2010.

Fig. 28. Countries with largest increases in low-carbon share of Travel & Tourism's energy demand, 2010-19[38]



Some pronounced shifts away from coal were also observed at a country level. 135 countries' Travel & Tourism sectors decreased the share of coal in their energy consumption from 2010 to 2019. Fig. 29 highlights the countries with the largest decrease. Notably, Poland moved from a 45% share in 2010 to 27% in 2019.

Fig. 29. Countries with the largest decrease in coal share of the sector's energy demand, 2010-19[39]



Looking ahead, the easing of Travel & Tourism's environmental footprint will require further reductions in energy intensity, as well as the decarbonisation of that energy. The decline in the overall energy intensity of Travel & Tourism, and the shift away from the most carbon-intensive fossil fuels will continue to be key drivers in reducing the GHG emissions of the sector.

5. TRAVEL & TOURISM'S WATER USE

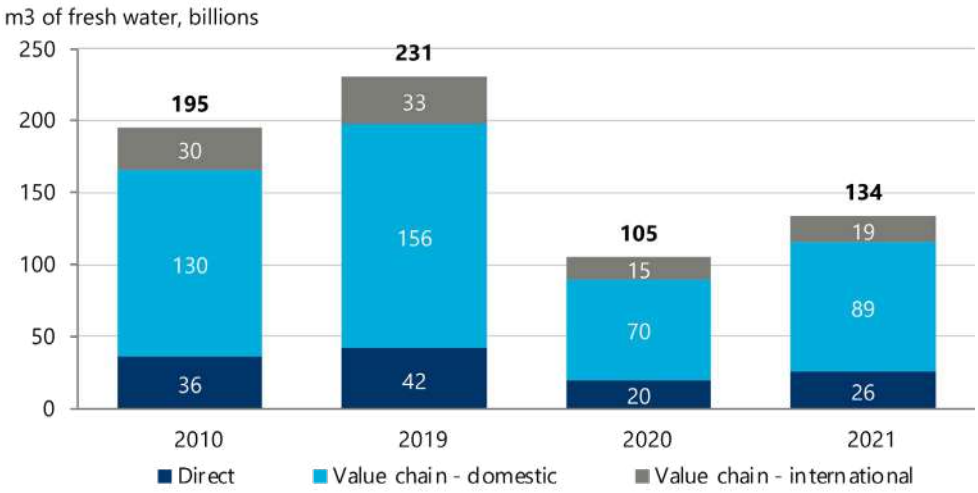
Tourism relies on fresh water, especially to produce the agricultural and food products that travellers consume. It is therefore essential to establish the total volume of water directly used by tourism, as well as the volume used in economic processes and products that indirectly serve domestic and international tourism. This chapter estimates the total water withdrawals attributable to Travel & Tourism from renewable freshwater sources (such as rivers, lakes and groundwater) as well as human activity and infrastructure, and non-conventional sources (such as desalination).

This aspect of tourism's environmental footprint highlights an important dependency on the natural world. Continued access to abundant and renewable sources of water requires maintaining balanced and consistent flows in and out of the water cycle. Natural or human-caused changes to the climate can disturb flows into water systems, either through episodic extreme events such as droughts, or longer-term changes in precipitation patterns. Water accessibility also depends on the scale of human extraction, which if excessive can result in water stress with severe consequences for both natural systems and human populations.

5.1 TOTAL WATER USE LINKED TO TRAVEL & TOURISM

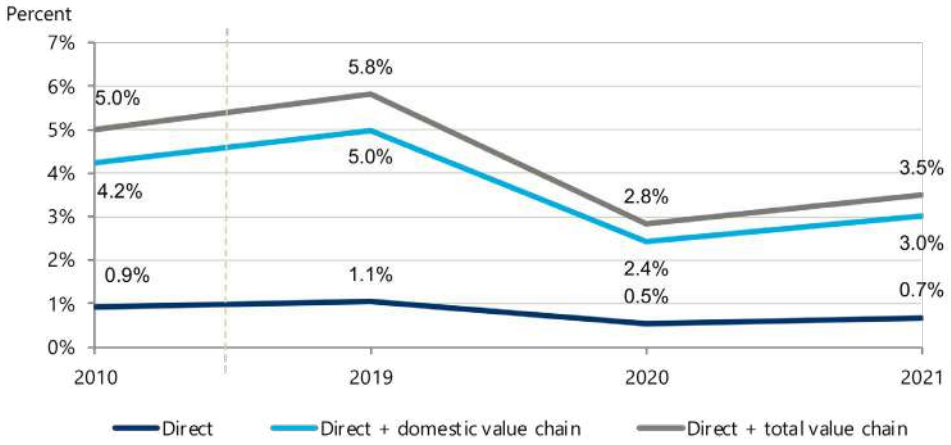
Most of Travel & Tourism's water footprint is made up of the embedded water within the goods and services it purchases from its supply chain. Fig. 30 below shows the total freshwater use of Travel & Tourism, in millions of cubic meters. It divides this footprint between the direct use of water within Travel & Tourism businesses, and the water content of its value chain. It also highlights how most of this embedded water is made up of domestic withdrawals, i.e., water sourced from the same country where the tourism activity takes place. Only a relatively small proportion of Travel & Tourism's embedded water footprint is traded across international borders. This points towards the highly local nature of water issues. In effect, Travel & Tourism's water footprint in each market is determined largely by the water systems and water management in that country itself.

Fig. 30. Travel & Tourism's direct and indirect (value chain) water footprint



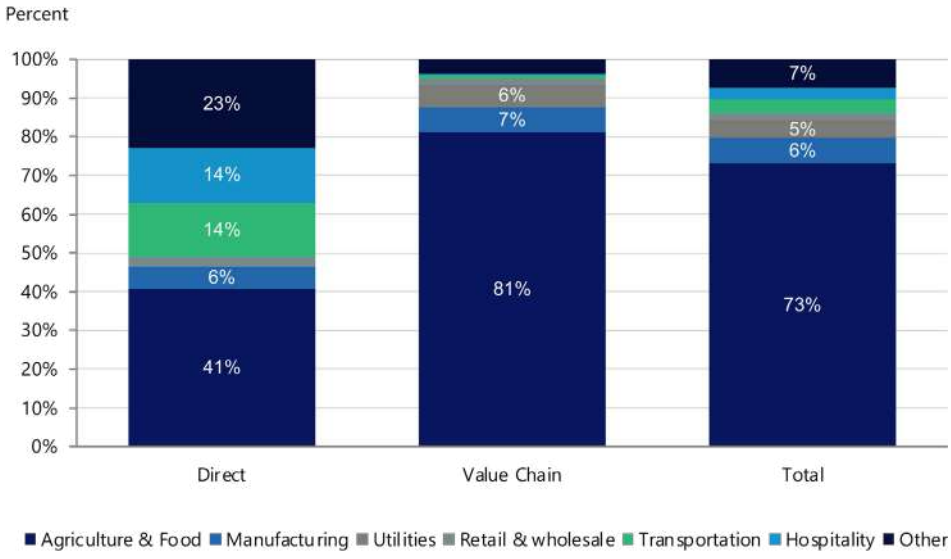
Travel & Tourism's share of total world water withdrawals is lower than its share of other environmental footprints, given that the majority of water use worldwide (70%) is linked to agriculture. As such, Travel & Tourism's water footprint is heavily influenced by how much of local agricultural production is geared towards meeting tourist demand.

Fig. 31. Travel & Tourism's share of total global water use



The centrality of agriculture and food production can also be seen in the industry breakdown of Travel & Tourism's water footprint. Fig. 32 shows the sectoral breakdown of Travel & Tourism's water use, 73% of which is accounted for by agriculture and food manufacturing. By contrast, transport and hospitality combined account for just 6%.

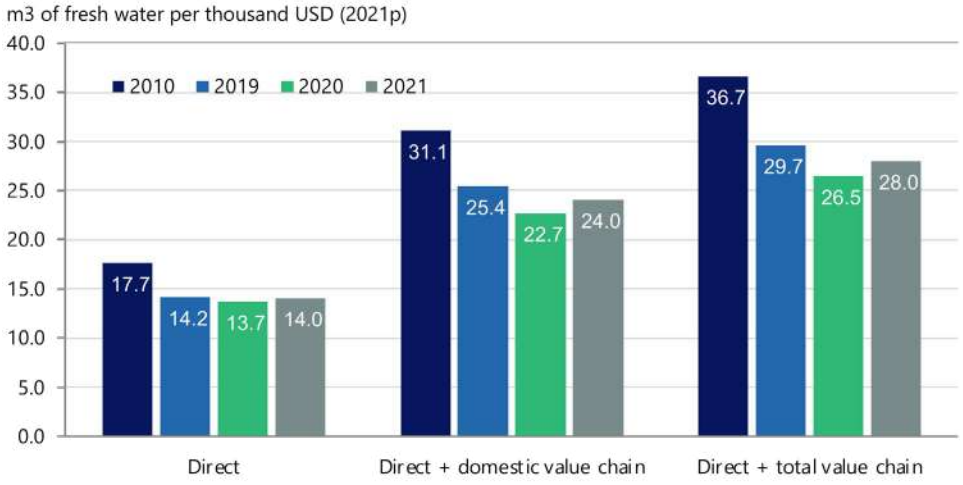
Fig. 32. Constituent industries accounting for Travel & Tourism's water footprint, 2021 [40]



Travel & Tourism's direct water demand per unit of economic value has experienced a sustained decline. Fig. 33 compares recent measures of its water-intensity (the volume of water consumed per unit of GDP) with equivalent

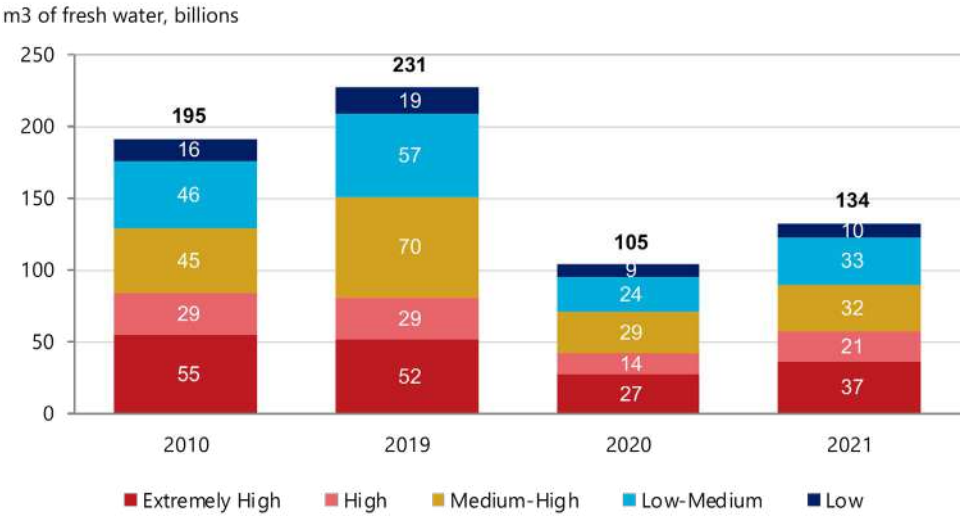
estimates for 2010. The pace of this decline is in line with broader economy-wide reductions in measures of water use per unit of GDP.

Fig. 33. Water-intensity of Travel & Tourism, 2010-21



Despite the reduction in water intensity, Travel & Tourism's geographic diversity means that its water demands are felt in many regions. The extent to which Travel & Tourism contributes to water insecurity or scarcity is related to the existing conditions for water supply in these countries. Fig. 34 splits the sector's water footprint according to the baseline water stress of the source country, using country-level data from the World Resource Institute's Aqueduct dataset.[41] Withdrawals in regions with high levels of water stress are likely to have a more significant impact, while countries with 'low' levels of water stress supply the smallest proportion of Travel & Tourism's water demands.

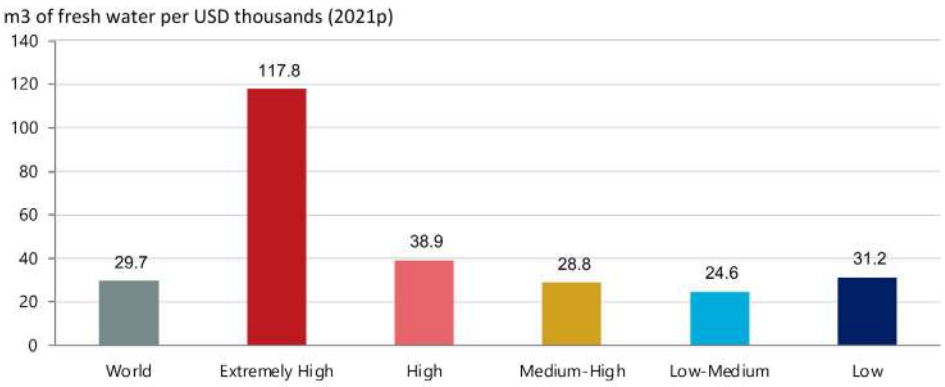
Fig. 34. Travel & Tourism's total water footprint, split by water stress category of source country [42]



Travel & Tourism's share of total national water use and water intensity tends to be higher in more highly stressed regions, as shown in Fig. 35. The data does not suggest that Travel & Tourism is particularly water-hungry, but rather that these countries tend to struggle with water efficiency in general. Hotter conditions can greatly increase the water requirements of various activities, from growing crops to cooling vehicles and industrial machinery, and air conditioning. Areas that are water-stressed may also have less access to the types of infrastructure that support the efficient use of water in economic processes. It is important to note the distorting effect that differences in relative price levels can have

on such intensity comparisons.

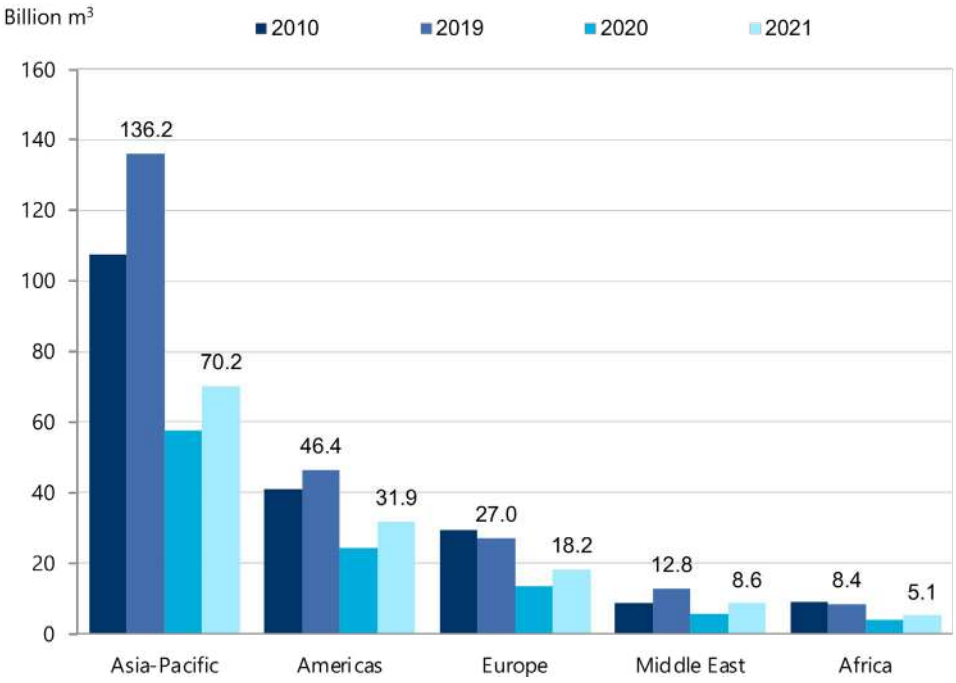
Fig. 35. Water-intensity of Travel & Tourism, by baseline water stress of tourism market, 2019 [43]



BREAKDOWN BY REGION

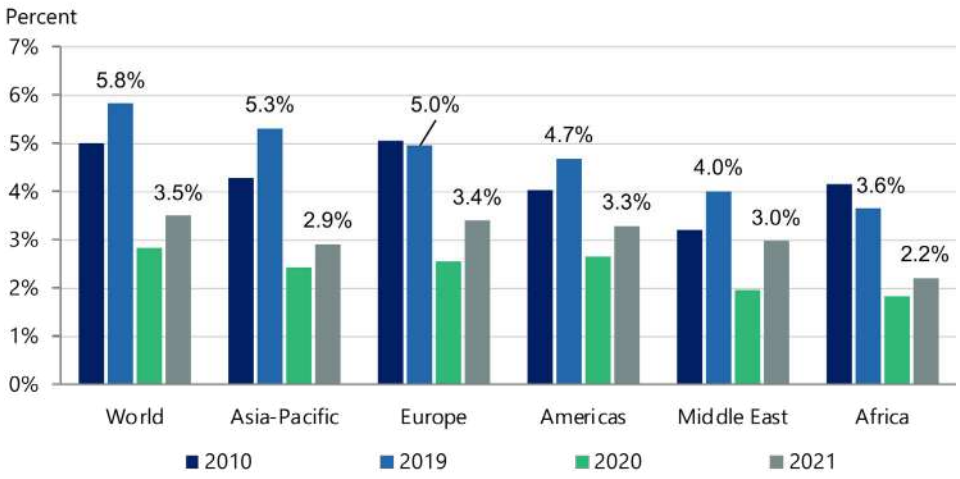
Given the global scope of Travel & Tourism, its demand for water is spread globally, as illustrated in Fig. 36**.** This shows the relative scale of tourism-linked water consumption in each region. Asia-Pacific, the Americas and the Middle East saw their Travel & Tourism-driven water footprint increase from 2010 to 2019, as expansions in tourism activity outpaced improvements in their water intensity. Meanwhile, Travel & Tourism in Europe and Africa saw declining water footprints over the same timeframe, with water intensity declining sufficiently rapidly to offset expansions in their tourism economies.

Fig. 36. Total water footprint of Travel & Tourism, by region[44]



Regional demand for water has changed over time (Fig. 37). While there is some variation between these regions, they mostly increased from 2010 to 2019.

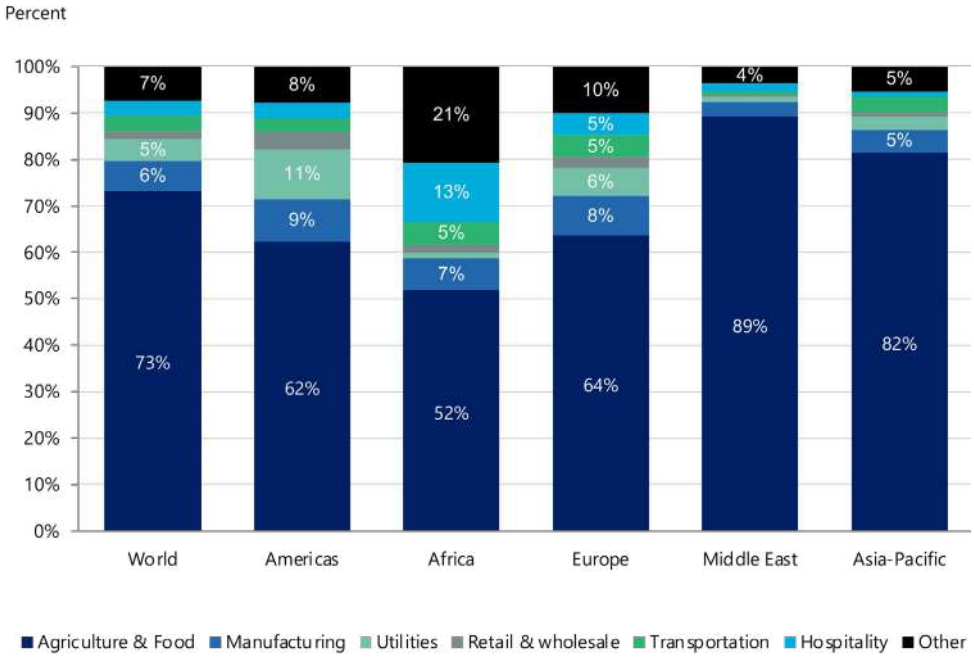
Fig. 37. Travel & Tourism's share of regional water use, 2019 [45]



Source: Oxford Economics, FAOAquastat

Variations in Travel & Tourism's water footprint can also be examined through regional differences in its industrial composition, see Fig 38. The large agriculture share in Travel & Tourism's water footprint points to other environmental implications of tourist-linked food production. In many countries, demand for crop and grazing land are principal drivers of deforestation, destruction of fragile ecosystems, and biodiversity loss. The sector's water footprint is a reminder of the environmental consequences of global food demand and as such, the sector's water consumption should not be considered trivial.

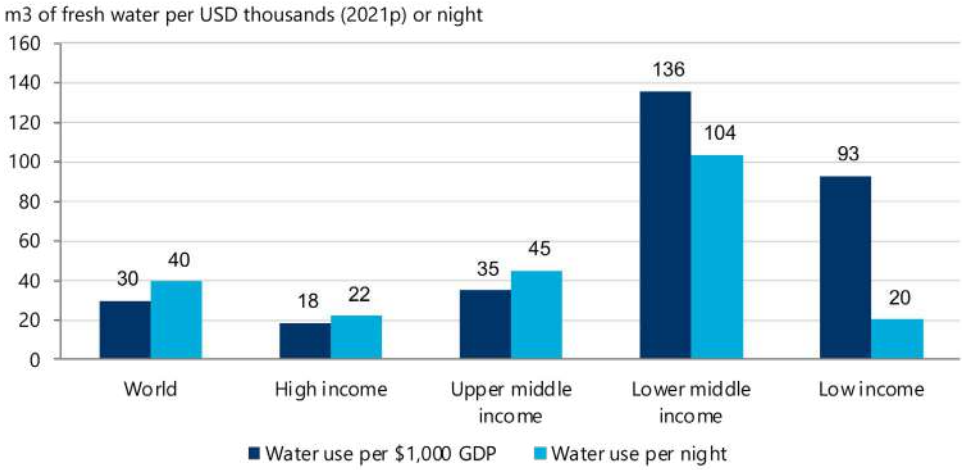
Fig. 38. Sectoral breakdown of Travel & Tourism water use, by region [46]



BREAKDOWN BY INCOME CATEGORY

Across income categories, Travel & Tourism in the world's poorest countries requires the most water per unit of economic value, but the *least* water per overnight stay by tourists, suggesting that low-income countries are very efficient at using water to support tourist visits, but due to prevailing price levels struggle to generate commensurate economic value from those visits. Meanwhile, middle-income countries have the least water efficient tourism economy, when controlling for tourist volumes.

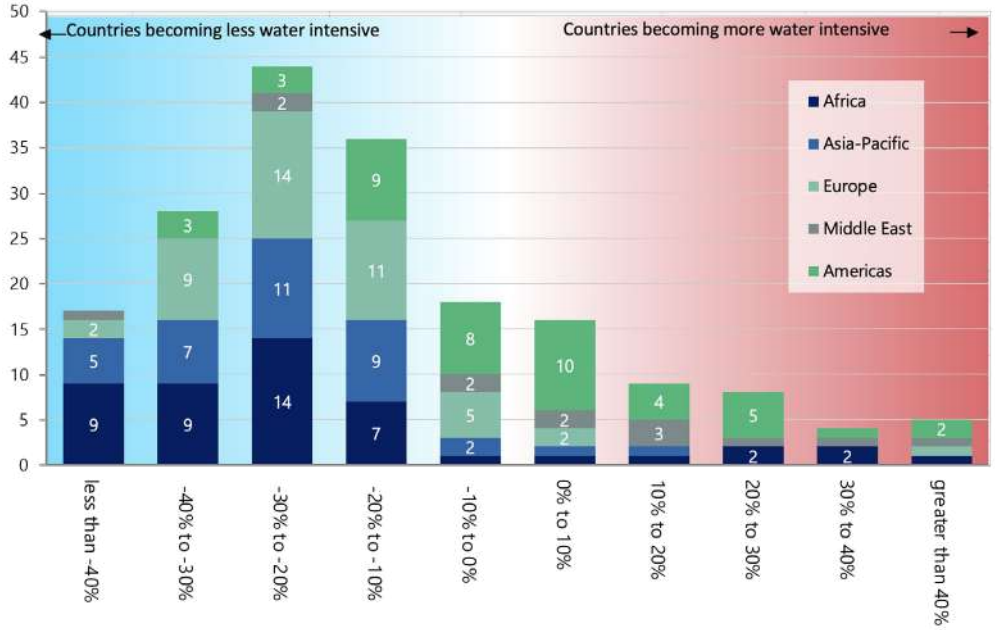
Fig. 39. Travel & Tourism water use per unit GDP and per overnight stay, split by country income categories [47]



5.2 COUNTRY LEVEL FINDINGS

Beyond these aggregate groupings, most countries saw the water intensity of Travel & Tourism fall between 2010 and 2019, see Fig. 40. This illustrates that even within regions with poorer overall water efficiency, there are still many success stories at the national level.

Fig. 40. Countries with specified changes in Travel & Tourism water intensity (m^3 per unit GDP), by region, 2010-19



Comparing country-level trends in Travel & Tourism GDP and water withdrawals can help appraise whether and where tourism economies have decoupled from water use. Fig. 41 compares the average growth in Travel & Tourism GDP (direct and indirect) with their average change in Travel & Tourism-linked water use, over the period of 2010-2019.[48] Countries above and left of the red dotted line saw growth in their tourism economies outpace Travel & Tourism's water use (or else Travel & Tourism's GDP fell at a slower pace than its water footprint). As shown, many countries are to the top-left of the line, indicating that for those countries there was at least somewhat of a decoupling Travel & Tourism's economic growth and its water withdrawals during the decade.

Fig. 41. Country average growth in Travel & Tourism GDP and water withdrawals, 2010-19

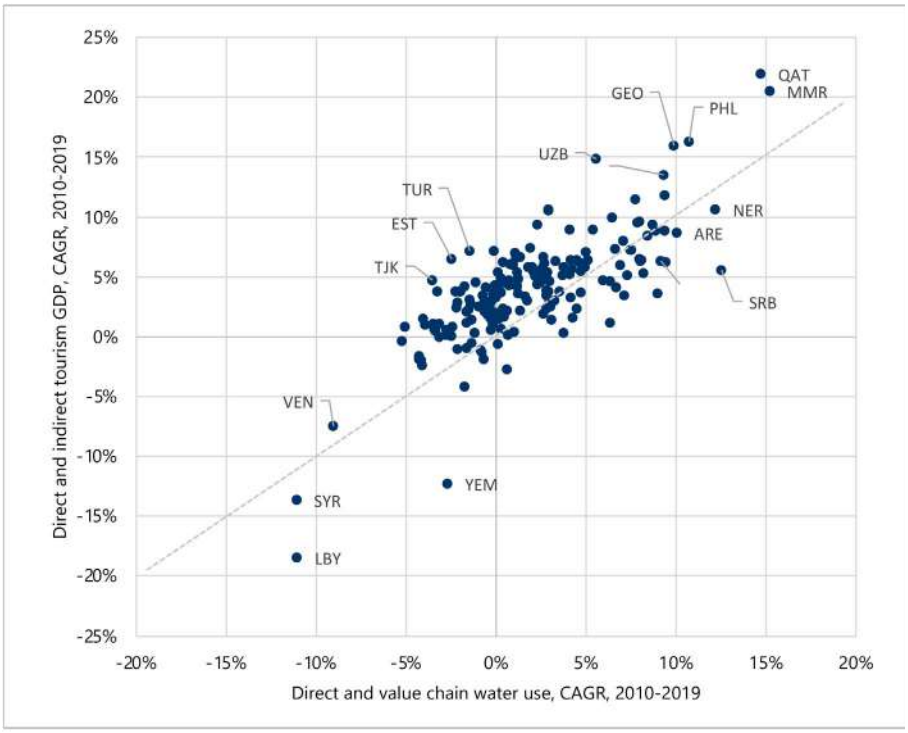
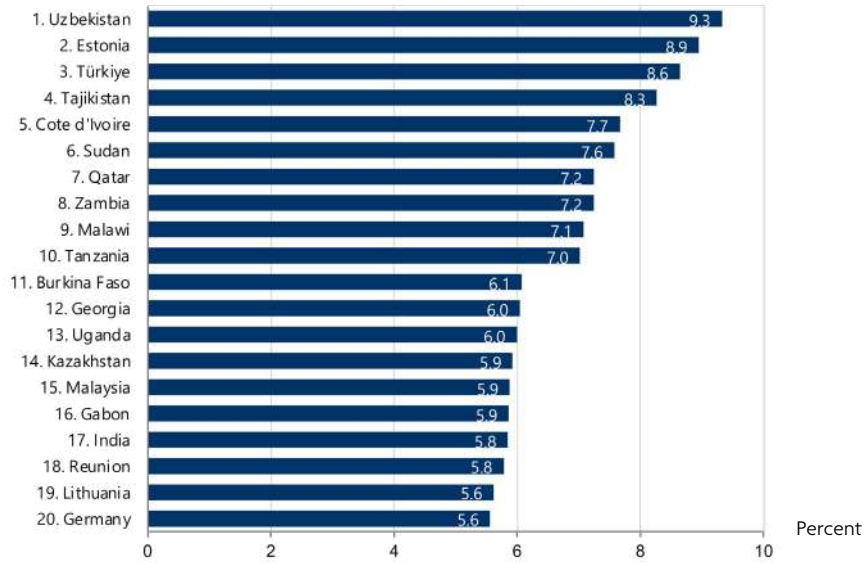


Fig. 42 identifies the countries that are furthest to the left/above the red dotted line. The metric depicted is average growth in Travel & Tourism (direct and indirect) GDP, minus average growth in Travel & Tourism's total water footprint. The figure ranks the major world tourism markets whose GDP growth over 2010-19 most rapidly outpaced their growth in Travel & Tourism-linked water demand.

Fig. 42. Countries with the largest percentage point difference in Travel & Tourism GDP and water use growth, 2010-19 [49]



6. TRAVEL & TOURISM'S AIR POLLUTION

Travel & Tourism activity produces different types of air pollutants that have implications for human health and environmental sustainability. For instance, combustion-based passenger vehicles produce carbon monoxide and nitrogen oxides, while the agriculture underpinning the food served in restaurants is responsible for most of its ammonia pollution. Other pollutants are generated as by-products of manufacturing and industrial processes along Travel & Tourism's supply chains.

Air pollutants contribute to respiratory and cardiovascular disorders and early mortality, responsible for nearly 7 million deaths each year.[50] Such pollutants can also damage ecosystems and natural habitats, create hazardous secondary pollutants, as well as harm plant growth and reduce crop yields. It is therefore important to understand the scale and character of Travel & Tourism's contribution to global air pollution. The modelling encompasses six types of pollutants, quantified in terms of the kilograms (kg) of such emissions created, and assesses the scale of such pollutants produced by the industries that directly or indirectly serve the demands of travellers:

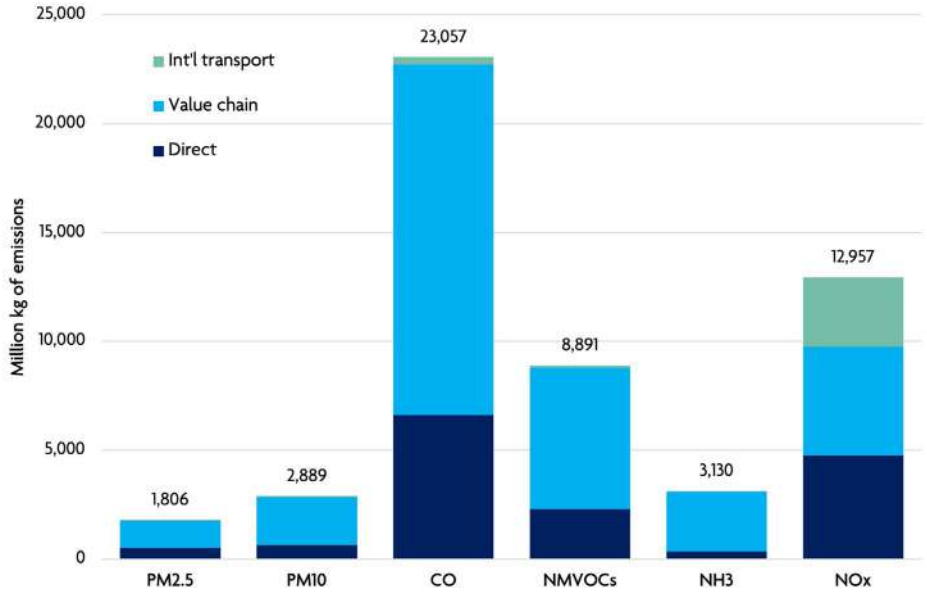
- **Particulate matter (PM)** describes a diverse class of tiny inhalable particles that include dust, black carbon, mould spores, minerals and other chemicals. These are classified by size, with this analysis focusing on the most common measures of **PM2.5** and **PM10**. The main sources of PM emissions are the burning of fossil fuels, as well as industrial processes and construction.
- **Carbon monoxide (CO)** is a toxic gas that can cause illness and death at high levels of exposure and is produced principally by motor vehicles and industrial processes.
- **Non-methane volatile organic compounds (NMVOCs)** are a group of chemicals with varying negative impacts on human health and the environment. Fuel burning, solvents and cleaning products are main sources of NMVOC emissions.
- **Ammonia (NH_3)** is commonly produced by agricultural activities, which can cause damage to plant and soil health.
- **Nitrogen oxides (NO_x)** are poisonous gases linked to smog and acid rain that cause respiratory problems and damage ecosystems. These are principally produced through by the burning of fossil fuels.

While this section contextualises and measures the impact of the mass of pollutants generated and emitted, these should not be considered a like-for-like quantification of their relative harms or dangers. Although the estimates are presented alongside one another, it is not appropriate to aggregate across the six types of pollutants.

6.1 TOTAL AIR POLLUTION LINKED TO TRAVEL & TOURISM

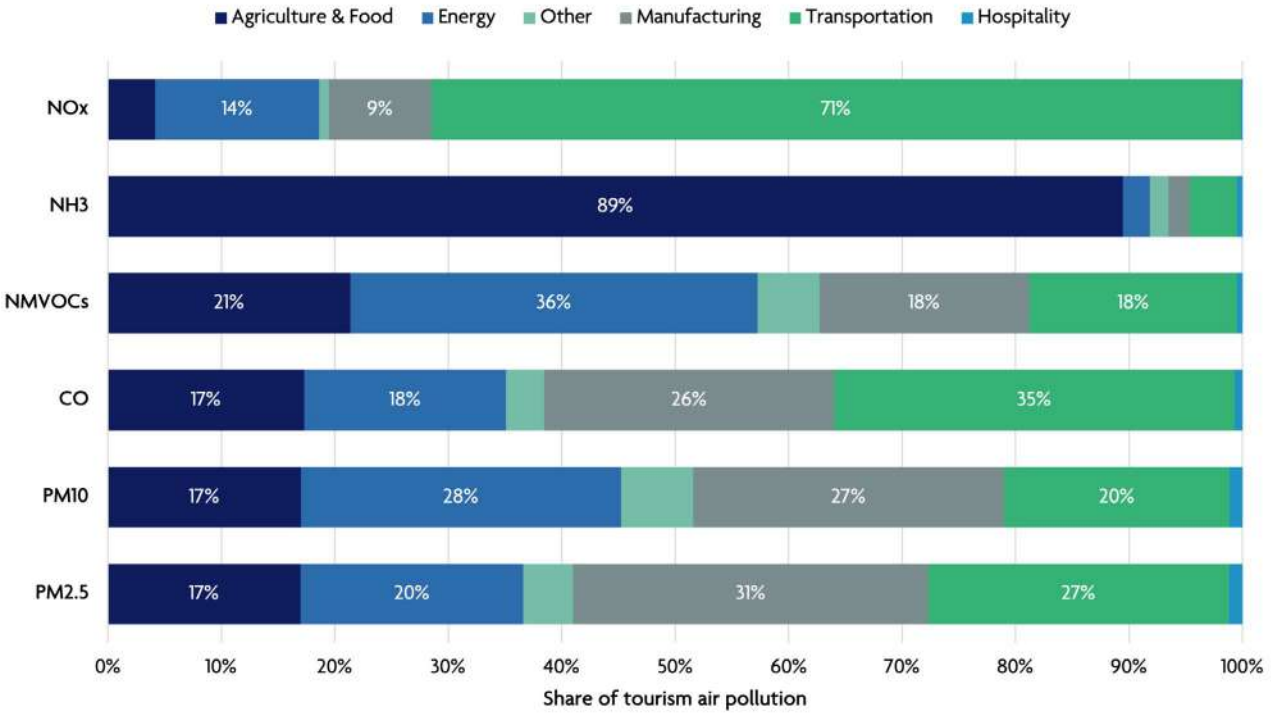
The emissions of air pollutants along Travel & Tourism's value chain are far larger than direct emissions by the sector itself. This is linked to the mix of industries that tend to emit each pollutant, and the relative concentration of those sectors within Travel & Tourism. For instance, emissions of ammonia (NH_3) are primarily contributed by agricultural sources, with virtually all of the agricultural activity linked to tourism featuring within its value chain.

Fig. 43. Travel & Tourism's direct and value chain air pollution, 2019



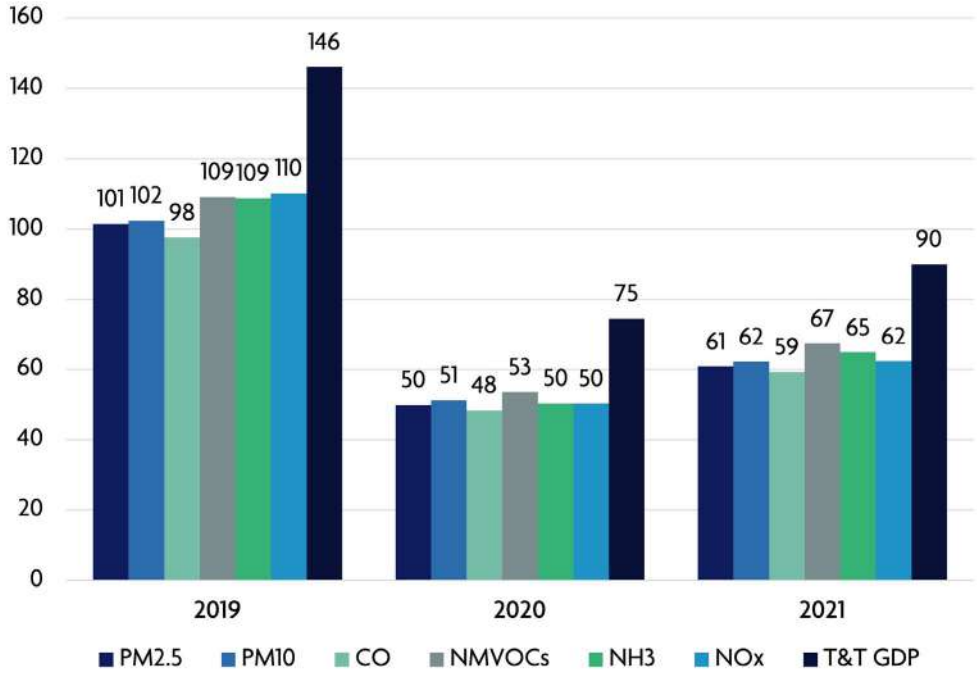
The pollution footprint of Travel & Tourism is linked to a broad mix of economic activities, and is attributable to a diverse set of industries. However, Travel & Tourism's NO_x and NH_3 footprint are notable exceptions, contributed predominantly by transportation and agriculture, respectively. These patterns are illustrated in Fig. 44.

Fig. 44. Industrial contributions to Travel & Tourism's air pollution footprint, 2019 [51]



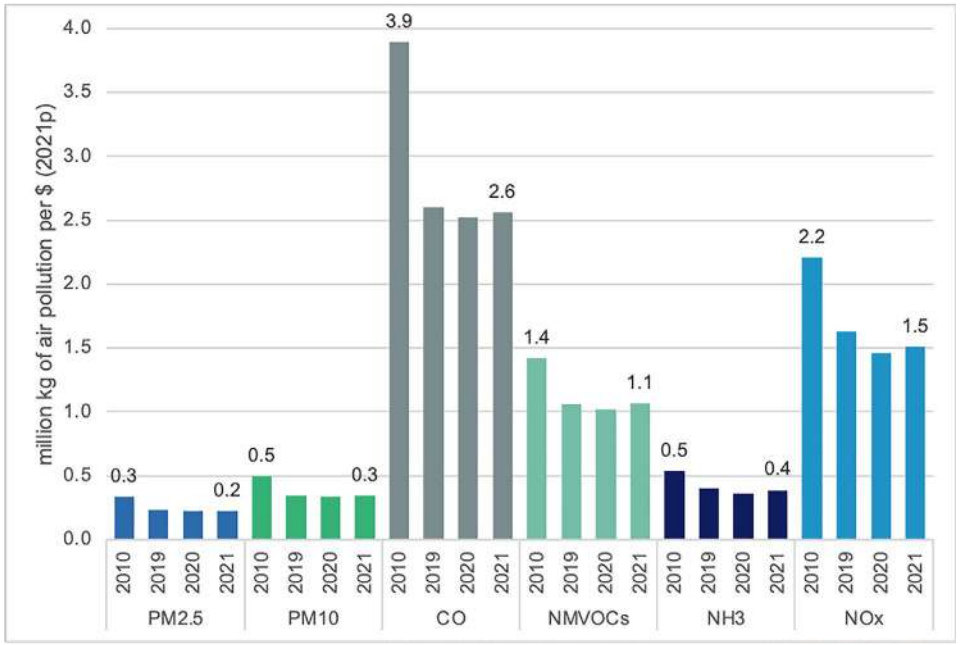
Since 2010, Travel & Tourism's air pollution footprint has mostly increased, but growth in Travel & Tourism's GDP contribution has outpaced these changes. Only Travel & Tourism's carbon monoxide footprint decreased in absolute terms from 2010 to 2019, supported by improvements in engine efficiency and emissions standards during the decade. Outputs of particulate matter, NMVOCs, and nitrogen oxides all increased. However, over the same period Travel & Tourism's GDP grew much more quickly, by an average of 4.3% per year, indicating that at a global level, there was some 'decoupling' between its output growth and its emissions of these various pollutants.

Fig. 45. Travel & Tourism total air pollution footprint, 2019-21; index with 2010 level = 100



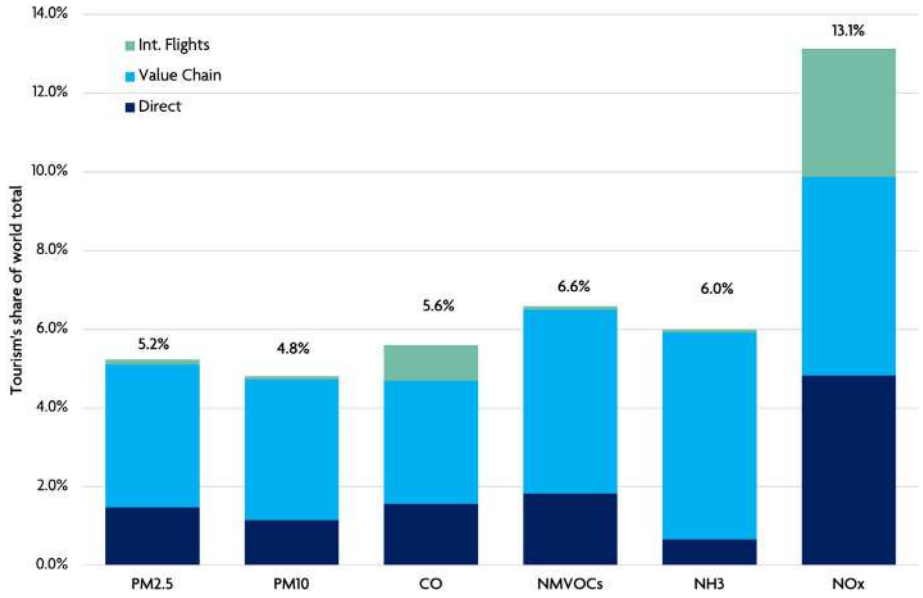
The decoupling is fundamentally tied to the declining pollutant-intensity of the sector. Over time, Travel & Tourism has created fewer emissions of pollutants per unit of economic value that the sector supports. Fig. 46 shows how this intensity has changed over time for each pollutant (under the broadest definition of Travel & Tourism – including its direct impact, the wider value chain, and international transportation).

Fig. 46. Emissions-intensity of Travel & Tourism over time [52]



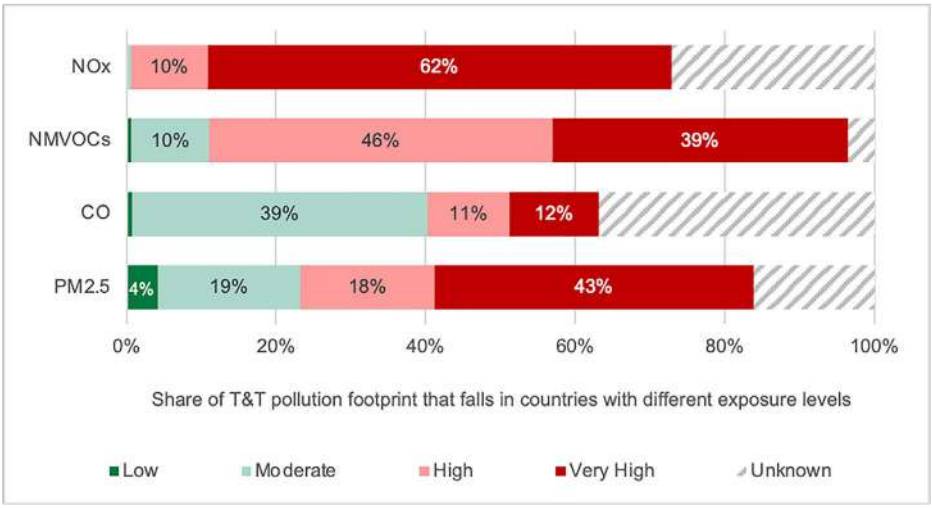
Travel & Tourism's share of global economic activity is larger than its share of global pollutant emissions, across most pollution types. Fig. 47 shows Travel & Tourism's share of global air pollution across each of the six pollutants in 2019. In the same year, the sector's share of global GDP – both direct and indirect – was 7.2%. This shows that Travel & Tourism was less pollution-intensive than the global average for all pollutants, except nitrogen oxides. Its higher share of global nitrogen oxides output is due to the predominance of transport in driving such emissions, as outlined in Fig. 44.

Fig. 47. Travel & Tourism's share of global air pollution, 2019



Unlike GHG emissions that are broadly global in consequence, the negative impacts of air pollution are more localised. Pollution that is emitted in countries where populations and ecosystems are already routinely exposed to high levels of air pollution can be more harmful than equivalent pollution in countries with lower levels of baseline exposure. Travel & Tourism's air pollution footprint is disproportionately concentrated in countries where the populations are already exposed to high or very high levels of air pollution. Fig. 48 summarises the geographic distribution of Travel & Tourism-linked pollutants, grouped according to each country's existing levels of exposure to each pollutant. Each country's exposure level is classified based on data from Yale's Environmental Performance Index.[53]

Fig. 48. Global distribution of Travel & Tourism air pollution by population exposure levels, 2019[54]



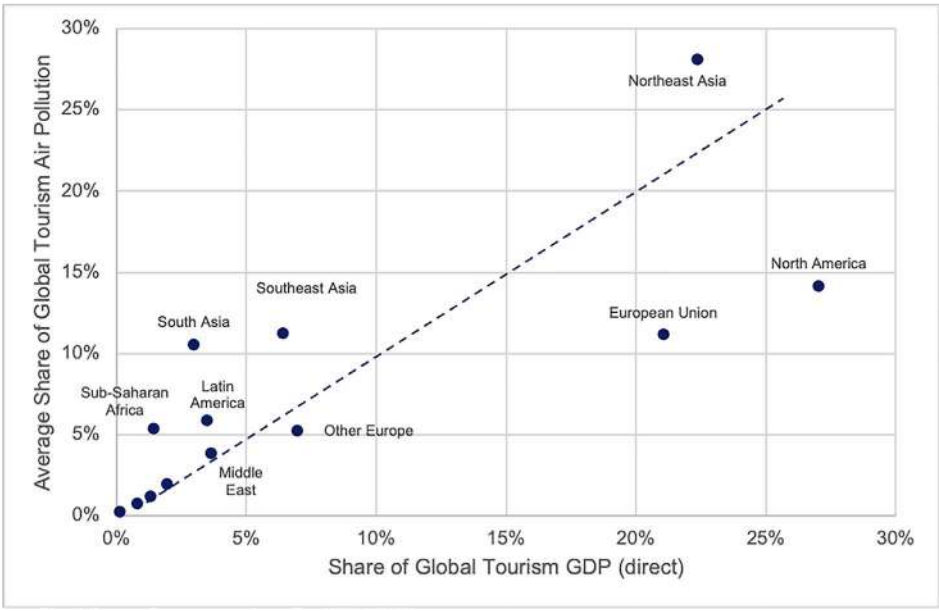
The share of pollution that falls in very highly exposed countries is especially pronounced, 62%, in the case of nitrogen oxides. Given Travel & Tourism's relatively higher share of global emissions of nitrogen oxides, this suggests that reductions in Travel & Tourism's NO_x pollution could have a substantial effect on alleviating overall levels of harmful exposure.

To some extent the concentration of Travel & Tourism's pollution footprint within highly polluted countries is reflective of the existing energy and transport infrastructure. In regions and nations that rely on less efficient forms of electricity generation, or those where most people only have access to old and inefficient vehicles or plants, the pollution impacts of all forms of economic activity are markedly higher. However, Travel & Tourism could still be influential in leading change in such areas, particularly in the transport sector.

6.2 **BREAKDOWN BY REGION**

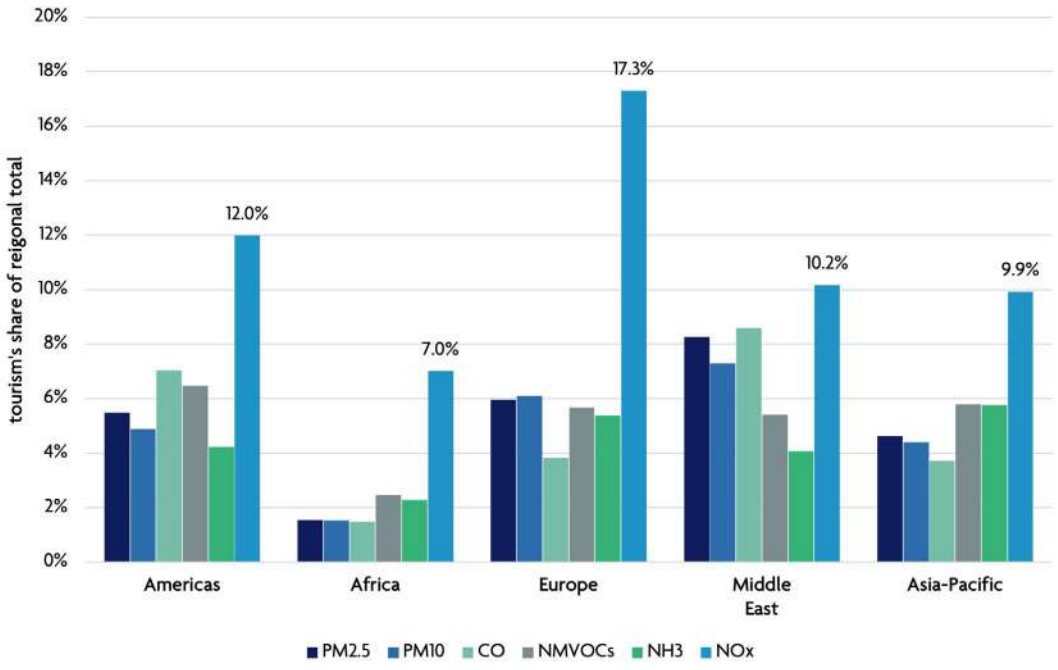
The varied character of tourism in different parts of the world is reflected in the diversity of its air pollutant footprint across regions. As with the other environmental impacts in this report, attribution of the sector's air pollution follows a consumption-based approach, attributing emissions to the end-use country whose tourism the emissions are supporting. Fig. 49 compares each region's share of global tourism GDP with its average share of Travel & Tourism emissions.[55] There are some large differences between these two proportions: for instance, North America accounts for 27% of Travel & Tourism's direct GDP, but only 14% of the sector's air pollution.

Fig. 49. Share of Travel & Tourism GDP and air pollution by sub-region, 2019[56]



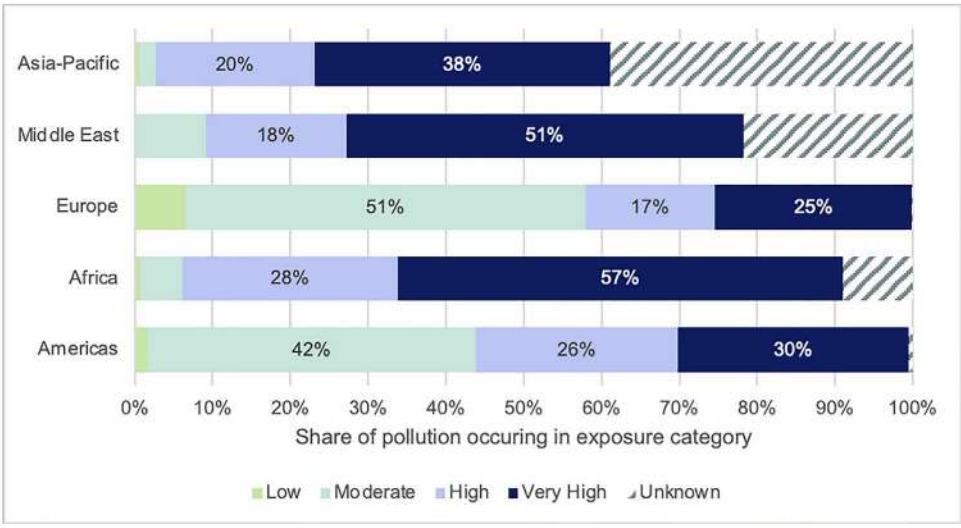
Travel & Tourism's contribution to total air pollution varies across the world and by pollutant. As shown in Fig. 50, Travel & Tourism's relative contribution to regional air pollution is lowest in Africa (with an average of 2.7% across all pollutants).

Fig. 50. Travel & Tourism's share of regional air pollution, 2019 [57]



The share of Travel & Tourism's air pollutant footprint that falls in highly exposed countries was lowest in Europe and the Americas. Fig. 51 illustrates the shares of regional Travel & Tourism-related emissions that occur in countries of different baseline exposure levels. The shares presented here are a simple average across all pollutant types. The data reveals differences in the extent to which Travel & Tourism is contributing to regional air quality issues, while also indicating the prevailing conditions for air pollution in these areas. Africa and the Middle East see the highest shares of their Travel & Tourism air pollution footprint being emitted in nations with high or very high exposure, at 85% and 69% respectively.

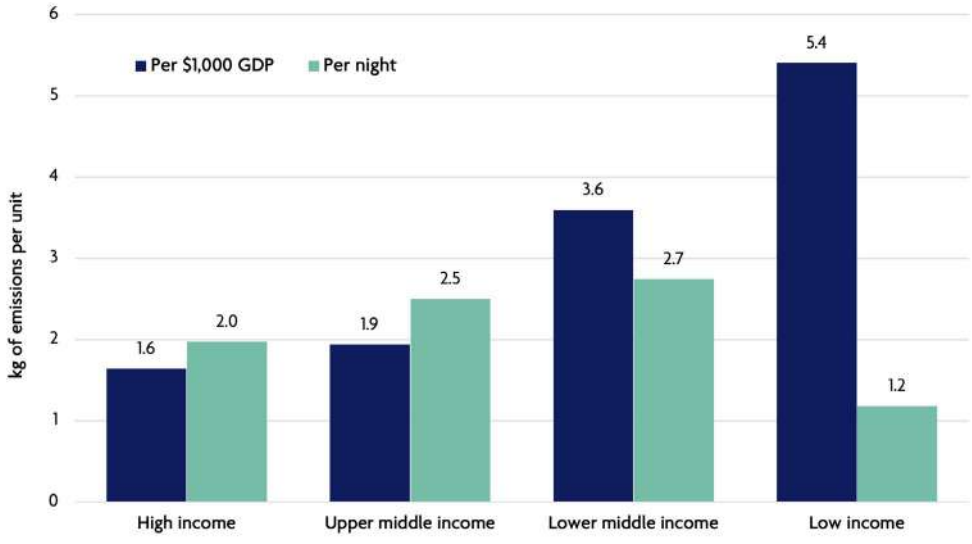
Fig. 51. Travel & Tourism's air pollution by population exposure level and region, 2019 [58]



6.3 BREAKDOWN BY INCOME CATEGORY

The pollutant-intensity of Travel & Tourism varies across the world's tourism markets, and these differences are a key driver of regional differences in the sector's air pollution footprint. However, intensities based on units of economic value (i.e. GDP) can be distortionary when comparing countries at very different levels of development. Intensities expressed as pollutants per tourist overnight stay offer a better like-for-like comparison between disparate parts of the world. Fig. 52 demonstrates this starkly: when considering nitrogen oxides, Travel & Tourism in low-income countries has by far the highest rate of pollution per unit of GDP, but by far the lowest rate of pollution per overnight stay. The same pattern is observed across all six pollutants discussed in this chapter.

Fig. 52. Travel & Tourism NO_x emissions-intensity across income groups [59]



7. TRAVEL & TOURISM'S MATERIAL EXTRACTION

The global economy is built on the extraction of raw materials. Even sectors that do not seem to depend on the natural world are reliant on materials drawn from nature for crucial and necessary inputs. Travel & Tourism is no exception, relying on commodities like crops, fossil fuels and other minerals for food, power sources and construction materials across the value chain.

To assess the role and extent of Travel & Tourism's raw materials use, this section quantifies the total mass of materials extracted: literally the weight of natural materials drawn from the soil, from underground, or from water which are then used to indirectly meet the demands of domestic and international tourists. The assessment does not identify any 'direct' materials extraction by the Travel & Tourism sector, since these extractive activities are performed by the primary industries such as agriculture, forestry, fishing and mining. The following four categories of raw material are assessed:

- **Biomass** describes the total mass of harvested crops, vegetation consumed by livestock, wood felled for timber or fuel, and fish drawn from rivers and oceans. In the context of tourism, this material forms the food consumed in restaurants and other establishments.
- **Fossil fuels** encompass the volume of oil, natural gas, coal and other fuels extracted by the energy industry.
- **Metal ores** are the materials dug by the mining sector that are used in metals manufacturing and ultimately fabricated into metal structures, machinery, vehicles, etc.
- **Non-metallic minerals** describe the stone, sand, clay, and other substances that are mined to form cement, concrete, and ceramics, as well as precursors to other industrial chemicals and fertilisers.

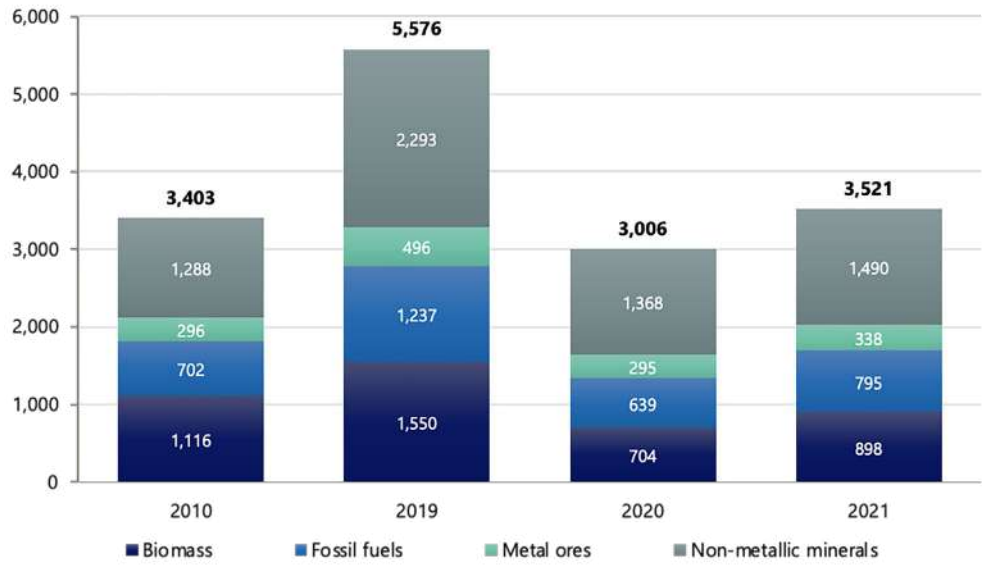
This aspect of Travel & Tourism's environmental footprint highlights some of its most important dependencies on the natural world. The creation of biomass inputs depends on services that can only be rendered by healthy and diverse soil, forest, and aquatic ecosystems. Fossil fuels are extracted from finite and non-renewable stocks, while minerals are extracted at a rate that is orders of magnitude greater than the geological processes that produced them.

7.1 TOTAL MATERIAL EXTRACTION LINKED TO TRAVEL & TOURISM

The material requirements of Travel & Tourism grew by 64% in the decade to 2019. This is shown in Fig. 53, which describes tourism's global materials footprint, in million tonnes, split by four main categories of material type. Non-metallic minerals is the largest of these four extraction categories, accounting for 41% of total material extracted in 2019, and the one experiencing the strongest growth from 2010-19, a 78% increase. Demand for these types of raw materials is predominantly driven by construction activity, reflecting the growth in tourism-linked investment in buildings and infrastructure during this time.

Fig. 53. Global materials extraction linked to Travel & Tourism

Million tonnes

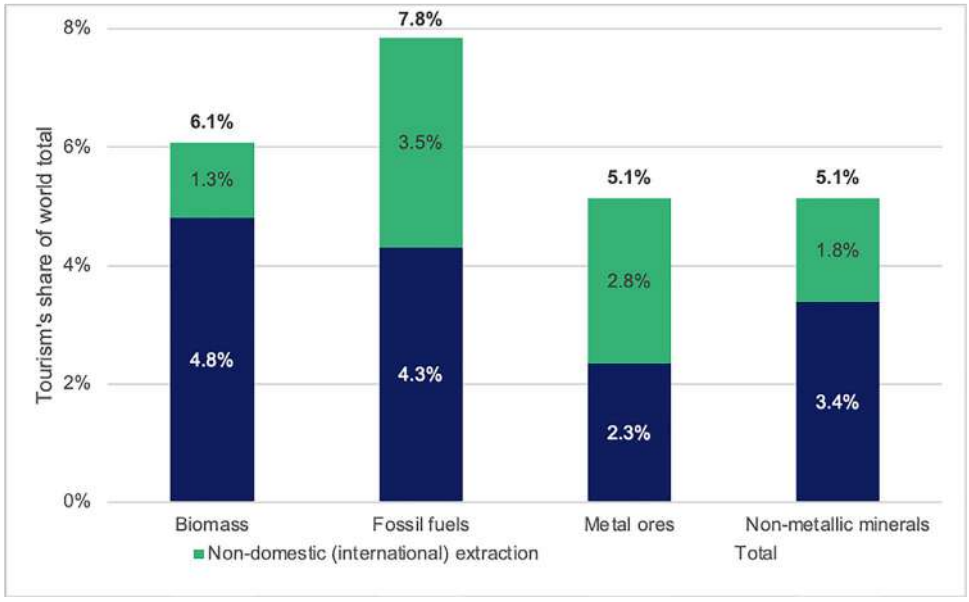


Source: UN Environment Programme, Oxford Economics

Travel & Tourism is relatively less material-intensive than the global average across all material types, except for fossil fuels. Fig. 54 reveals the share of total global materials extraction in 2019 that can be attributed to the economic demands of Travel & Tourism, suggesting that Travel & Tourism uses fossil fuels more intensively than the global economy overall, whilst the opposite is true for the other material types analysed.

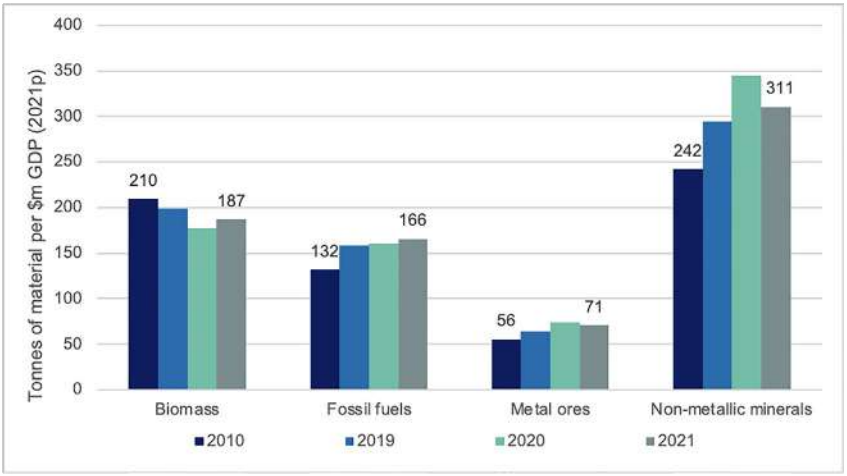
Travel & Tourism's biomass footprint is more 'localised' than its fuels and minerals footprint given the local nature of agricultural supply chains, as per Fig. 54. The remainder of Travel & Tourism's materials footprint has a much larger internationally-traded share.

Fig. 54. Travel & Tourism's share of global materials extraction, 2019



While the material-intensity of Travel & Tourism is lower than the global average, intensities have increased since 2010 across all material types except biomass. Fig. 55 shows the material-intensity, that is, the tonnage of material extracted per unit of GDP, across the four broad categories of materials. While the material-intensity of Travel & Tourism has increased overall over the last decade, the notable exception is biomass, where decreasing intensities may reflect global efforts to achieve greater efficiency within the agricultural sector.

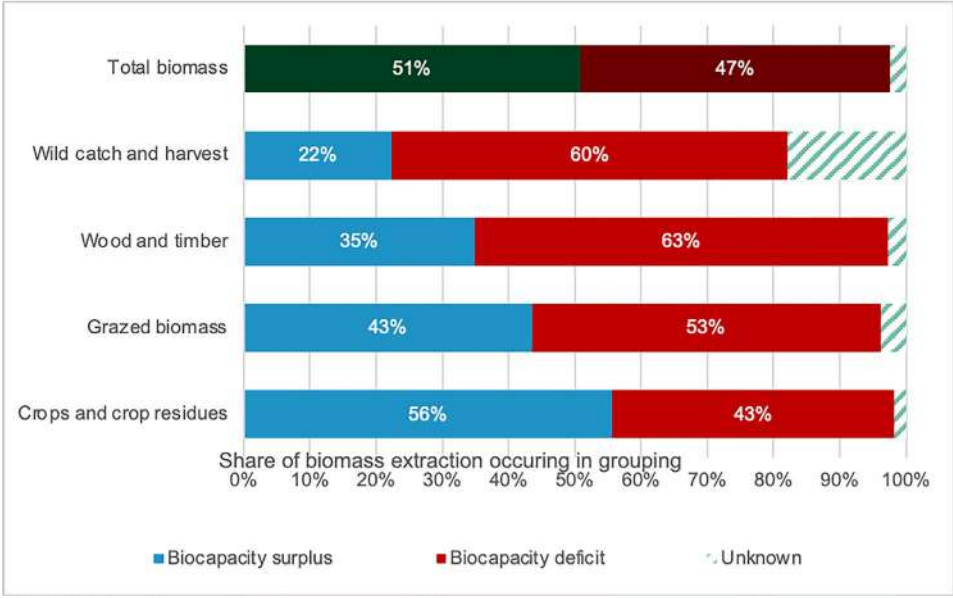
Fig. 55. Material-intensity of Travel & Tourism over time [60]



The biomass requirements of Travel & Tourism contribute to the over-exploitation of nature, in particular in regions with a biocapacity deficit. Biocapacity describes the capability of an ecosystem to regenerate the resources being harvested and extracted from the land. Regions that are in biocapacity surplus extract fewer resources than their ecosystems can sustainably regenerate, while a region with a biocapacity deficit is extracting resources at a pace that cannot be met by natural regeneration. Fig. 56 shows the share of Travel & Tourism's biomass extraction that occurs in countries which are in biocapacity surplus or deficit respectively, according to their ecosystem type[61]. The data reveals that around half of Travel & Tourism's biomass footprint falls in countries that are in biocapacity surplus.

There is considerable variation in this footprint, across biomass of different types. 22% of Travel & Tourism-linked wild fish catch and aquaculture harvest took place in countries whose fishing ground ecosystems are in biocapacity surplus. 56% of Travel & Tourism's total crop requirement falls in countries whose croplands are in ecological surplus. The fact that so much biomass consumption takes place in areas of ecological deficit is not solely due to Travel & Tourism, but rather reflects a global food system that places extreme demands on ecological capacity in many parts of the world.

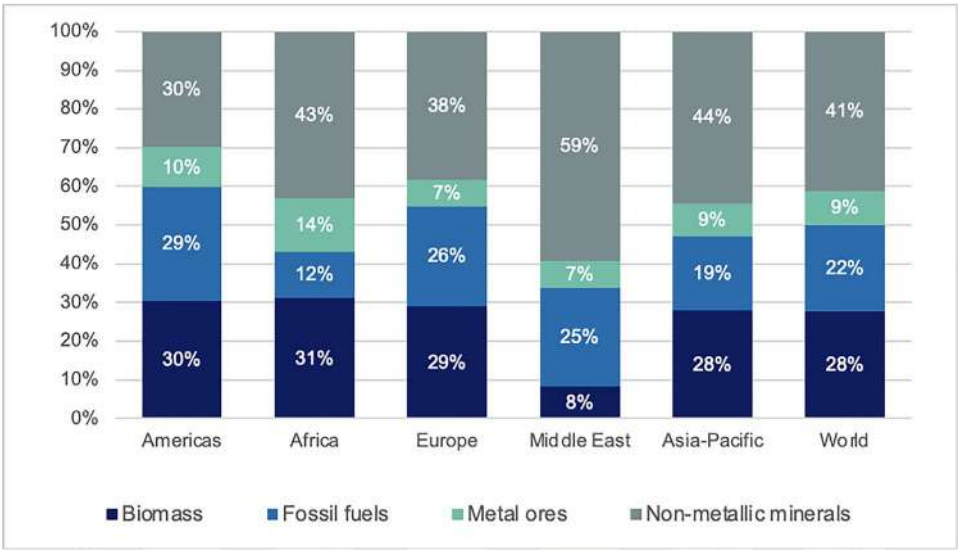
Fig. 56. Travel & Tourism's global biomass footprint, grouped according to whether the country is in biocapacity surplus or deficit, 2019 [62]



7.2 **BREAKDOWN BY REGION**

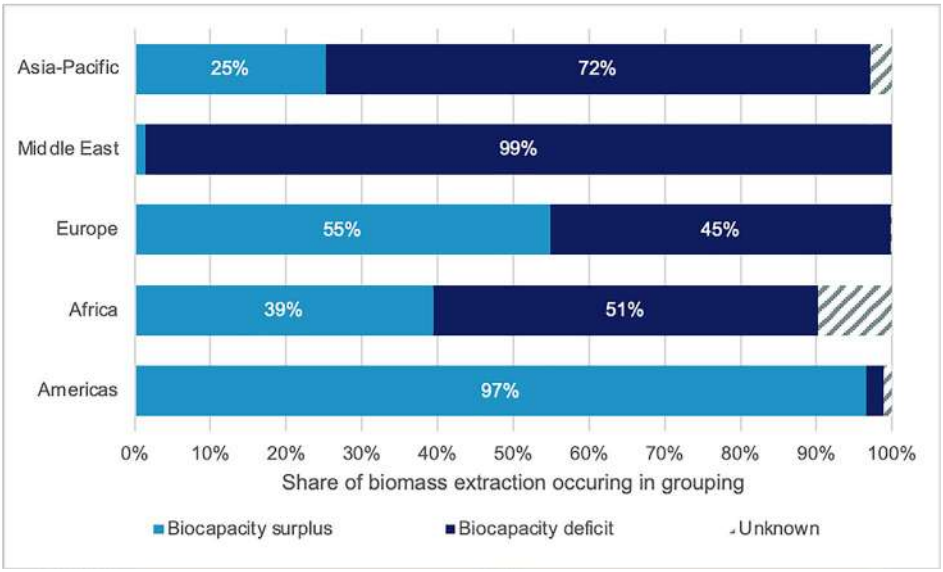
The nature of Travel & Tourism's raw material footprint varies in different regions of the world, as per Fig. 57. The share of its material extraction that is represented by biomass is fairly consistent across regions, reflecting the universal centrality of crop and food demand to Travel & Tourism activity. The exception is the Middle East, where the scale of ambitious Travel & Tourism capital investment programmes mean that construction materials feature much more prominently in its material footprint. Non-metallic minerals make up 59% of material extracted to support Travel & Tourism in the Middle East, nearly double the equivalent share in the Americas (30%).

Fig. 57. Regional composition of Travel & Tourism's material footprint, 2019 [63]



Regional analysis can also help to identify where and to what extent the biomass requirements of Travel & Tourism may contribute to ecosystem degradation, depending on the country's biocapacity surplus or deficit, as per Fig. 58.[64] This illustrates the significant regional variation in Travel & Tourism's material footprint across the world: in the Middle East it is heavily concentrated in countries with a biocapacity deficit (99%), while in the Americas it lies almost entirely in countries in biocapacity surplus (97%).

Fig. 58. Travel & Tourism's regional biomass footprint, grouped according to whether country is in biocapacity surplus or deficit, 2019

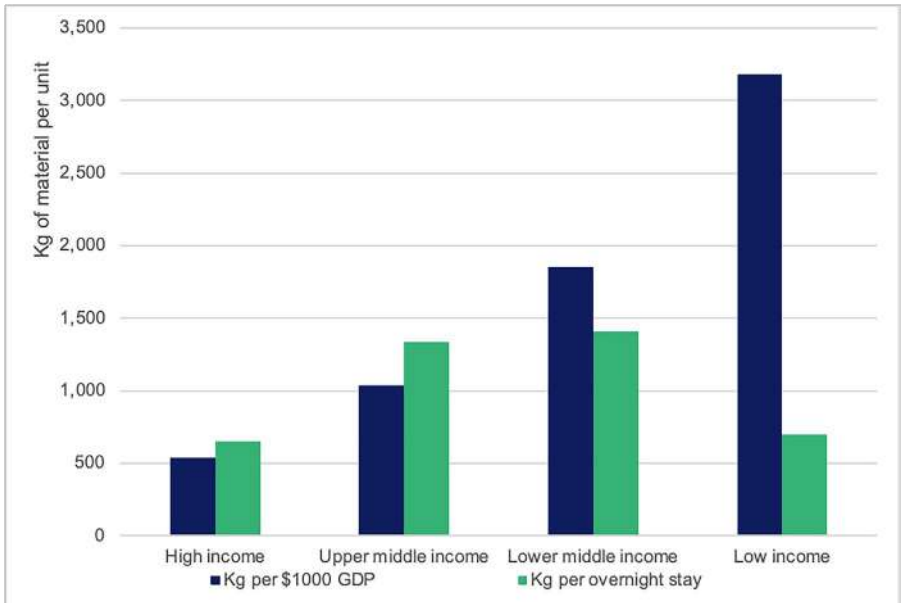


The extracting of biomass from nations in biocapacity surplus is not itself a signal of sustainability. For instance, Travel & Tourism's biomass footprint in the Americas is concentrated overwhelmingly in Brazil and the USA, both of which are in biocapacity surplus but are also experiencing significant challenges from ecosystem loss and biodiversity decline in key habitats.

7.3 BREAKDOWN BY INCOME CATEGORY

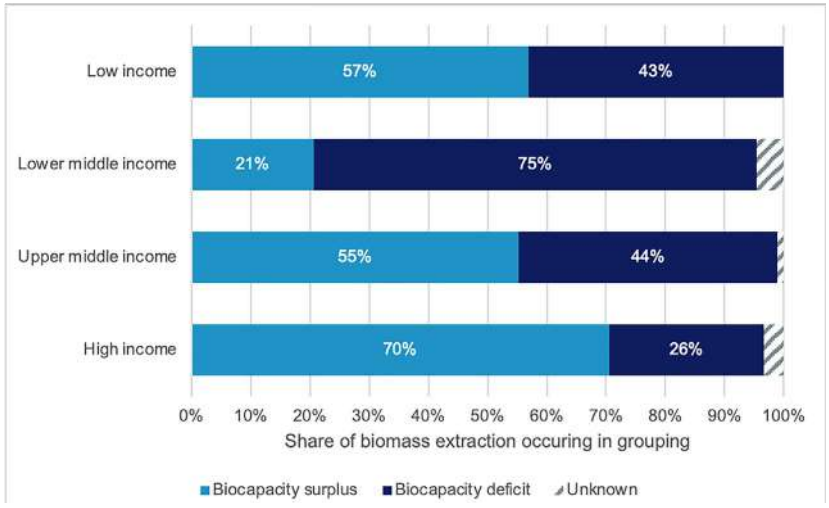
Travel & Tourism in low-income nations is the most material-intensive per dollar of GDP; but the least materials-intensive per overnight tourist stay. GDP-based environmental intensities also capture variations in purchasing power, with a dollar of GDP in lower-income countries likely to represent a larger volume of goods and services than a dollar of GDP in a higher-income country. As such, Fig. 59 includes the material-intensity of tourism calculated per unit of GDP and per tourist night.

Fig. 59. The material footprint of Travel & Tourism per unit GDP and per tourist night, by income groups [65]



Travel & Tourism's biomass extraction in lower middle-income countries is highly concentrated (75%) in countries with a biocapacity deficit. Meanwhile, most of its biomass footprint in high-income countries lies within countries in biocapacity surplus (70%), as illustrated in Fig. 60.

Fig. 60. Travel & Tourism's biomass footprint, grouped according to whether biomass extraction takes place in a country in biocapacity surplus or deficit, by income level, 2019 [66]



7.4 COUNTRY LEVEL FINDINGS

Comparing growth in Travel & Tourism GDP (direct and indirect) with the associated material footprint can help appraise the extent to which the sector's economic value creation has decoupled from its material use, as can be seen in Fig. 61, for the period of 2010-2019.[67] Countries below and to the right of the red line have seen their Travel & Tourism GDP grow more quickly than its material extraction. Many countries sit to the bottom-right of the line, indicating that there was somewhat of a decoupling over the decade.

Fig. 61. Growth in tourism GDP and material extraction by country, 2010-19

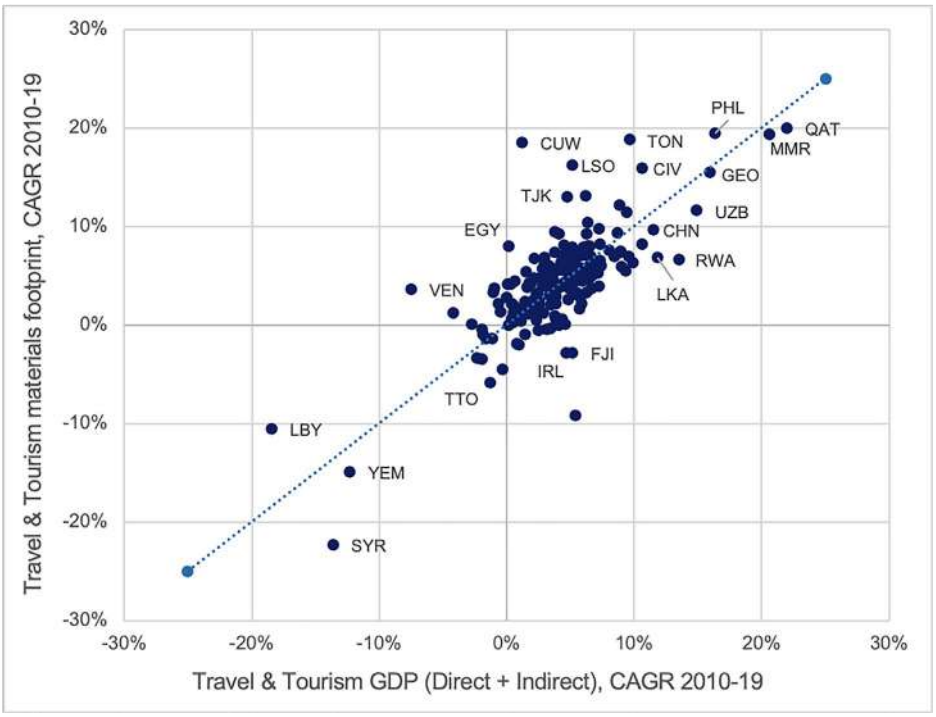
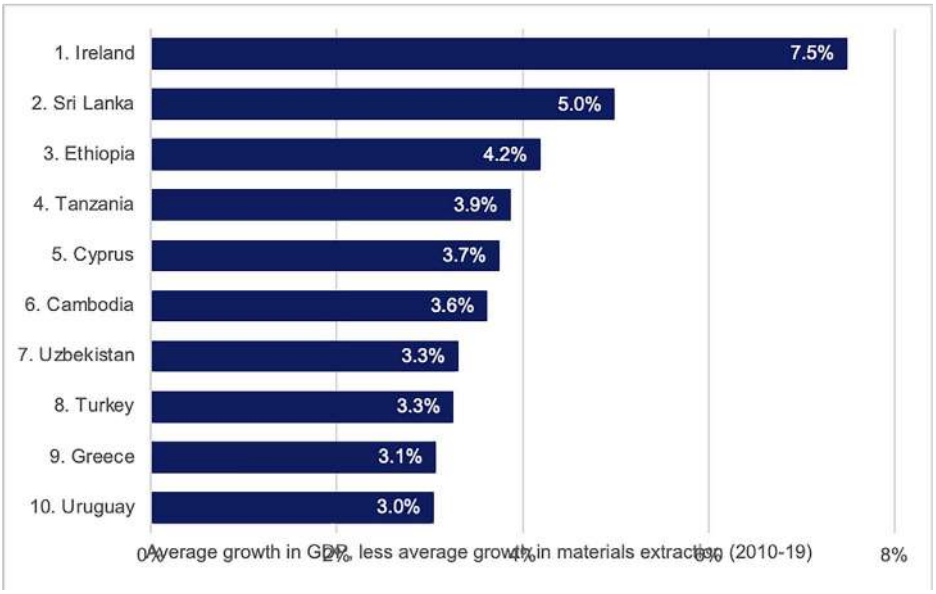
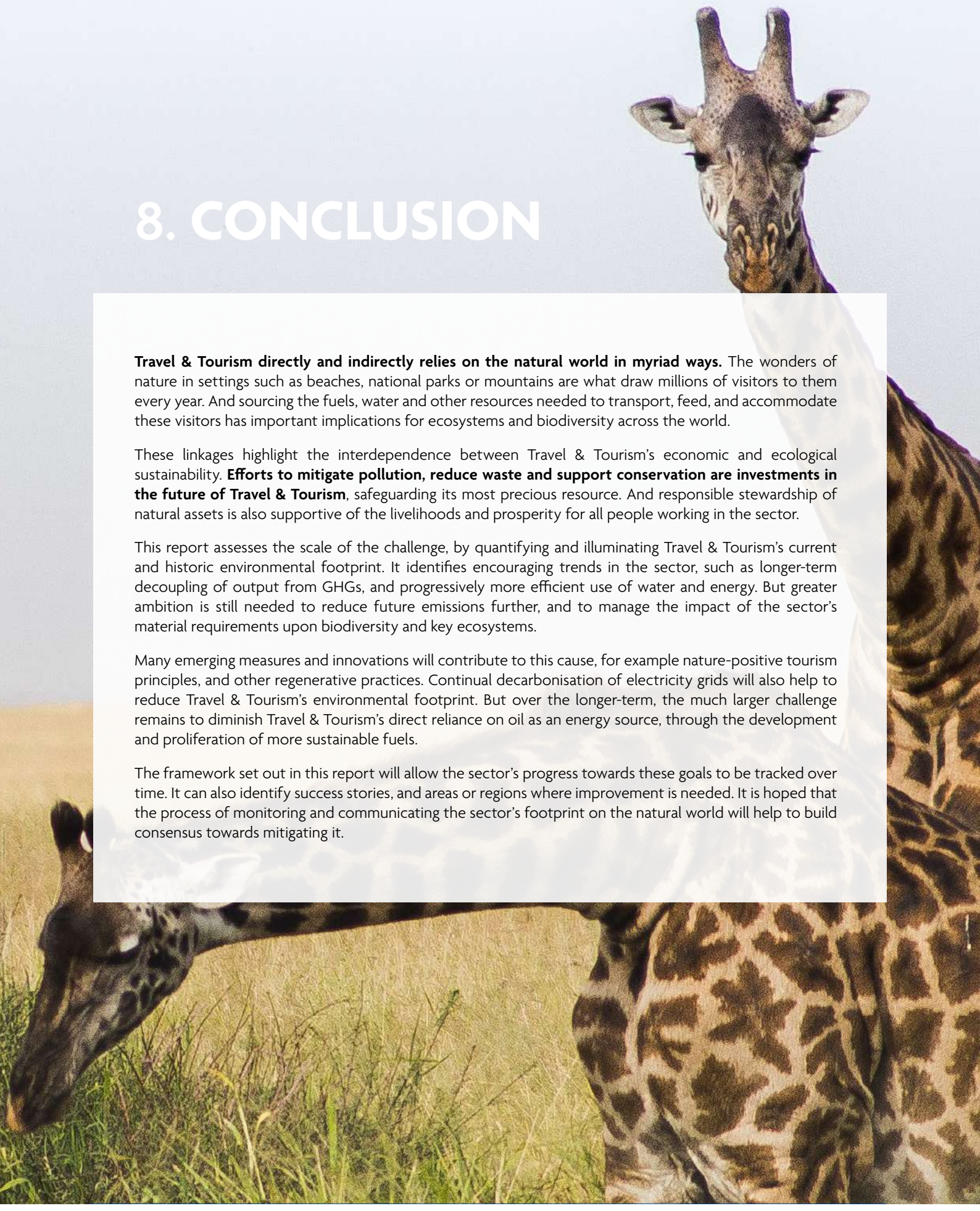


Fig. 62 identifies countries furthest to the right and below the red line in Fig. 61. The metric depicted is average growth in Travel & Tourism GDP, minus average growth in Travel & Tourism's material footprint (aggregated across materials). As such, it depicts the major world tourism markets whose tourism GDP growth in the decade to 2019 most rapidly outpaced growth in Travel & Tourism-linked material extraction.

Fig. 62. Countries with the largest difference in tourism GDP and materials growth, 2010-19[68]





8. CONCLUSION

Travel & Tourism directly and indirectly relies on the natural world in myriad ways. The wonders of nature in settings such as beaches, national parks or mountains are what draw millions of visitors to them every year. And sourcing the fuels, water and other resources needed to transport, feed, and accommodate these visitors has important implications for ecosystems and biodiversity across the world.

These linkages highlight the interdependence between Travel & Tourism's economic and ecological sustainability. **Efforts to mitigate pollution, reduce waste and support conservation are investments in the future of Travel & Tourism**, safeguarding its most precious resource. And responsible stewardship of natural assets is also supportive of the livelihoods and prosperity for all people working in the sector.

This report assesses the scale of the challenge, by quantifying and illuminating Travel & Tourism's current and historic environmental footprint. It identifies encouraging trends in the sector, such as longer-term decoupling of output from GHGs, and progressively more efficient use of water and energy. But greater ambition is still needed to reduce future emissions further, and to manage the impact of the sector's material requirements upon biodiversity and key ecosystems.

Many emerging measures and innovations will contribute to this cause, for example nature-positive tourism principles, and other regenerative practices. Continual decarbonisation of electricity grids will also help to reduce Travel & Tourism's environmental footprint. But over the longer-term, the much larger challenge remains to diminish Travel & Tourism's direct reliance on oil as an energy source, through the development and proliferation of more sustainable fuels.

The framework set out in this report will allow the sector's progress towards these goals to be tracked over time. It can also identify success stories, and areas or regions where improvement is needed. It is hoped that the process of monitoring and communicating the sector's footprint on the natural world will help to build consensus towards mitigating it.

ENDNOTES

1: Data includes Scopes 1, 2 and 3 (value chain) and international transport

2: Biocapacity surplus describes a state where biomass extraction can be sustainably regenerated by its ecosystem, while biocapacity deficit means ecosystems are being unsustainably extracted from. The proportions do not sum to 100% due to a small proportion (2%) of the biomass footprint falling in territories whose biocapacity cannot be reliably assessed.

3: WTTC (2023) Travel & Tourism: Economic Impact 2023

4: WTTC (2022) Travel & Tourism: Economic Impact 2022

5: The GHG Protocol is the world's most widely-used greenhouse gas accounting standard. (GHG Protocol website)

6: The source of GHGs information is the PRIMAP-hist dataset, as published by the Potsdam Institute for Climate Impact Research. Energy data are drawn from the International Energy Agency. Data on air pollutants are sourced from EU's Emissions Database for Global Atmospheric Research. Water use statistics are drawn from the UN Food and Agriculture Association, and materials extraction data from the UN Environment Programme. Please see the methodological report for further detail.

7: This calculation assumes that the economic and environmental characteristics of the sectors that serve tourist demand are equivalent to the broader industries of which they are a part. In other words, a tourist's $100 purchase of clothing is assumed to stimulate an economic and environmental impact that is equivalent to $100 of 'average' production in the clothing manufacturing industry for that country (and/or the country where the clothing is imported from). This means that the modelling does not capture any qualitative variation in the kinds of items that tourists buy. To the extent that tourists are responsible for consumption of higher-end or luxury items, that are potentially more polluting/resource-intensive, our estimates of environmental footprint could be considered conservative.

8: IPCC (2023) AR6 Synthesis Report: Climate Change 2023 https://www.ipcc.ch/report/sixth-assessment-report-cycle/

9: While carbon dioxide (CO_2) is the most dominant, all other significant greenhouse gases are included in the estimates quantified this chapter, including for example methane (CH_4), nitrous oxide (N_2O), fluorinated gases, and other synthetic chemicals.

10: Building on a 20-year partnership between World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), GHG Protocol works with governments, industry associations, NGOs, businesses and other organizations. GHG Protocol supplies the world's most widely used greenhouse gas accounting standards.

11: In aggregate, the Scope 2 and 3 impact channels of the GHG Protocol are broadly analogous to the value chain category in the GSM framework.

12: Note: For GDP comparisons throughout, induced GDP impacts are excluded for coherence, due to the lack of a corresponding 'induced' GHGs concept.

13: GDP includes direct and indirect. Emissions includes Scope 1-3 emissions and international transport.

14: Includes Scope 1-3 emissions and international transport. The GDP measure only includes direct and indirect.

15: Scope 2 emissions describe the GHGs linked to the electricity consumption of tourism-facing industries. The 'Utilities' emissions within Scope 3 captures the GHGs embedded in the electricity purchased by businesses within the supply chains of Travel & Tourism.

16: This breakdown includes international transport emissions.

17: Emissions include Scope 1-3 and international transportation.

18: Emissions includes Scope 1-3 and international transportation. GDP includes direct and indirect impacts.

19: Includes Scope 1-3 emissions and international transport for 2019.

20: The figures include domestic emissions only. This includes Scope 1 and 2 emissions, domestic Scope 3 emissions, and international transport.

21: This means comparisons where Travel & Tourism is expressed as a percentage of overall economy-wide GHG emissions, or other national total environmental impacts.

22: This study does include all such global emissions in its estimates of magnitudes and intensities, but any impacts expressed as a percentage of country or regional totals will exclude them. This is ultimately to avoid describing Travel & Tourism-linked emissions in Country B as a proportion of Country A's national total.

23: "Domestic emissions" refers to emissions that occur within-country (rather than within-region). "Rest of world emissions" includes the GHGs emitted in other countries within the named region, as well as the wider world.

24: Includes direct, value chain, international flight energy use. The GDP measure only includes direct and indirect.

25: Major tourism markets are defined as countries with >$2 billion in total tourism GDP are included. This criterion captures 115 of our 185 study countries.

26: Emissions include Scope 1-3 and international transport. GDP includes direct and indirect.

27: The global economy used an estimated 572 million TJ of energy in 2021.

28: The energy used by international flights is included in direct energy use.

29: The IEA reports the total lifetime GHG emissions of natural gas are 50% less than coal per MWh of electricity produced.

30: This sum is a conservative measure of the emissions linked to energy demand, since these are calculated on an industry basis. They do not include GHG emissions within other industries linked to their direct energy requirements, e.g., the burning of fuels used by construction vehicles, or onsite generation of electricity by manufacturing firms.

31: This study uses a consumption-based method for attributing Travel & Tourism's total environmental footprint to individual countries. This means that energy use is attributed to the country whose tourism economy it is supporting, regardless of whether the energy was used within that country, or in another country and 'embodied' within imported goods and services.

32: Energy use includes direct, supply chain, and international flights. GDP includes direct and indirect impacts.

33: Includes direct, value chain, and international flight energy use for 2019.

34: Includes direct, value chain, and international flights.

35: Includes direct, value chain, and international flights.

36: Includes direct, value chain, international flight energy use. The GDP measure only includes direct and indirect impacts.

37: Energy includes direct, value chain, and international flights. Emissions includes Scope 1-3 and international transportation.

38: Includes direct, value chain, and international flights.

39: Includes direct, value chain, and international flights.

40: Includes both direct and value chain water use. The water use ascribed to 'agriculture & food' in the direct channel captures tourist *direct* purchases of food from (e.g.) retailers, food vendors or farm shops. By contrast, the water embedded in meals that are served to tourists in (e.g.) restaurants, cafes and hotels are captured in the equivalent figure in the value chain channel. This is due to agriculture & food being categorised as an input into the hospitality sector supply chain.

41: World Resource Institute (2019) Aqueduct 3.0 Country Rankings https://www.wri.org/data/aqueduct-30-country-rankings. Baseline water stress refers to total water withdrawals, expressed as a share of available renewable water supplies. Each country's ratio is calculated and grouped into categories of water stress: Extremely high (>80%), High (40-80%), Medium - high (20-40%), Low - medium (10-20%), and Low (<10%).

42: Includes both direct and value chain water use. The breakdown excludes countries for whom no estimates for baseline water stress exist. These exclusions tend to be small island states, and account for 1-2% of the global total water footprint.

43: Includes both direct and value chain water use.

44: Includes direct and value chain water use.

45: For comparison with national and regional water inventories, this chart represents direct and domestic value chain water use.

46: Includes direct and value chain water use.

47: Water use here includes direct and value chain. The GDP measure includes direct and indirect.

48: 2020 and 2021 are excluded from this comparison to avert distortions linked to pandemic disruptions.

49: To focus this comparison on the most significant tourism markets, only those countries with >$2 billion in total tourism GDP are included. This criterion captures 115 of our 185 study countries.

50: Our World in Data (2019) https://ourworldindata.org/air-pollution#air-pollution-is-one-of-the-world-s-leading-risk-factors-for-death

51: Includes direct, value chain, and international transport emissions.

52: This chart plots the rate of emissions of air pollutants, per million USD of tourism GDP (in real 2021 prices), and includes direct, value chain, and international transport emissions.

53: Environmental Performance Index, Yale University (2021)- a population-weighted average of air quality measurement readings for four separate pollutants https://epi.yale.edu/epi-results/2022/component/noe

54: Travel & Tourism air pollution here includes both direct and value-chain impacts. For this exposure analysis, pollution is assigned to the geography in which it is emitted, not according to the Travel & Tourism market whose demands it is ultimately supporting. For example, consider where pollution is created by factories in the Philippines making goods for sale to tourists in Australian shops. These pollutant emissions are experienced by the population of the Philippines, and so are categorised in this chart according to the exposure level measure for the Philippines. Emissions that occur in countries which do not have air quality data available are categorised as 'unknown'.

55: This measure is a simple average across the six pollutants.

56: Includes direct, value chain, and international transportation.

57: Includes direct, value chain, and international transport.

58: As for the global breakdown in Fig. 48, air pollution is attributed to the country where it occurs, regardless of which country's tourism it is ultimately supporting. Includes emissions from direct and value-chain activities. Numbers presented are an average across NOx, NMVOCs, CO, and PM2.5.

59: Includes direct, value chain, international transport. The GDP measure only includes direct and indirect.

60: The chart plots the rate of materials extraction, per million USD of tourism GDP (in real terms).

61: National Footprint and Biocapacity Accounts, York University Ecological Footprint Initiative and Global Footprint Network (2022) https://data.footprintnetwork.org. Biomass extraction in countries which do not have available biocapacity data are marked as 'unknown.'

62: Here, each type of biomass extraction is attributed to the country where the actual extraction occurs, regardless of which country's tourism it supports.

63: This includes domestic and international value chain materials extraction.

64: For this calculation, Travel & Tourism's footprint is disaggregated into to the regions in which biomass materials extraction is occurring (regardless of which country's tourism it is supporting).

65: Includes domestic and international value chain materials extraction. The GDP measure only includes direct and indirect.

66: Biomass footprint here is allocated to the countries where the biomass extraction occurs, regardless of which country's tourism it is ultimately supporting.

67: 2020 and 2021 are excluded from this comparison to avert distortions linked to pandemic disruptions.

68: To focus this comparison on the most significant tourism markets, only those countries with >$2 billion in total tourism GDP are included. This criterion captures 115 of our 185 study countries.

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Ministry of Tourism

Saudi Arabia's Ministry of Tourism leads the Saudi Tourism ecosystem. The Ministry sets the Kingdom's tourism sector strategy and is responsible for the development of policies and regulations, developing human capital, gathering statistics, and attracting investment. It works in partnership with the Saudi Tourism Authority, which promotes Saudi Arabia as a global tourism destination, and the Tourism Development Fund, which executes the Ministry's investment strategy by providing funding for the sector's development. Headed by His Excellency Ahmed Al Khateeb, the Ministry was founded in February 2020, following the opening of Saudi Arabia to international leisure tourists for the first time in its history in 2019. Saudi Arabia aims to welcome 100 million tourists by 2030, increasing the sector's direct contribution to GDP from 3.8% in 2019 to 10%.
For more information, visit: **MT.gov.sa**

The Sustainable Tourism Global Center (STGC) is the world's first multi-country, multi-stakeholder global coalition, incubated within the Ministry of Tourism of Saudia Arabia, that will lead, accelerate, and track the tourism industry's transition to net-zero emissions, as well as drive action to protect nature and support communities. It will enable the transition while delivering knowledge, tools, financing mechanisms and innovation into the tourism sector. The STGC was announced by His Royal Highness the Crown Prince Mohammed Bin Salman during the Saudi Green Initiative in October 2021 in Riyadh, Saudi Arabia. His Excellency Ahmed Al Khateeb, Minister of Tourism for Saudi Arabia then led a panel discussion during COP26 (November 2021) in Glasgow, United Kingdom, to elaborate on how the Center will deliver on its mandate with founding country representatives and experts from partner international organisations.

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