TOURISM AND CLIMATE CHANGE MITIGATION
EMBRACING THE PARIS AGREEMENT

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EMBRACING THE PARIS AGREEMENT: PATHWAYS TO DECARBONISATION

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TOURISM AND CLIMATE CHANGE MITIGATION
EMBRACING THE PARIS AGREEMENT: PATHWAYS TO DECARBONISATION

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FOREWORD

Climate change is the biggest existential threat facing us on planet earth. It falls to our generation to comprehensively address it for the sake of those who will follow. To start taking action, we need to understand our impact and that is what this report aims to do.

It is beyond doubt that how we are enabling the natural desire to travel, explore and experience new things is contributing to climate change. And we know that more and more people will be able to afford to indulge their desire in the decades ahead. So how can we reconcile meeting people's natural travel desires with the urgency of addressing our global carbon footprint? It is the responsibility of those of us in leadership positions in the tourism and travel sector today to ask that question and to begin finding solutions.

This report represents a first step. A quest for understanding. The nations of the world came together in Paris in December 2016 and agreed on the need for significant reductions in CO_2 emissions. What does this ambition mean for our sector? What commitments have already been made that will impact on us? What further action do we need to take to ensure that our sector becomes part of the solution, rather than being perceived as part of the problem?

This report recognises the importance of collaboration between the public and private sectors in this area – both have a role to play in securing our future. Collaboration at a multinational level will need to be replicated at national and regional levels if we are to be successful in delivering change.

The challenge ahead of us is significant. I hope that this report will give you a sense of the scale of that task, and ideas about the next steps that we need to take together to meet it.

The analysis is now done. It is time for us all to act.

Peter De Wilde
ETC President

EXECUTIVE SUMMARY

We all know that climate change is happening. It may seem remote to some of us, but in many of the world's tourist destinations it is now a daily or annual reality. Tourism is both at risk from climate change, and one of its causes. This report is about how tourism can become part of the global solution, rather than part of the problem.

Commissioned by the European Travel Commission, it provides the first global analysis of the risks to the tourism industry from climate change. It is also a roadmap towards a low-carbon tourism economy, which will require nothing less than a revolution in the sector.

While it draws on high-level climate change expertise, it also contains the views and experience of 17 travel and tourism leaders, who acknowledge that the viability of some destinations is seriously threatened, and that business as usual is no longer possible.

The report does not pull its punches. The choices made today will determine the scale of climate change in the future. According to the World Economic Forum, failure to tackle climate change is the single biggest risk to the global economy.

The "very product" is at risk

2016 was the warmest year on record, and extreme events such as droughts and hurricanes are becoming more frequent. The atmospheric concentration of CO_2 is at a level that last occurred over three million years ago.

While global CO_2 emissions actually fell marginally in 2015, they are expected to have risen by 2% in 2017. Human influence on the climate system is clear.

Climate change is a significant risk for the tourism industry, and that risk is greatest in countries where tourism growth is projected to be strongest. Analysis of 27 indicators concludes that Western Europe, Central Asia and Canada fall into the low risk category, while countries in the Mediterranean are at higher risk.

While Africa, the Middle East, South Asia and small island states face the greatest threats, particularly those countries where tourism is a substantial part of the economy, all countries would be affected by reduced Gross Domestic Product (GDP) growth worldwide.

In any case, the industry is global and interconnected; there are no borders when it comes to the challenges and consequences of climate change. As one interviewee put it, if 1.5 or 2 degrees of climate change does happen, then "the very product we offer is going to come under threat". Coral reefs, beaches and cities are already being damaged, with some projected to be wiped off the map.

Put bluntly, it is difficult to overstate the significance of climate change for the competitiveness and sustainability of travel and tourism.

THE REPORT

Tourism as a contributor to climate change

Tourism is not just at risk from climate change. It is also one of the factors driving it, and it is a significant contributor to emissions growth.

By 2030 there are projected to be 1.8 billion international visitor arrivals, an increase of over 3% a year from 2010, not to mention the billions more who travel domestically. Tourists are also travelling further than ever before and by more energy-intensive means of transport.

Almost all the energy used in tourism is derived from fossil fuels. Transport is the main contributor to tourism CO_2 emissions – with flying accounting for 40%, car transport for 32% and accommodation for 21%.

One scenario estimates that emissions from travel and tourism will increase by 169% by 2050 if no action is taken.

The Paris Agreement – game changer and new challenge

With the Paris Agreement now setting a target of keeping global temperatures at no more than 2 degrees above pre-industrial levels, and 195 countries signing up to steep emissions reductions, travel and tourism risks being out of step with other sectors. At the very moment emissions need to fall sharply, those from tourism are set to grow. According to one interviewee, "tourism risks being considered a dirty industry, if it is not seen to be doing its share".

While a shift towards renewable energy means progress is possible on accommodation, and ultimately on electric cars, flying remains the biggest obstacle to emissions reduction. Within the EU, aviation accounts for 13% of all transport emissions, and these emissions are expected to grow by around 50% by 2035.

With the EU setting a total emissions reduction target of 40% by 2030, the challenge is clear. Such targets are likely to be even more ambitious in future, with a global goal that there will be no net carbon emissions after 2070.

The low carbon revolution

The bottom line is that tourism cannot be considered sustainable unless it can be decarbonised, which means a whole new way of looking at the industry, and essentially removing fossil fuels from the energy mix.

But first tourism must be able to measure its emissions; what you can measure, you can manage. Reporting levels in travel and tourism are relatively low, but the Paris Agreement will put more pressure on organisations and businesses to monitor and disclose their emissions as standard practice.

Decarbonising the tourism industry must, of course, be part of wider policy initiatives both nationally and internationally. The greening of the electricity grid, the electrification of ground transport, more fuel-efficient and alternative-powered aircraft and better building codes are all part of the solution.

There are also potential benefits to taking action, including business continuity, cost savings, reputational benefits and opportunities for early movers. One industry leader has saved €67m through eco-efficiencies since 2012. This report also tells the story of how one German hotel has become a "zero-emissions property", and how a US chain has managed to grow revenue while cutting emissions.

Aviation is the single largest contributor of emissions in the tourism sector and is the most difficult issue to solve. Global emissions are projected to triple, or even quadruple, between 2010 and 2040. Attempts to replace fossil fuels with biofuels have not succeeded to date, partly due to the low price of oil and the lack of incentive to invest in alternatives.

Prepare for carbon pricing – and prioritise investment over offsetting

While not perhaps the most desirable option for business, tourism leaders interviewed for this report agree that fuel and carbon pricing are critical factors, and are possibly the only way to force businesses to act.

Carbon pricing is continuing to expand worldwide, with more than 40 countries already using it. Some businesses in other sectors are using it routinely, as either a shadow price, or as a higher internal price to incentivise innovation. The authors believe that tourism operators and destinations should prepare for the introduction of carbon pricing in every country.

They also conclude that investment in emissions reduction technology is more economical and more reliable than offsetting, which involves buying certificates from emissions reductions projects in other sectors. This is because once the tourism industry is transformed (through renewable energy), costs should decline substantially. Offsetting, however, would remain an annual cost, and one that may become more expensive, as more industries need to use the mechanism to reach more ambitious global targets.

What needs to happen next

The authors believe that the cost of inaction is substantial, including reduced growth, loss of tourism assets, and negative effects in developing countries.

Decarbonisation should be viewed as a long-term investment in sustainable tourism growth, and will require joint action by policymakers, governments, the tourism sector and experts.

Policymakers should define decarbonisation targets for the tourism sector, including aviation and shipping, (which are not covered by the Paris Agreement), introduce a price for carbon, and support research into alternative fuels for aviation.

Governments need to develop tourism specific policies around climate change, which would allow businesses to put strategies and investments in place. Europe should also pioneer a tourism emissions inventory, which would include large emitters such as airlines, tour operators, and hotel and car rental chains.

The report recommends that the tourism sector measure its own emissions, introduce carbon shadow pricing, use low-carbon fuels and renewable electricity, and (at least in the short to medium term) invest in high quality offsetting measures.

The authors also believe that the industry should reconsider its approach to growth. Rather than focussing on arrival numbers, it should encourage visitors to stay longer, visit places closer to home, or aim to attract more high spending visitors.

They also recommend that the ETC work together in partnership with industry organisations to establish an expert panel to outline a transition to a decarbonised tourism economy.

Conclusion

Tourism leaders interviewed for this report agree that unmitigated climate change would be a cataclysm for the world, and that tourism needs to play its part to reduce emissions and build resilience.

It is time for bold action. It is time to embrace the Paris Agreement and create a pathway to decarbonisation. The future of tourism, the wellbeing of billions, and the fate of many destinations are all at stake.

Our changing climate and the action imperative

In 2007, the Davos *Declaration on Climate Change and Tourism* and the subsequent Tourism Minister's Summit in London recognised climate change as "…one of the greatest challenges to the sustainability of tourism in the 21st century" (1). Over the subsequent decade, evidence about our changing global climate system and the implications for environmental systems and society has grown rapidly.

Understanding of climate change impacts and the evidence behind it has advanced significantly

Evidence of the continuing, rapid warming of the planet has been unrelenting (see Box 1) and significant advances have been made in our understanding of changes in extreme weather associated with climate change (2, 3). Land and sea surface temperatures have continued the multi-decade warming trend, with the five warmest years in the instrumental record occurring since 2010. Consistent with the expected physical responses to a warming climate, the frequency, intensity, and duration of extreme heat, heavy precipitation, and drought events are increasing in most continental regions of the world. A warming planet accelerates the water cycle, generating unfamiliar regional weather patterns and more extremes of rainfall and drought. The observed changes are rapid in comparison to the pace of the natural variations in climate that have occurred throughout Earth's history (2, 3). In its most recent assessment report, the United Nations Intergovernmental Panel on Climate Change (IPCC) concluded that climate change is "unequivocal" and that human influence on the climate system is clear (2).

Box 1. Climate change in numbers

Global climate change can seem abstract for many, but there are multiple lines of evidence that reveal how the global climate system is already changing:

- 2016 was the warmest year on record globally since measurement began in 1880
- Global land surface temperature was 1.43°C above the 20th century average in 2016
- Land surface temperatures north of 60° have warmed at more than twice the global rate (+3.5°C)
- Oceans absorb more than 90% of the excess heat caused by greenhouse gases (GHG) warming and have warmed at all depths, with surface temperatures reaching a record 0.75°C above the 20th century average
- 2016 marked the 40th consecutive year (since 1977) that the annual temperature has been above the 20th century average
- 16 of 17 warmest years on record globally have occurred since 2000; the five warmest have occurred since 2010
- For any given month in 2016, 12% or more of global land areas was experiencing at least severe drought conditions, the most on record (since 1950)
- Arctic sea ice extent is the lowest in the 37-year satellite record
- Over 1 trillion tons of Greenland ice was lost between 2011 and 2014 alone
- Global mean sea levels continue to rise, reaching a record high in the satellite era
- Oceans absorb about 25% of the carbon dioxide produced by human activities and as a result have become 30% more acidic; a rate unprecedented over the last 300 million years.
Sources: (3-5)

The year 2015 was a historic year for global CO_2 emissions, as the multi-year slowdown in emissions growth finally transitioned to an absolute decrease of 0.1% (6, 7). This may mark the beginning of a new era when global CO_2 emissions are decoupled from GDP, which grew by 3.0% in the same year.

Notwithstanding the positive slowdown in global CO_2 emissions, the atmospheric concentration rose faster from 2015 to 2016 than ever before in the 58-year measurement record, by 3.5 parts-per-million (ppm). Emissions from fossil fuel consumption continue to drive the increase in atmospheric CO_2, but this record increase was also caused by terrestrial ecosystems absorbing less carbon during the strong El Nino pattern (8). As a result, in 2016 the atmospheric concentration of CO_2 surpassed the 400 parts-per-million (ppm) threshold, a level that last occurred over 3 million years ago when global temperatures were much warmer than today (2).

"Carbon dioxide levels are increasing faster than they have in hundreds of thousands of years. It's explosive compared to natural processes."

Pieter Tans, lead scientist of NOAA's Global Greenhouse Gas Reference Network

The magnitude of future climate change risks will be determined by choices made today

Global climate will continue to change as a result of past heat-trapping GHG emissions and climate system feedbacks. The choices made today and in the years ahead to reduce GHG emissions will determine the magnitude of climate change and associated risks in the decades and centuries ahead. IPCC (2013) concluded that with significant reductions in GHG emissions, it is still possible that the global average temperature increase could be limited to 2°C or less – the United Nations threshold delimiting dangerous climate change. The window of opportunity to do so is very rapidly closing (9).

A high-emissions future represents a commitment to profound climate change, where little in society would remain unaffected. Inaction to significantly and rapidly reduce GHG emissions could cause global average temperatures to increase by 5°C or more by the end of this century. Such a climate future would transform areas of the earth and, according to the IPCC (10), substantially increase the likelihood of *"… severe, pervasive and irreversible impacts for people and ecosystems"*. The failure of climate change mitigation and adaptation was rated as the greatest risk to the global economy by the World Economic Forum's 2016 global risk assessment (11). The World Bank (12) warns that climate change imperils much of the development gains made in the developing world over the last several decades and is already eroding the basis for sustainable development in some regions. The OECD (13) estimated that the annual impact of only 2.5°C warming on the global economy would range from between 0.7% and 2.5% of GDP to 2060. The negative impact from additional warming beyond 2060 would exceed 3% of GDP; with higher losses if unaccounted for sectors (like tourism[1]) and non-market impacts were included. By comparison, a 1.4% reduction in annual global GDP in the UNWTO's (14) slower-than-expected economic growth scenario results in 22% fewer international tourism arrivals in 2030 (1.4 billion instead of 1.8 billion).

The implications of climate change for the tourism sector are far-reaching and already influencing sector investment, planning and operations (15,16). Any phenomenon that is estimated to directly and adversely affect economic growth in many areas of the world, greatly increase regional water and food insecurity, harm or displace more than a billion people, greatly increase extinction risk, and progressively threaten security is not compatible with sustainable tourism development.

Countries have differing levels of climate risk

The sector will be unevenly affected by the direct and indirect impacts of a changing climate, as well as tourism and non-tourism adaptation and mitigation policy responses to climate change. Some tourism regions are more sensitive to the regional manifestations of climate change than others and the capacity to adapt to the risks and opportunities of climate change vary considerably at the destination scale, though all would suffer from the anticipated reduction in global GDP growth as a result of global warming. Figure 1 provides the first global analysis of the differential climate change risk for tourism, using 27 indicators representative of internal and transnational climate and carbon risks to the tourism sector, as well as indicators of tourism sector and destination country adaptive capacity in 181 countries[2].

Countries with the lowest risk and potential opportunities for some tourism segments are found in western and northern Europe, central Asia, as well as Canada and New Zealand. Several European countries possess some of the lowest risk scores worldwide (Denmark, Austria, Finland, Norway, Hungary and Switzerland). These countries reveal the importance of a sector-wide perspective on climate change risk. Although winter sports tourism is vulnerable in several of these countries, when the broader tourism economy and adaptive capacity are considered, opportunities exist in other market segments. Southern and Mediterranean ETC members have higher-risk scores that are near the global average, with the highest in Cyprus, Greece, and Turkey.

The highest sectoral risk is found in Africa, the Middle East, South Asia and Small Island Developing States (SIDS) in the Caribbean as well as Indian and Pacific Oceans. Figure 2 further delimits where sectoral consequences are likely to be most impactful by comparing climate change risk and the relative importance of the tourism economy in each country (based on percentage GDP from tourism in 2015).

Figure 1. Global climate risk for tourism
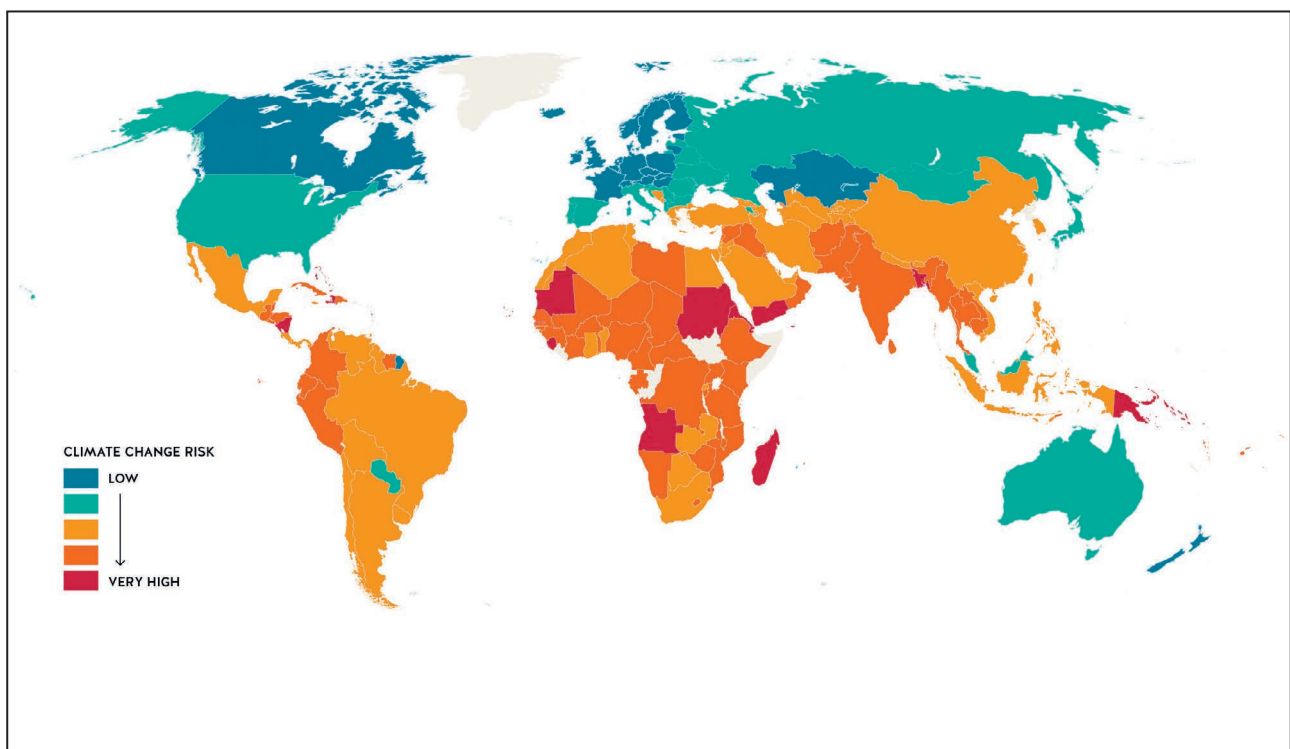
[1] The analysis focused on a limited number of major industrial sectors. Tourism as a non-conventional industry category was not included in the analysis.

[2] The 27 indicators are organised into six dimensions of sectoral risk:

(1) tourism assets (5 indicators) - degradation or loss of natural and cultural heritage assets that attract tourists (climate, ecosystems, beaches, snow) as well as damage to tourism infrastructure and destination communities
(2) tourism operating costs (5 indicators) – impacts on climate-sensitive tourism operator costs (energy, water, food) that will alter competitiveness
(3) tourism demand (6 indicators) – impacts that alter domestic and international markets (economic growth), including mobility costs (mitigation policy) to reach destination countries
(4) host country deterrents (3 indicators) - impacts that deter destination choice of international tourists (weather disasters, and health and security risks)
(5) tourism sector adaptive capacity (5 indicators) – capacity of the tourism sector in a country to adapt to climate change
(6) host country adaptive capacity (3 indicators) – capacity of the destination country to adapt to climate change and maintain tourism assets, infrastructure and socio-political conditions conducive to international tourism.

Figure 2. Comparison of climate risk and tourism contribution to GDP
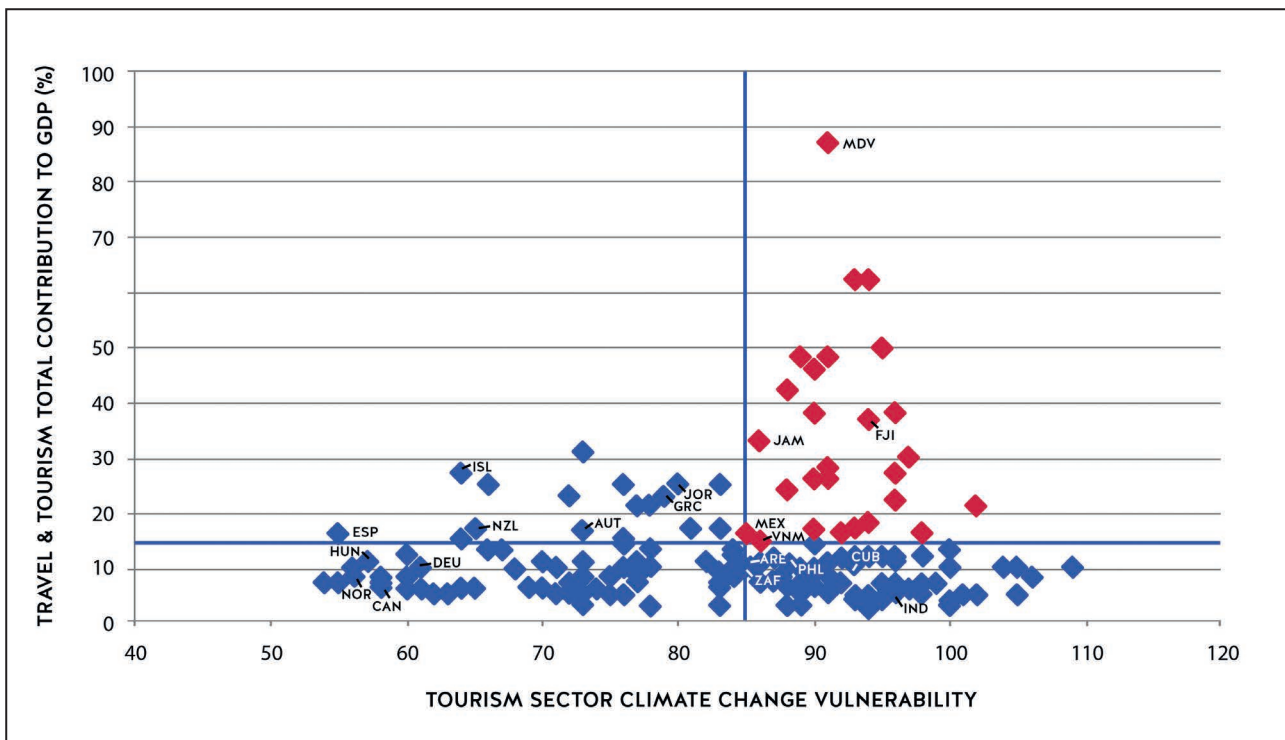
The upper-right quadrant represents countries with higher risk and where tourism represents a significant proportion of the national economy (more than 15% GDP). These countries are almost exclusively SIDS, including the Maldives, Seychelles, Mauritius, Antigua and Barbuda, Bahamas, Saint Lucia, Grenada, Barbados, Jamaica, Vanuatu, Fiji, and Kiribati. Non-SIDS in this quadrant include Costa Rica, Belize, Honduras, Laos, Thailand, Cambodia, Vietnam, Mexico, Namibia, and Gambia. Importantly, in the globalised and increasingly interconnected world of tourism, the consequences in highly vulnerable countries will be amplified beyond their borders to influence travel patterns, value chains, and tourism investment worldwide.

Looking to the future, climate change risk also aligns strongly with regions where tourism growth is projected to be the strongest over the coming decades. Climate change is highest in regions where the largest growth in tourism is projected, including the sub-regions of Sub-Saharan Africa and South Asia. Climate change will increasingly represent a headwind for long-term tourism growth in these regions.

Current GHG emissions trajectories are not compatible with the UN Sustainable Development Goals

There are very strong interconnections between climate change and the UN Sustainable Development Goals (SDG) 2030 agenda. Both the IPCC (10) and World Bank (17) have concluded that current GHG emissions trajectories are simply not compatible with the SDGs and no scenario exists by which the SDGs of 2030 could be
met in a world transformed by climate change. The ambition of the tourism sector to contribute significantly to the SDGs (18) will be increasingly undermined by the impacts of climate change

"The climate and sustainable development agendas are more than mutually enforcing, their fates are intertwined."

Conclusion of the March 2017 UN General Assembly High-Level Event on Climate Change and the Sustainable Development Agenda

under higher emissions scenarios, particularly in the high risk countries identified in Figures 1 and 2. The challenge that climate change poses to growth in the tourism sector and its ability to contribute to the SDGs in many developing countries remains an important information gap and policy omission, and should be more thoroughly considered in tourism development plans and projections, official development assistance, and international climate change negotiations.

It is difficult to overstate the significance of climate change for the competitiveness, sustainability and geography of global tourism development in the 21st century. WTTC (19) (p.5) set out the collective challenge for tourism: "The next 20 years will be characterised by our sector fully integrating climate change and related issues into business strategy, supporting the global transition to a low-carbon economy, (and) strengthening resilience at a local level against climate risks…" Policymakers must work closely with the tourism sector to better understand how climate change and climate policy may re-shape the competitive position of destinations, segments and companies, so that tourism-specific strategies can be co-developed to enable the sector to contribute to the low-carbon, climate-resilient economy.

The imperative to respond to the grand challenge of climate change has been powerfully emphasised by global leaders of government, business, and civil society. This remarkable international consensus and massive multi-year effort culminated in the watershed Paris Climate Agreement.
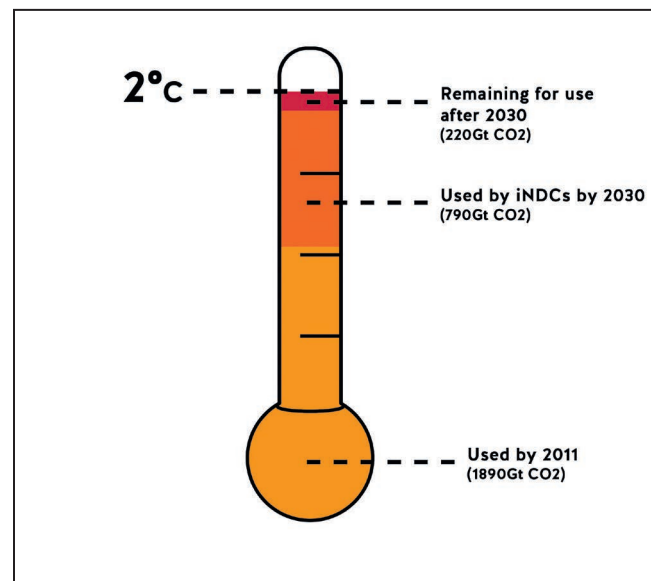
The Paris Agreement

The Paris Climate Agreement was signed by 195 of the world's governments in 2015 and entered into force in November 2016 (160 parties have now ratified the Agreement). The Paris Agreement represents a global consensus to set the world on a new path of international collaboration on climate change. It is a pact between nations and generations to accelerate the transition to a decarbonised economy. The key provisions of the Agreement and its outcomes have important implications for the future of tourism.

Preventing dangerous and irreversible interference with the global climate system is the central objective of the UN Framework Convention on Climate Change. Recognising the consequences of an even lower magnitude of climate change, the Paris Agreement (20) (p.22) increased global ambitions for climate stabilisation from a 2° policy target to "well below 2 °C (...) and pursue efforts to limit the temperature increase to 1.5 °C". In order to have a likely chance of achieving

Figure 3. Our inter-generational global carbon budget

the strengthened policy goal (probability of more than 66%), the IPCC (2014) determined that cumulative (past, present and future) CO_2 emissions from all human activities had to remain below 1000 Gigatonnes of Carbon[3] (GtC). This effectively established a global carbon budget for humanity to share over generations. With approximately 65% of our carbon emissions budget already spent (see Figure 3), the IPCC (2014) estimated that global emissions will need to be reduced 40-70% by mid-century and that net CO_2 emissions must then decrease to zero[4] by approximately 2070 to remain within the +2° climate guardrail. The implications of 'peak carbon' for regional tourism development strategies remain an important knowledge gap for policymakers.

[3] 1 Gigatonne or metric gigaton is equal to 1,000,000,000 metric tons.
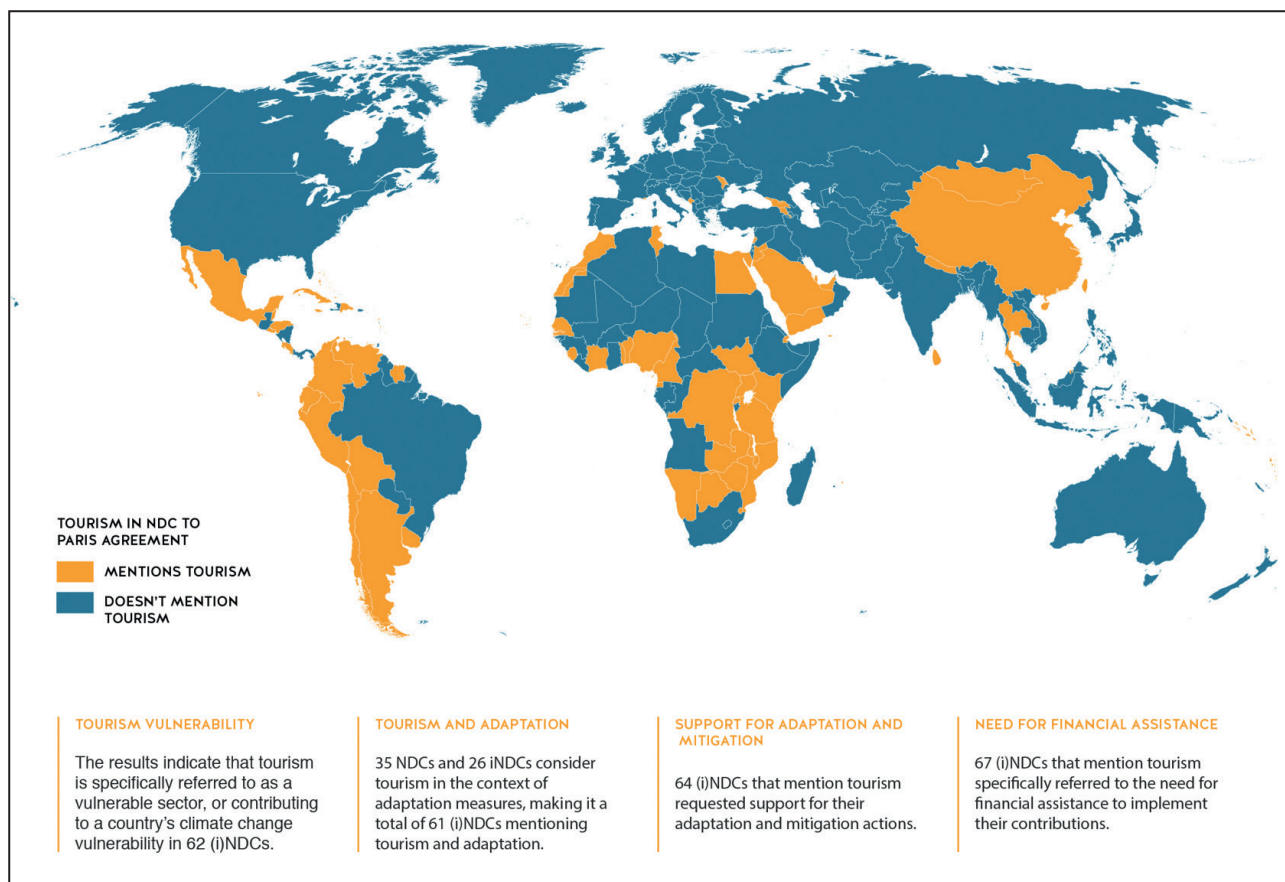
[4] Net-zero does not imply absolutely zero CO_2 emissions, but that the remaining very limited emissions are balanced with carbon sequestration capacities
(natural and technology enabled) that remove the equivalent CO_2 from the atmosphere, so that net atmospheric concentrations do not increase.

The Paris Agreement adopted a bottom up approach to emissions reductions, inviting all nations to submit Nationally Determined Contributions (NDCs) outlining their voluntary emissions reduction ambitions. A dominant criticism of the Paris Agreement is that, even if all countries' emissions reduction pledges were successful, present ambitions would not be sufficient to achieve the policy goal to restrict global warming to 'well below 2°C'. Several analyses of the Paris Agreement have estimated that the submitted NDCs, if achieved, would result in a global temperature increase of between 2.7°C to 3.7°C (21-24).

Box 2. Tourism in Paris Agreement Nationally Determined Contributions

The tourism sector is mentioned in 82 of the Nationally Determined Contributions (or intended NDC where applicable) submitted to the Paris Agreement, with regard to prioritisation for adaptation, mitigation, or financing. Tourism is identified as a high priority in 16 (i)NDCs and a priority in an additional 35 (Figure 4). Of the countries that identify tourism as a high priority, most were in the high-risk category of Figure 1, including for example: Bahamas, Egypt, Jamaica, Maldives, Mexico, Morocco, Seychelles, and Tunisia. Other countries identify tourism as a sector of concern, but that the implications were uncertain because of limited information. The fact that some countries where tourism is most at risk to climate change and where tourism is a significant proportion of their GDP do not explicitly identify the tourism sector as a priority within their NDC submissions is a visible omission and signifies a need to raise awareness about sectoral climate change risks and the essential connections to advancing SDGs. Specific discussion of mitigation or adaptation concerns or actions related to tourism were included in 25 (i)NDCs. Discussion of tourism ranged from identification and coarse costing of anticipated impacts to various stages of adaptation planning. For example, Antigua and Barbuda indicated that: "Physical adaptation measures will not always be enough to prevent significant loss and damage to the infrastructure and economy of Antigua and Barbuda... As a coastal economy, a one meter sea level rise would impact 10% of major tourism resorts." Mauritius estimated that damage to coral reefs and beaches would cost their tourism economy US$50 per year by 2050. While several countries (e.g. Sierra Leone and Kenya) expressed the desire to increase the climate resilience of their tourism sector, others such as Bahamas and Barbados had developed white papers or strategic plans for the tourism sector under climate change. Egypt provided the most detailed seven-point adaptation strategy. Fewer countries identified concerns related to climate mitigation policy and China was the only country to indicate that it would develop policies to promote low-carbon development in tourism (and other service sectors). The only state to discuss tourism in their (i)NDCs was Andorra, which identified risk to an economic pillar of its economy (winter tourism).
No ETC member identified risks or opportunities in the tourism sector: a notable gap for the world's leading international tourism destinations. Recognising this uncertainty and that nearly half of the abrupt regional changes in the ocean, sea ice, snow cover, permafrost and terrestrial biosphere remain possible even at the +2°C guardrail (25), the Paris Agreement also afforded significant attention to adaptation and building climate resilience. All tourism destinations will need to adapt to climate change, whether to minimise risks or to capitalise on new opportunities. This reality places greater emphasis on improving our understanding of the risks that warmer scenarios present for tourism and adaptation strategies for managing those risks, including the limits to adaptation. Persistent regional knowledge gaps should be addressed through support of Parties to the Paris Agreement, particularly in Africa, the Middle East, South Asia, South America and many SIDS (26). Improved climate risk analysis is also needed at the company level. The Task Force on Climate-related Financial Disclosures (27) also emphasised the need to take into consideration different climate scenarios when assessing and disclosing potential climate-related risks and opportunities.

Figure 4. Countries that include tourism in NDC submissions to the Paris Agreement

TOURISM IN NDC TO
PARIS AGREEMENT

■ MENTIONS TOURISM

■ DOESN'T MENTION
TOURISM

TOURISM VULNERABILITY

The results indicate that tourism is specifically referred to as a vulnerable sector, or contributing to a country's climate change vulnerability in 62 (i)NDCs.

TOURISM AND ADAPTATION

35 NDCs and 26 iNDCs consider tourism in the context of adaptation measures, making it a total of 61 (i)NDCs mentioning tourism and adaptation.

SUPPORT FOR ADAPTATION AND MITIGATION

64 (i)NDCs that mention tourism requested support for their adaptation and mitigation actions.

NEED FOR FINANCIAL ASSISTANCE

67 (i)NDCs that mention tourism specifically referred to the need for financial assistance to implement their contributions.

> "If 1.5 or 2.0 degrees of climate change does eventuate, then the very product we offer as a travel industry is going to come under threat. As various other industries really start to put very solid plans in place to reduce carbon emissions, it is increasingly obvious that our industry is not doing anything in a collective sense."

Tourism leader's interview

Parties have committed to update emissions reduction goals and report on progress every five years

The Paris Agreement (20) (p.3) unmistakably acknowledged the gap between voluntary emissions reduction ambitions and policy objectives when it affirmed that, "…much greater emissions reduction efforts will be required than those associated with the intended nationally determined contributions in order to hold the increase in the global average temperature to below 2˚C above pre-industrial levels". To address this gap, the Paris Agreement created an enduring framework that requires parties to return every five years with updated emissions reduction goals (starting in 2020) and report on their progress every five years (starting in 2023). The expectation is that each successive round of global stocktaking and ambition setting should represent enhanced ambitions that progressively close the emissions gap. This new framework of recurrent cycles sends a vital signal to the business and investor communities that they can have complete confidence

in the continuity of climate policy and regulatory frameworks that will facilitate and accelerate the transformation to a decarbonised global economy. As countries intensify policy and regulatory actions to achieve progressively greater Paris Agreement emissions reduction commitments, they will require all sectors to contribute to the transition to the net-zero economy of the second half of the century. Like all sectors, tourism must be proactive in identifying strategies and pathways by which it can decarbonise over the next 50-60 years.

> "If this means additional costs, we can live with it. But uncertainty is one of the worst enemies of industry. As long as we have clarity, industry can cope with it."
>
> **Tourism leader's interview**

Tourism's emissions growth path and contribution to climate change

Tourism continues to expand and diversify, and is one of the largest and fastest growing economic sectors worldwide (18). Since 1950, international tourist arrivals have grown from 25 million to 1.235 billion in 2016. Of these international arrivals, 616 million (50%) occur in Europe, 308 million (25%) in the Asia Pacific region, 199 million (16%) in the Americas, 58 million (5%) in Africa, and 54 million (4%) in the Middle East. Domestic travel is estimated to be four times this volume (1). International travel for holidays, recreation and other forms of leisure is estimated to account for 53% of travel, and 27% to visit friends and relatives, for religious reasons or health (18). Only 13% of all international travel is for business and professional purposes. The aircraft is the most important transport mode, used by 55% of all travellers worldwide, followed by road travel (39%), water (4%) and rail (2%) (18).

> "There are regions in the world that are already victims of tourism, like Barcelona. Tourism can be too much. We raise the question if growth is everything. Or should we think more sustainable, try to work on a new definition of success for tourism? Is it only growth? A lot of discussion started not long ago, but it is very intense now."
>
> **Tourism leader's interview**

Tourism is projected to grow at an average rate of 3.3% per year between 2010-2030, with estimates that there will be 1.8 billion international tourist arrivals in 2030 (18). International arrivals in Asia, Latin America, Central and Eastern Europe, Eastern Mediterranean Europe, the Middle East and Africa are expected to grow at the highest rate (4.4% per year), with the strongest growth forecast in Asia and the Pacific (4.9% per year). Arrivals in Europe are expected to grow at more modest levels (2.3% per year) increasing from 475 million in 2010 to 744 million arrivals in 2030. Modelling by UNEP (28) produced estimates of between 2.4 and 3.1 billion international arrivals in 2050 for a green economy and business-as-usual scenario respectively[5]. Given the prospects of growth, many countries see tourism as an important pillar of future economic development and the broader promise of contributing to the United Nations Sustainable Development Goals 2030 Agenda.

As we collectively look forward to the future of tourism, we need to explore how these growth pathways are to be accomplished in a rapidly decarbonising global economy. All tourism is dependent on energy, and virtually all energy use in tourism is currently derived from fossil fuels. Tourism transport, accommodation, and activities at destinations were estimated to contribute approximately 5%[6] (1304 Mt) to global emissions of CO_2 in 2005 (1). There has been considerable growth in the sector since then. The sector's carbon footprint was, in 2005, roughly equivalent to the combined emissions of Germany and the United Kingdom. Most tourism related CO_2 emissions were generated by transport, with aviation accounting for 40% followed by car transport at 32%, and accommodation representing a further 21%.

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[5] As indicated, none of these future projections consider the implications of climate change and climate policy for global economic growth, transportation costs, or destination impacts.

[6] Note that all calculations in UNWTO et al. (1) represent energy throughput (operational uses), and thus do not fully account for the sector's total contribution to emissions. Because these estimates necessarily exclude lifecycle emissions (e.g. construction of infrastructure for energy production), indirect emissions embedded in goods and services needed to maintain the tourism system (e.g. construction of hotels), and aviation's contribution to radiative forcing (warming) through short-lived GHGs (see (32)), existing estimates of tourism's contribution to climate change should be viewed as conservative (33).

Tourism sector emissions are projected to increase substantially because of strong growth in international tourism. In the UNWTO et al. (1) global business-as-usual (BAU) scenario tourism CO_2 emissions increased 135% between 2005 and 2035. A more recent BAU scenario that examined tourism emissions trajectories to 2050 projected a 169% increase (from 2010). The substantial and widening gap between tourism emissions trajectory and ambitions to significantly reduce emissions is visible in Figure 5, corresponding to more than 2.5 Gt CO_2/yr by 2050. Notably, the model on which Figure 5 is based already considers technological efficiency gains (40). In order to achieve the 70% emissions reduction by 2050 (from 2015 levels) a 2.2% reduction is required each year throughout this 35-year period. Each year that emissions grow from the 2015 baseline this annual reduction requirement will increase.

"We recognise there is a situation in which industry cannot maintain a business-as-usual approach in regard to CO_2, there is a need to decarbonise tourism. If climate policy is going to work for tourism, fossil fuels will have to become more expensive. In the longer term, energy-intense forms of tourism will become unfeasible. Ignoring climate change will increasingly impose costs for tourism and make certain forms of tourism unfeasible."
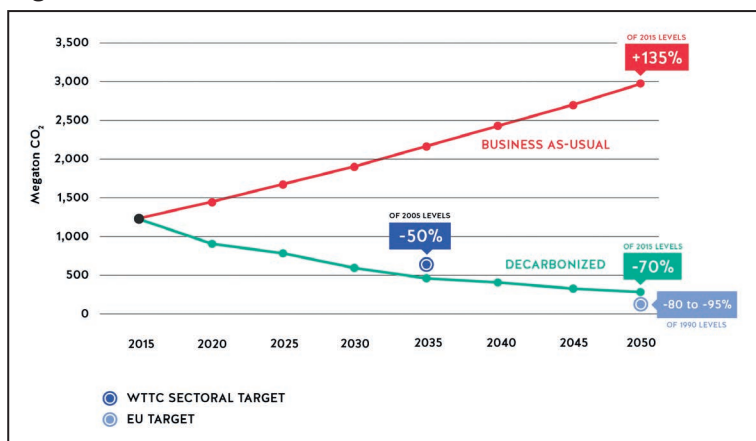
Tourism leader's interview

Additional progress will occur through shifts to renewable energy sources in some regions. For example, the EU goal is to have a 27% improvement in renewable energy use compared to BAU by 2030. Such progress on decarbonisation would primarily benefit accommodation, which represents an estimated 21% of the tourism sector's global emissions, and eventually car-based trips as a greater proportion of cars are electrified. The requirements or ambitions for renewables in the other regions of the world are not as high as in the EU, and thus will only marginally reduce emissions from tourism. Nevertheless, the biggest challenge will be aviation, especially if the assumptions of new sustainable biofuels are not developed according to the timelines anticipated by the sector. Independent analyses by the UK (29 and UNEP (30 concluded that IATA projects are 'very optimistic'.

The incompatibility of the sector's strong emissions growth with global mitigation requirements to stay within the +2°C guardrail was recognised by the IPCC (31) Fifth Assessment Report. The need to alter tourism's emissions trend has been acknowledged in the sector for more than a decade (e.g. see the 2003 Djerba and 2007 Davos Declarations on Tourism and Climate Change). Importantly, in 2009 WTTC showed global leadership when
it communicated an aspirational sector emissions reduction target of -50% by 2035 (from 2005 levels). This emissions reduction ambition is consistent with science-based emission[7] reduction pathways recommended by the IPCC (10) and Paris Agreement ambitions of leading countries. In interviews for this report, global tourism leaders steadfastly confirmed the need for the sector to reduce its contribution to climate change in line with international policy goals and consistent with burden sharing of other economic sectors.

Figure 5. Global tourism emissions trends and ambitions

[7] Emissions reduction targets adopted by companies, sectors, or countries are considered science-based if they are consistent with the level of reduction required to achieve the Paris Agreement +2C policy goal, as determined in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Box 3: Tourism emissions and climate policy in the EU-27

Total tourism-related emissions have never been directly assessed in the European Union (EU). As the leading destination for international tourism and a global leader on combating climate change, this remains an important information gap for policy development. Studies that provide insight into the contribution of tourism to EU27 emissions trends have focussed exclusively on air transport and do not include ground transport, accommodation or activities. A study of tourist transport emissions within the EU25 calculated these at 684 Mt CO_2-eqivalents in the year 2000 (34), corresponding to 13% of all emissions in the EU in that year. More recently, the European Aviation Environmental Report (35) concluded that in 2012, aviation represented 13% of all EU transport CO_2 emissions, and 3% of the total EU CO_2 emissions. It also estimated that European aviation represented 22% of global aviation's CO_2 emissions. With total flights projected to increase from 8.84 million in 2014 to 12.8 million in 2035, the report projects emissions growth of 44-53% (35). While estimates of current and future emissions from tourism in the EU28 do not exist, based on moderate arrivals growth (2.3%/year through 2030 – (18)) and aforementioned strong aviation emissions growth, sector emissions are anticipated to increase substantially in the decades ahead under existing policy conditions. This emissions trajectory is visibly in conflict with the EU-27 economy-wide domestic emissions reduction target of at least 40% by 2030 (from 1990 levels). Tourism policy will need to be urgently re-examined in order to enable the sector to alter its emissions pathway to one compatible with EU climate policy.

Box 4. Emissions reduction versus emissions efficiency targets

Climate change mitigation is measured in terms of the total amount of CO_2 (see our global carbon budget in Figure 3) that can be emitted before global temperatures will increase beyond the +2°C Paris Agreement guardrail. It is important to distinguish relative emissions efficiency (or intensity) gains from the absolute emissions reduction required by the Paris Agreement, as these are sometimes confused or incorrectly used interchangeably with respect to reporting mitigation progress or setting goals. Emissions efficiency gains reduce emissions per unit of economic activity (e.g. CO_2 per guest night or per available seat kilometre). While improvements are always positive, emissions efficiency gains do not necessarily result in the reduction of emissions. This is particularly the case in sectors with strong growth trajectories. For example, while the emissions efficiency of commercial aircraft has improved substantially over the last 50 years, absolute emissions from the sector have consistently grown with strong increases in air traffic. The climate system response and policy targets within the Paris Agreement are only measured in total emissions reductions.

Decarbonising tourism: from ambitions to action pathways

Tourism cannot be considered sustainable unless it can be eventually decarbonised to a level consistent with a net-zero economy of the later decades of this century, and closing the emissions gap represents a major challenge and opportunity for future tourism development. Decarbonisation of the sector in line with the Paris Agreement will have to rely on technology, management and social innovation, as well as new partnerships, and far-reaching policies and regulations. In order to meet mitigation pledges in line with the Paris Agreement, emissions reduction needs to become a sector-wide priority and proceed strategically. Tourism must first develop the capacity to systematically measure its emissions, so that emissions can be monitored and managed against specified decarbonisation goals of the sector and strengthening ambitions of the international community through the Paris Agreement. With operational plans for NDCs being developed in almost every country, tourism needs to more actively engage with the low-carbon transition to identify, advocate and partner in the many cross-sectoral synergies that support the decarbonisation of tourism. National policies need to ensure that all tourism businesses participate, with incentive structures rewarding innovation towards low-carbon operations.

Carbon pricing continues to expand

Carbon pricing continues to expand to an ever-widening number of markets throughout the world (see Box 5), broadening the stimulus toward a low-carbon economy. Tourism operators and destinations should prepare for the eventuality of carbon pricing in virtually all jurisdictions. Significant emissions reductions can be best achieved through systemic and partnered approaches, with, for instance, entire destinations working towards a low-carbon future, involving industry, policymakers, and local communities. A central challenge will be to focus on significant sources of current and future emissions and identify strategies that will lead to significant, absolute emissions reductions. This requires an understanding of the major drivers of emissions growth as well as the costs and long-term risks of decarbonisation strategies. Joint leadership from industry and governments at all levels is needed to develop policies that will enable significant decarbonisation of global and national tourism systems.

Box 5. Carbon-pricing worldwide

The Paris Agreement recognises the pivotal role of carbon pricing in supporting ambitions to decarbonise and provides a foundation for facilitating international cooperation on carbon pricing approaches. The World Bank (36) notes that 40 countries and over 20 sub-national jurisdictions have a price on carbon and about 100 parties — accounting for 58 percent of global GHG emissions — are planning or considering the same. As illustrated below, some countries have set very low initial carbon prices to introduce this new 'currency' to industry (see inset of US$1 to $5 t and then plan to gradually increase the price as carbon accounting, reporting and trading systems become more robust. In a 2016 survey of over 6000 companies worldwide, 27% indicated they have implemented an internal price of carbon for strategic planning (37). In Europe, corporate internal carbon pricing is almost universally above the current Emissions Trading Scheme (ETS) price (€6.99 ₶ Emissions Allowance, 28 September 2017), with the majority of internal prices set 2-10 times higher. The level of internal prices varies widely, with some companies setting shadow prices to those they anticipate regulators will implement, while others set much higher internal prices to strongly incentivise innovation. The state of internal carbon pricing practice in travel and tourism remains uncertain.

Greater transparency and accuracy in emissions reporting is needed

The Paris Agreement has placed greater demands on transparency and accuracy in emissions reporting and ambition setting. The Paris Agreement (20, article 13.1 and 13.7) agreed to establish an "enhanced transparency framework" of harmonised GHG accounting procedures in order to "build mutual trust and confidence and promote effective implementation". Major initiatives to increase reporting and disclosure of carbon emissions and climate risks are also originating from the global financial community. In response to the Paris Agreement, the G20 Finance Ministers and Central Bank Governors asked the Financial Stability Board to review how the financial sector can better account for climate-related challenges. Their Task Force on Climate-related Financial Disclosures (27) recommended that climate-related disclosures be provided in mainstream annual financial filings.

> "To save energy and resources is economically viable. We have tracked €67 million in economic savings through eco-efficiencies since 2012."
>
> ## Tourism leader's interview

These are important developments for tourism, which has limited capacity to systematically measure emissions (see Box 6), impeding its ability to monitor and report progress on sectoral emissions reductions ambitions (38-41). Only where emissions are measured, verified, disclosed and monitored over time, these can be managed against specific decarbonisation goals. WTTC (16) recognises that the measurement gap remains a challenge the sector must address, and that "(a)wareness needs to be raised on how to set targets on climate impacts grounded in science, how to measure and communicate progress, with robust disclosure against standardised frameworks and metrics".

The Development of the Hotel Carbon Measurement Initiative represents important progress at the business scale, but greater investment in building sector-wide emissions estimates is required to credibly demonstrate progress against declared emissions reduction ambitions. As outlined in the 2017 Manila Call for Action for Measuring Sustainable Tourism (MTS), governments urgently need to work with the tourism industry to improve business and sector-scale emissions monitoring capacities. Consistent with the UNFCCC principle of 'common but differentiated' responsibilities for emissions reductions, the world is looking to OECD nations and the climate policy leaders within Europe to advance the development of a tourism sector emissions tracking framework. Pioneering a European tourism emissions inventory would have great value, prioritising emissions data from larger-scale emitters, including airlines, tour operators, large hotel and car rental chains to track the sector's overall performance.

Figure 6: Carbon taxes, emissions trading and shadow pricing
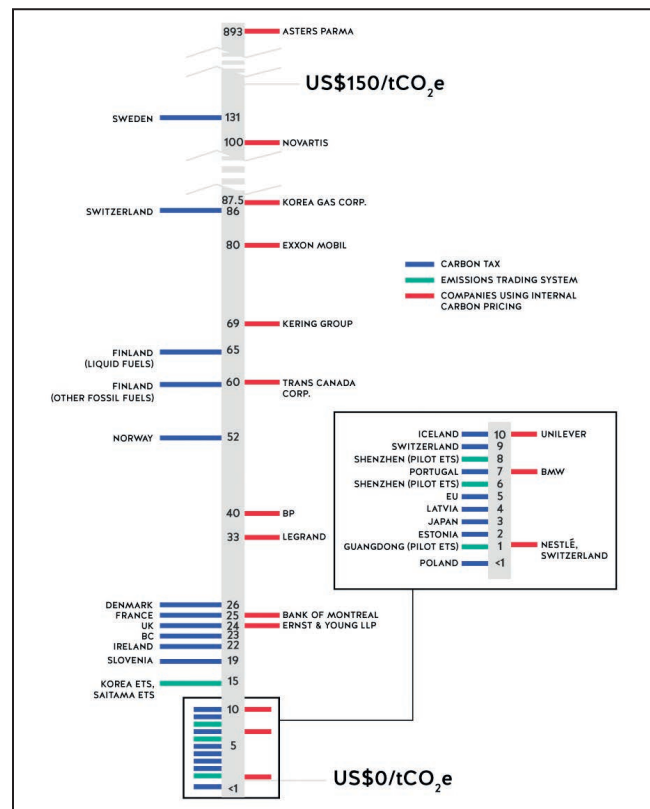
Box 6. The state of carbon reporting in travel and tourism

A 2016 review of carbon reporting in travel and tourism (38) (p.7) concluded that while, "(t)here is evidence that an increasing number of travel and tourism companies are engaging in environmental and carbon reporting… reporting levels are still comparatively low, and quality is often insufficient". The large proportion of small and medium-sized enterprises (SMEs) in travel and tourism contributes to the lower level of reporting, as smaller organisations have limited capacity to implement carbon accounting and reporting processes. As mandatory reporting requirements and investor pressure increase, monitoring and disclosure of GHG emissions will progressively become mainstream, following the example of global leaders like TUI.

For the second year in a row, TUI Travel PLC, one of the world's leading leisure travel companies, was ranked in the top 20 of Carbon Clear's annual ranking of best practice carbon reporting processes, strategy and performance among FTSE 100 companies. TUI climbed two places this year to fourth position, recognising their sector leading commitment to measure, report and verify their carbon footprint, their existing and planned strategies for reducing emissions, their actual carbon reductions and their work to engage stakeholders about their climate change programmes.

The Task Force on Climate-related Financial Disclosures (27) noted that organisations are increasingly being held accountable for the standard set in ambitions and disclosures, with litigation beginning to occur when organisation practice has failed to meet the standard in its disclosure. In the era of social media, the court of public opinion can be even more costly when ambitions and action outcomes do not align.

> "It is a very simple affair to measure emissions, and what you can measure you can manage. There is a lack of effort."

Tourism leader's interview

The IPCC (10) notes that decarbonisation pathways offer different trade-offs and that, while the economic implications have most often been contrasted, other factors that relate to sustainable development matter as well. Tourism and the benefits it provides to the world have not been an active part of this dialogue. The OECD and UNEP (42) (p.9-10) emphasised that, "the transformation towards a low-carbon tourism sector will require major investments in technology, a strong focus on carbon management by businesses, and behavioural changes by tourists. However, the main responsibility for promoting emissions reductions lies with governments". Although tourism has been identified as a priority sector within many country's NDCs (see Box 2) it is absent in the EU28 and other European countries as well as other international markets.

Policy initiatives could support decarbonisation

Wide-ranging policy initiatives at the country scale could support the decarbonisation of tourism, including the greening of the electricity grid in virtually all destinations, stricter emissions standards for new vehicles and continued electrification of ground transport, the introduction of more fuel-efficient aircraft and potentially commercial-scale alternate fuels, and improved building energy efficiency codes.

Tourism must clearly add its voice in these policy choices for decarbonisation to be successful and cost-effective. Stronger policy engagement also reduces potential reputational risks associated with perceived inaction to reduce emissions. The lack of visible progress on a strategy to achieve emissions reduction ambitions may be one driver of the proposed International Air Passenger Adaptation Levy (IAPAL) that was reintroduced into the negotiations of the Paris Agreement and an international air passenger duty and bunker fuel (air and marine) levy were proposed to the UNFCCC as financing mechanisms for international 'losses and damages' from climate change (43). If such levies were implemented, travel and tourism would pay for the impacts of climate change as well as the costs to reduce its emissions to avoid escalating 'damage levies'.

> "In the future the sector may be more exposed to criticism as a 'dirty' sector, as other sectors move to cleaner energies while aviation remains dependent upon fossil fuels. The traveling public and media scrutiny might increase if there is a perception that 'other industries are doing more'. That means that the industry should do everything it can on the ground to reduce emissions and other harmful environmental and social effects. Land transport and hotels need to step up to mitigate that risk to the overall sector."

Randy Durband, Global Sustainable Tourism Council (GSTC)

Tourism-related climate policy needs to focus on significant sources and drivers of emissions

With the increasing size of the gap between tourism's projected emissions and emissions reduction ambitions (Figure 5, to be effective tourism-related climate policy must focus on significant sources and drivers of current and future emissions. Currently, three sub-sectors are estimated to account for 93% of total emissions of CO_2 from tourism: aviation (40%), car travel (32%) and accommodation (21%). Three processes in particular are thought to contribute to increasing emissions: the growing number of tourists worldwide, their choice of increasingly remote destinations – as reflected in growing average travel distances - and the use of energy intense transport modes (1, 44).

Accommodation

The potential to reduce emissions in the various tourism subsectors varies considerably. The accommodation sub-sector is well suited to make swift mitigation progress for at least three interrelated reasons:

(1) accommodation establishments usually can improve their economic bottom line by refurbishing towards low-carbon operations
(2) they can source power immediately from renewable sources at a very low additional cost or install on-site solar power where the property footprint is larger
(3) they can influence supply-chain emissions, by sourcing low-carbon foodstuffs and other products.

The Hotel Energy Solutions toolkit (45) provides best practice guides to improve the awareness and understanding of energy use in accommodation, and to develop energy efficiency and renewable energy solutions to reduce energy consumption and emissions as well as raise consumer awareness to support change and overcome barriers. Box 7 presents the rapidly-evolving and cost-effective potential of solar power for hotels/resorts. The accommodation sector could become zero-emissions for the 2035 sectoral target, provided that national governments rapidly develop clear and stable policy frameworks and building codes to facilitate necessary construction and refurbishment investment decisions. The introduction of, and increase in, carbon pricing (see Box 5) will further reduce the payback period and incentivise low-carbon accommodation in many jurisdictions. Box 8 illustrates the zero-emissions strategy of a four-star hotel in the Black Forest, Germany. Box 9 demonstrates that revenue growth and emissions growth can be decoupled across a broad property portfolio.

Box 7. The solar potential of hotels/resorts in small island developing states

An analysis of the solar energy potential of the accommodation sector in the Caribbean region found this rapidly evolving technology has strong potential to contribute to the decarbonisation of the tourism sector, while simultaneously delivering cost savings to hotels and sustainability co-benefits for some of the destination countries considered the most vulnerable to the impacts of climate change. Taking into consideration solar (local solar irradiation; roof orientation and structure; and shadow effect) and electricity grid parameters (average diesel-powered carbon intensity) of a sample of properties across 20 countries, the installation of 130 MW of rooftop solar on 230 hotels (minimum 200 rooms) would reduce CO_2 emissions by 73,210 Mt per year. The decarbonisation potential could be greatly enhanced if ground mounted systems and other forms of renewable energy systems (such as micro-wind or biogas) are also considered. Extrapolation to the accommodation sub-sector of SIDS worldwide would vastly increase these annual carbon reductions in the sector.

The transition to solar power offers financial benefits for hotels because the drop in solar costs in the last five years has made it competitive with grid prices throughout the Caribbean. Advances in storage technology provide new capabilities to reduce grid power during peak periods (resulting in further savings) and a reliable source of back-up power. A separate analysis of power load profiles, electricity price structures, and battery storage systems determined that the accommodation sector is in the best position to take economic advantage of new on-site storage capacity and management software (46). A sectoral low-carbon partnership supplying carbon-offsets from solar generating hotels in SIDS to aviation's emergent Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) programme represents an opportunity to decarbonise the tourism sector with Gold Standard offset credits[8], while providing green technology transfer (a goal of the Paris Agreement) and lower cost, secure power for resorts.

Box 8. Making zero-emissions accommodation a reality

Hotel Victoria is a city hotel located in Freiburg, Germany, in a building dating back to 1875. With its 65 rooms, the four-star hotel required 270,000 kWh of electricity in 2016, as well as 430,000 kWh of heat. This amounts to 30 kWh of energy per guest night. To become a zero-emissions hotel, Hotel Victoria implemented several strategies:

1) Heat insulation: parts of the building were clad in additional insulation (24 cm), leading to a 60% reduction in heating energy requirements.
2) Replacement of heating system (oil to wood pellets): this saved 50,000 L of heating oil per year, which were replaced with 70 t of wood pellets sourced from a local saw mill.
3) A geothermal cooling system for air conditioning. Cold water at 10°-13°C cold is pumped up from a depth of 16-24 m. The water is used to cool rooms through a heat exchanger and convector ventilation systems installed in all rooms.
4) Installation of renewable energy sources: this includes the installation of 30 kWp photovoltaic cells on rooftop, as well as 30 m^2 of solar thermal panels to support warm water generation. The hotel also becomes part-owner of a wind power station.
5) Technology is continuously replaced. For example, to replace old pumps or cooling technology not only saves vast amount of energy, it also involves payback times as short as 18 months.

All electricity that the hotel cannot produce itself is sourced from a local power supplier with a 100% renewable energy portfolio.

Source: www.hotel-victoria.de

Box 9. Decoupling emissions and revenue growth

The US real estate company Host Hotels & Resorts achieved revenue growth of 22% over five years while at the same time reducing total emissions by 23%. The company has a science-based target to reduce its emissions by 28% by 2020 (from a 2008 base-year).

Source: www.cdp.net/ja/research/global-reports/tracking-climate-progress-2016

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[8] Carbon offsets are a way for businesses and consumers to compensate ('offset') their CO_2 or other greenhouse gas emissions by purchasing certificates generated by emissions-reduction projects elsewhere in the economy or another region. Offsets may be less expensive or more feasible and convenient than reducing an individual's or company's own emissions. The income from offset certificates enables the project to achieve further reductions and increases emissions reduction efficiencies economy wide. The Kyoto Protocol authorised offsets as a flexible mechanism to enable governments and private companies to earn carbon credits that can be traded in a marketplace. The Gold Standard for carbon offset projects is the most widely-respected independent certification standard globally. The Gold Standard is currently supported by over 80 civil society groups around the globe and ensures that energy efficiency and renewable energy projects reduce emissions and provide benefits to the local population.

Ground and sea transport

Similar challenges persist for auto mobility. Road traffic accounts for almost three quarters (71.1%) of transport emissions, with estimates that absolute emissions from vehicles will continue to grow, in spite of efficiency gains (10). Up to 1950, emissions from the global vehicle fleet were close to 0.5 Gt CO_2/yr, but these had grown 10-fold by 2010, to 5.5 Gt CO_2 (47). Car numbers are expected to grow to 2 billion by 2030, from 812 million in 2002 (48,49). Even though specific energy use and emissions are expected to decline, emissions from transportation could grow to more than 11 Gt CO_2 by 2050 (47). Similar is true for shipping, which includes cruises, with estimates that emissions of CO_2 will grow from 0.8 Gt CO_2 in 2010 to 2.3 Gt CO_2 by 2050 (47).

Aviation

In contrast to accommodation, emissions reductions cannot be easily achieved in aviation. Aviation has specific importance for the decarbonisation of tourism because it is the largest single contributor of emissions and because a large share of emissions is emitted at flight altitude (i.e. in the upper troposphere and lower stratosphere, where the heat-trapping capacity is different than emissions released at the earth's surface (32). Aviation produces about 2% of all CO_2 emissions worldwide (781 Mt CO_2 in 2015) (50), though its contribution to global warming (radiative forcing) is proportionately larger (see Box 10), with a central estimate that air travel is responsible for 4.9% of global warming (32). Although a wide range of solutions have been advocated and invested in by airlines and aviation organisations, including air traffic management, new air frames, engine technology innovations, and biofuels, these have not been projected to result in absolute emissions reductions at least through the 2040s (51-54). ICAO (55) has projected emissions from aviation will grow by a factor of 2.8-3.9 between 2010 and 2040. Figure 7 illustrates the issue: Even though new aircraft models are increasingly efficient (measured in energy use per available seat kilometre), overall emissions from aviation have continuously grown.

Figure 7: Efficiency of new aircraft in comparison to overall emissions growth from aviation

Source: Based on (51)
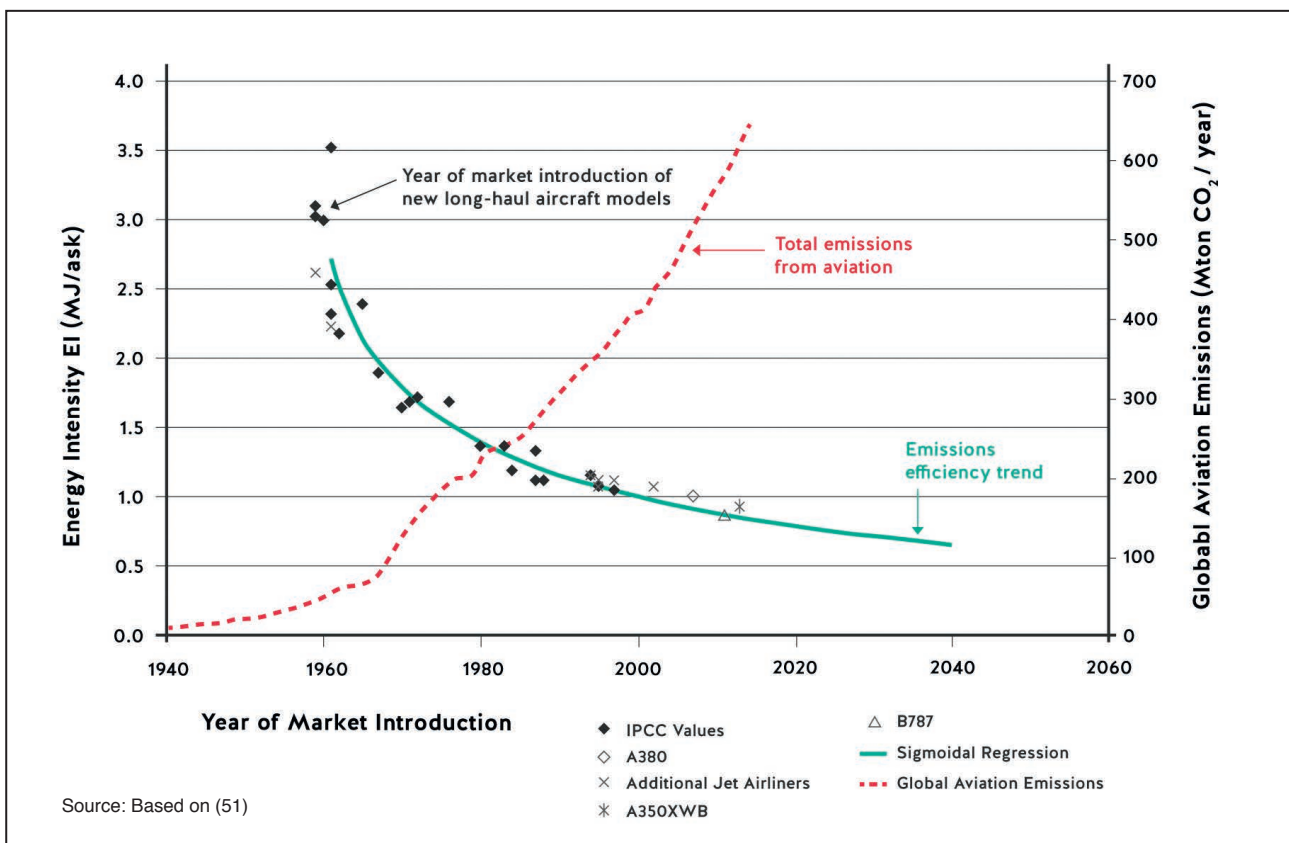
Box 10. The complex climate influences of aviation emissions

Aviation emits gases and particles, primarily at cruise altitudes within the upper troposphere and the lower stratosphere. Emissions include carbon dioxide (CO_2), water vapor (H_2O), hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NO or NO + NO_2), sulfur oxides (SO_x), and nonvolatile black carbon (BC or soot). These emissions transform, depending on local atmospheric conditions, and can have cooling or warming effects. Emissions of CO_2, BC, NO_x, HC, CO, SO_x, and H_2O have been identified as affecting climate, including direct emissions (CO_2, H_2O, soot particles), by-products (O_3, stratospheric H_2O), and perturbed methane (CH_4). All of these make a positive contribution to warming, i.e. they have positive radiative forcing (RF) properties. Gaseous emissions of SO_x and NO_x can transform into volatile nitrate and sulfate aerosols, while gaseous HC emissions can turn into semivolatile organic particles, also with positive RF. In contrast, sulfates generally have a cooling effect (negative RF) unless they coat soot particles. While it remains difficult to exactly estimate the effect of different gases and particles, research indicates that the net radiative forcing of the different gases and particles is positive, and probably considerably higher than the forcing caused by CO_2.

Source: (56).

The Kyoto Protocol tasked the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO) with responsibility for mitigating CO_2 from international aviation and shipping. In October 2016, ICAO adopted a framework for the global Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). CORSIA addresses any growth in CO_2 emissions from international civil aviation that exceed 2020 levels. It is an aspirational programme designed to stabilise aviation CO_2 emissions at the 2020 level through what is termed carbon-neutral growth, and then to halve aviation CO_2 emissions by 2050 (compared with 2005 levels (55. CORSIA will start a pilot and voluntary first phase in 2021, with data collection beginning in 2019. CORSIA is being designed as the primary tool towards an aspirational goal of carbon-neutral growth (CNG) of international aviation worldwide from 2020, with full implementation between 2027 and 2035, when all member states have to join the programme. The scheme expects aviation emissions to continue to grow at a rate of around 3.5% per year, doubling by 2035. Even with full implementation, measures will thus not actually produce a reduction in global aviation emissions, as these will continue to grow.

Several experts have challenged the capacity of CORISA to achieve the emissions reduction ambitions of aviation because the programme:

- Only covers CO_2, ignoring non-CO_2 emissions that are estimated to have the same order of magnitude as the forcing caused by CO_2 (57)
- Applies to only to 80% international air traffic, due to various exceptions, such as Small Island Developing States (58)
- Only covers emissions exceeding 2020 levels (i.e. it allows the sector to grow for another three years in emissions, before additional emissions will be 'covered' by the scheme)
- Is voluntary in its pilot (2021 through 2023) and first phase (2024-2026), involving only a share of airlines for at least another decade. Only after 2035 would most airlines be forced to join (57)
- Even though only a small share of emissions from aviation will be covered, the scheme would require offsetting at unprecedented scales (an estimated 142 to 174 Mt CO_2 in 2025 growing to between 443 to 596 Mt in 2035 Mt – (59)). This will result in a situation where the scale of projects increases every year while available project opportunities will decline. If expected breakthroughs in alternate low-carbon fuels do not materialise as early as projected, the requirements for offsetting credits would escalate rapidly after 2030
- Plans to source offset credits through low-cost projects, including Reduced Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+). Forest projects have been criticised as highly unreliable offset projects, which in the case of REDD+ do not sequester carbon, rather than continue to maintain existing carbon pools. This will lead to a situation where atmospheric concentrations of CO_2 rise, even where projects work

- In estimating the possible costs of the CORSIA scheme, International Energy Agency projections were considered (8 to 20 US$/ton CO_2-eq in 2020 and 20 to 40 US$/ton in 2035) but an additional low scenario (6 US$/ton CO_2-eq in 2020 and 12 US$/ton in 2020) was added. By comparison 95% of companies reporting their current internal price of carbon in 2016 (37) use costs of more than 6 US$/ton CO_2-eq and a large majority already use costs of more than 12 US$/ton CO_2-eq (see Figure 5).

GHG emissions reduction pledges and policies within the EU

Within the European Union, pledges have been made to reduce overall emissions of greenhouse gases (GHG) by 20% by 2020, and 40% by 2030, compared to 1990. Furthermore, the EU has voiced ambitions to implement at least a 27% share of renewable energy sources in its final energy consumption, and to achieve at least a 27% improvement in energy efficiency, below a 'business-as-usual' scenario (60. Up to 2050, EU emissions are to be reduced by 80-95% compared to 1990 (61, 62. There is also a specific objective for transport for 2050, defined as a 60% decline in GHG emissions compared to 1990 (63.

The EU currently relies on one major legislative instrument to reduce emissions, the European Union Emissions trading system, which imposes caps on CO_2 emissions of large emitters (Directive 2009/29/EC), as well as legislation for sectors not covered by the EU ETS on a national level. The EU ETS operates in 31 countries (EU28, plus Iceland, Liechtenstein and Norway), and limits emissions from more than 11,000 power stations and industrial plants, as well as airlines operating between EU countries. The scheme covers 45% of the EU's GHG emissions, and gradually reduces allowances under a cap. Within the cap, companies receive or buy emissions allowances, which they can trade; companies can also buy limited amounts of international credits from emissions saving projects worldwide. Every year, companies must surrender allowances that cover its emissions, or face fines. Excess emissions reductions (beyond those required) can be saved for future needs or be traded with other companies. The system has the objective to allow for emissions cuts where these are most inexpensive and feasible given current technologies and management practices.

"The low oil price does not incentivise investments in alternative fuels. It is an economics and policy problem, where [alternative] fuels are simply too expensive to use on any significant levels. Where we see governments to play a fundamental role is in providing loan guarantees, capital grants for production facilities, adopting legislation which allows aviation fuels to compete on fuels used by land transports; it can be developing tax incentives for the development of fuel facilities. It takes leadership from policymakers, it takes leadership from industry. Otherwise we will not get beyond current levels of usage of biofuels."

Tourism leader's interview

The EU ETS for aviation currently only covers intra-EU air travel. It was introduced because emissions from aviation had continued to grow since 1997 without signs of progress on mitigation. In response, the European Commission independently developed proposals for including aviation in its ETS. Aviation has been included EU ETS since 2012. The scheme currently only applies to flights within the territory of the European Economic Area countries (i.e. the EU28, Iceland, Liechtenstein and Norway). In the 2013-2016 phase of the EU ETS, intra-European flights were allocated total allowances covering 39 Mt CO_2, compared to 54.9 Mt CO_2 emitted in 2014. Airlines would have been thus forced to reduce 16 Mt of CO_2 emissions per year over the period 2013-2016. In 2013, under pressure to allow airlines time to find international consensus at the ICAO level, international aviation has been temporarily excluded from the ETS, to be aligned with ICAO's mitigation proposal, the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA; see following sections).

Figure 8: Interrelationship of flight length and contribution to emissions from aviation

Source: Based on (51)
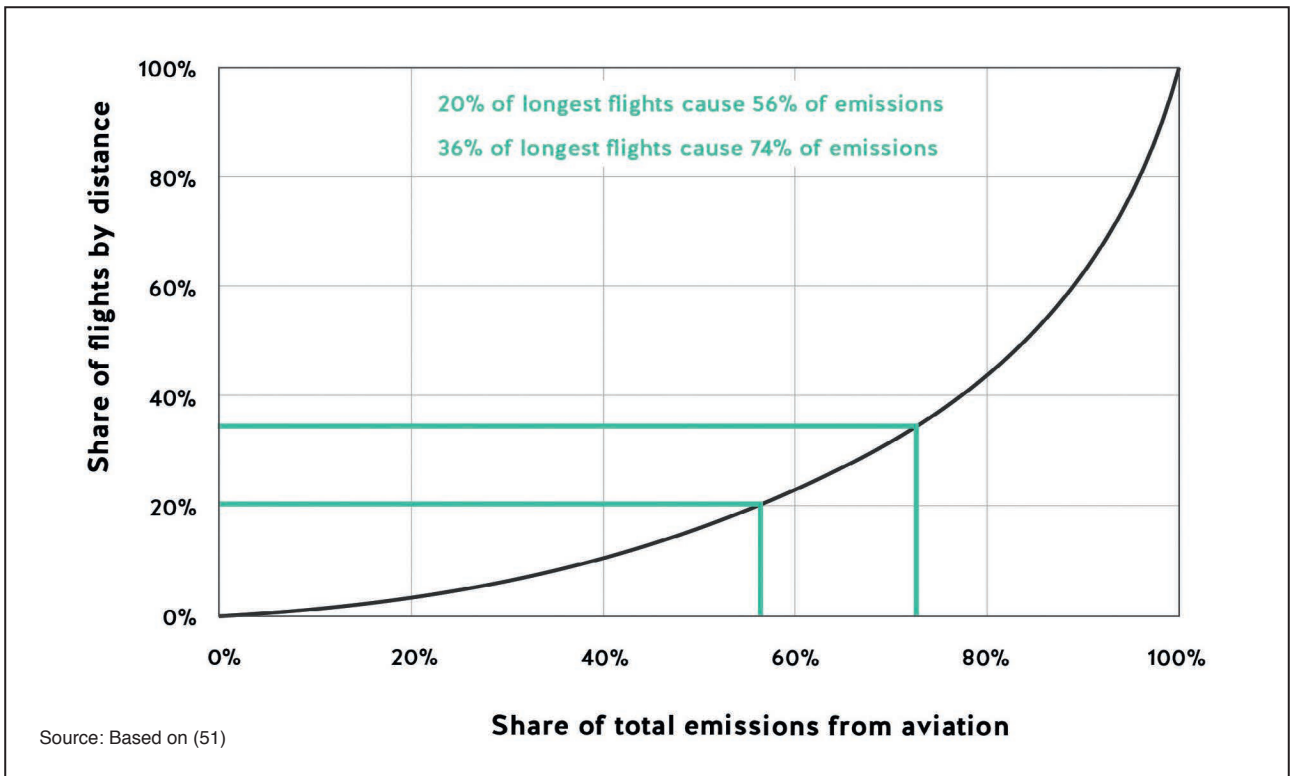
The EU has engaged in additional measures to decrease fuel use from aviation. The Renewable Energy Directive defined a mandatory target of 10% renewable energy content in aviation fuels by 2020 (35. Biofuels meeting the sustainability criteria of the Directive are exempted from obligations under the EU ETS. Even though the European Advanced Biofuels Flightpath initiative, launched in 2011, provided a roadmap to achieve an annual production of 2 million tons of in biofuels by 2020, this goal has not been achieved. The low cost of conventional kerosene is cited as the major reason that "…to date, there has been no regular production of aviation alternative fuels in Europe" (35) (p.38-39). The absence of a price on GHG emissions creates a market situation where there is little incentive to use innovations (64). Individual countries have utilised a range of policies and tax strategies to further incentivise emissions reductions from air travel (see Boxes 11 and 12), both through uptake of new technologies and changes in travel patterns. With regard to the latter, it will be relevant to consider in particular the role of long-haul travel: As illustrated in Figure 8, the 36% of the longest flights cause 74% of global emissions from aviation, and it is unlikely that a reduction strategy can be successful that does not consider these interrelationships.

Box 11: The UK Air Passenger Duty (APD)

The APD is an excise duty that is charged to outbound passengers flying out of an airport in the UK. The duty is not payable by international passengers who are in transit and will continue their journey to another country within 24 hours of their arrival in the UK. The APD was first introduced by the British government in 1994 as a revenue-raising mechanism to compensate for aviation sector exemptions on fuel taxes (bunker fuels for international aviation) and Value Added Taxes (VAT). The UK government also estimated the increased APD fee structure would cut CO_2 emissions by about 0.3 million tonnes (Mt) a year by 2010-2011, and all aviation related GHG emissions by the equivalent of 0.75 Mt of CO_2 a year (65). The APD has undergone a number of structural and price changes since its introduction in 1994 (66). In 2009 differential fees for EU and non-EU destinations were replaced with four distance-based geographical categories with progressively higher fees were introduced (ranging from £11 to £55 in economy class). In 2015 the progressive distance bands were returned to a two-tier system and current duties are: Europe £13 and other international £75. Children under the age of 16 and flying in economy class were also exempt from APD in 2015. Important questions remain whether anticipated emissions reductions were realised or whether the geography of outbound travel changed as a result of the substantial duties imposed by APD. The APD provides a highly useful social analogue for carbon levy costs associated with the progressive implementation and carbon pricing of the CORSIA scheme.

Box 12. Transportation taxes in Sweden

Sweden has one of the most ambitious emissions reduction targets in the world, with pledges to reduce emissions by 40% by 2020 in comparison to 2005. A tax on CO_2 was first introduced in 1991. Today, Sweden has both an energy and CO_2 tax, in the order of 0.68 Euro per litre of fuel. Sweden also has a VAT on domestic air travel, which is identical to the tax imposed on other transport modes (6%). The country decided to introduce a distance-based flight tax at 8,50 to 45,00 Euro per passenger. The tax is comparable to flight taxes and air passenger duties in France, Germany, Austria, Norway, and the UK (see Box 10). Sweden is also considering the introduction of a bonus-malus system for cars, modelled on the French initiative. The system is intended to forward an incentive, up to 6500 Euro to drivers buying the most environmentally friendly cars, and to impose an additional annual tax on inefficient vehicles. The tax reform is intended to contribute to emissions reductions from Swedish transport by 70% by 2030, in comparison to 2010 (domestic flights are excluded from this goal).

Box 13. Travelling different can decarbonise tourism

Considerable differences exist in the emissions contribution of individual trips. A recent analysis (67) of leisure travel emissions found that transportation associated with the average German holiday trip generated emissions of 320 kg CO_2, with 4% of the German population engaging in five or more such leisure holiday trips per year. Transport emissions are determined by transport distance and transport mode choice. A range of between 12 kg CO_2 (railway) and 2350 kg CO_2 (long-haul flight) existed for the transport component. The longest trips (>10,000 km) represented only 1.3% of all leisure trips, but resulted in 14% of total German holiday CO_2 emissions. Currently, most destinations focus on growth in arrival numbers, which overlooks opportunities to optimise existing tourism systems in terms of spending or extended length-of-stay. Studies show, for example, considerable scope for visitors to spend more or to stay longer (68). Destinations can also, through their marketing, attract visitors who are economically valuable (spending per day), but imply a low-carbon 'cost' to travel to the destination (69).

"We do not need to encourage people to travel. We need to encourage them to travel differently."

Tourism leader's interview

Investment in emissions-reduction technology is both more economical and more reliable from a policy perspective than offsetting

What are the potential costs of realising tourism's emissions reduction ambitions? One study (41) has examined the potential costs associated with different policy pathways (i.e. emissions reductions within the tourism sector, offsetting through the purchase of emissions credits from outside the tourism sector, or a combination of both) to achieve tourism sector emissions reduction ambitions (-50% by 2035) and transform the sector to be part of the decarbonised economy of mid-century (-70% by 2050). Investment in emissions abatement within the tourism sector combined with strategic external carbon offsets was found to be approximately 5% more cost effective over the simulation period (2015-2050) than exclusive reliance on offsetting. In other words, investing in efficiency gains and shorter cycles of technological innovation within tourism is more economical than to focus on purchasing emissions reduction credits from outside the sector.

The analysis found that there are additional strategic considerations that support investment in emission-reduction technology and practices in the tourism sector versus a strong reliance on offsetting from other sectors. The first is carbon cost exposure post-2050. Investment in abatement transforms the tourism sector over the next four decades, assuming sufficient amounts of renewable energy can be provided, including in particular sustainable biofuels for aviation. As a result, mitigation-related costs decline very substantially in the post-2050 period, as the sector has been largely decarbonised. In contrast, the annual cost associated with a strategy of exclusively relying on offsetting with emissions credits from outside the sector continues to increase after 2050 because the carbon liability has not been reduced and the price of available offsets increases as the global economy seeks to achieve net-zero emissions.

A second risk associated with an offsetting-based policy pathway is that it would leave the tourism sector exposed to potential changes in climate policy. The five-year cycles of stocktaking and ambition rising within the Paris Agreement make this very likely. More stringent emissions reduction targets and timelines may also introduce an emissions cap on all or parts of the tourism system or impose limits on allowable carbon trading (offsets) in order to drive emissions reduction innovation in all parts of the global economy. Such policy changes would expose the tourism sector to additional offsetting cost increases or leave it struggling to accomplish newly required emissions reduction targets, potentially hindering future tourism growth.

> "Industry has said that by 2050 we want to be at 50% of emissions that we were in 2005. The only way this is going to happen is if alternative, sustainable fuels become a big part of our jet fuel demand."
>
> **Tourism leader's interview**

The cost to achieve the -50% target through abatement and strategic offsetting, while significant, represented less than 0.1% of the estimated total global tourism economy in 2020, rising to 3.6% in 2050. Put another way, if distributed equally among the 6.6 billion international and domestic arrivals projected for 2030, the cost of the low-carbon tourism sector transition would be estimated at US$11 (in 2015 US$) per trip or equivalent to many existing travel fees. If the cost were divided only among the 1.8 billion international arrivals projected by the UNWTO (70) for 2030, the cost per arrival would be approximately US$38 (in 2015 US$); which is comparable to many of the carbon prices (regulated and internal) in Box 6. As there is no feasible way to implement such a levy across all trips globally, the most efficient way would be through an economy-wide price on carbon that reflects its true social cost. Then tourism would not need to set up a system to collect it; society would do that for all trips, and all other GHG generating activities, and allocate the revenues to emissions-reduction priorities.

Given the substantial cost of inaction, including diminished global economic growth, ensuring the degradation or loss of some tourism assets worldwide, and the disproportionate negative impact on tourism in SIDS and other developing countries that look to tourism for important contributions to SDGs, the decarbonisation of tourism is properly framed as an investment in long-term sustainable tourism growth. As outlined in Box 14, all tourism stakeholders have an important role in this transformation.

Box 14. Decarbonisation action framework

Differential actions and responsibilities are required to enable the travel and tourism sector to achieve significant emissions reductions. By stakeholder group, these could include:

Policymakers
- define decarbonisation targets for the tourism sector, including aviation and shipping, on supranational (aviation/shipping) and national (accommodation, ground transport) levels
- introduce a price for carbon, with long-term price signal updated at each Paris Agreement stocktake cycle
- support research and development of alternative fuels for aviation and other low-carbon technologies germane to emissions reduction in the tourism sector
- work with the tourism industry to establish monitoring systems for tourism sector emissions.

Tourism industry:
- measure emissions
- introduce carbon shadow pricing
- improve eco-efficiencies to increase climate resilience and reduce emissions
- use low-carbon fuels, renewable electricity
- engage in energy co-production (renewables) with destination communities;
- invest in high-quality carbon offsetting
- explore cross-sectoral partnerships to invest offsetting purchases in actions that decarbonise the tourism sector
- increase investment in research and development of alternative fuels for aviation.

Other tourism stakeholders
- advocate for low-carbon legislation, support mitigation governance
- contribute to emissions measurement at global, national, business levels
- provide advice on deployment of new technologies
- develop models to assess cost of sector restructuring in a decarbonising economy
- share knowledge about best practice carbon disclosure, emissions reduction and climate resilience strategies
- coordinate development of destination decarbonisation and adaptation strategies.

Tourism leaders' voices on overcoming the challenge of climate change

In May to July 2017, interviews were conducted with 17 industry and tourism organisation leaders, including global tourism (UNWTO, UNEP, OECD, European Commission), global airlines (IATA, ATAG), global cruises (CLIA), destinations (Germany, Iceland), tour operators (TUI, Thomas Cook), platforms (Amadeus) and private sector leaders (Emirates, Etihad, Intrepid Travel, Mandarin Oriental, Ryanair). Interviews covered perspectives on climate change risks and opportunities for the sector; the sector's mitigation responsibilities in the context of the Paris Agreement; as well as leadership and enabling conditions to move forward on decarbonisation and climate resilience.

Leaders expressed consensus that the climate has changed and is already affecting tourism destinations around the world. Leaders affirmed that the magnitude of future climate change is largely dependent on emissions of greenhouse gases from human activities, including tourism, and that all sectors and countries have a collective responsibility to solve this global grand challenge. Climate change was unequivocally perceived as a significant risk for tourism development and economic growth more broadly. Leaders underlined, in no uncertain terms, that the viability of tourism in some destinations is threatened, specifically under scenarios of unabated climate change, and that risks associated with climate change far outweigh opportunities, particularly for many countries that depend on tourism to make progress on the UN Sustainable Development Goals.

Against this background, leaders were strongly supportive of the Paris Climate Agreement and its objective to limit global warming below 2°C, compared to pre-industrial times. They acknowledged that achieving this goal would require deep cuts in emissions, across all economic sectors. Leaders declared that the tourism sector and its stakeholders have a responsibility to engage in mitigation, in line with other economic sectors. They outlined that international aviation and cruises are not covered by the Paris Agreement and that travel and tourism need to more broadly engage in support for special decarbonisation strategies in these subsectors.

Leaders confirmed that they had sufficient high-level information on climate change risks for most tourism regions and the scale of emissions reduction needed, but that increasingly targeted decision-relevant information for climate adaptation and emissions reduction strategies development was needed. Strengthened collaborations among government, businesses, non-governmental organisations and universities were seen as integral to addressing these information gaps and fostering shared learning throughout the sector.

Information on climate change available to stakeholders had limited impact on planning, operations or investments, so that measurable progress on emissions-reduction ambitions was not yet visible. Leaders acknowledged that this situation was unsatisfactory, but anticipated that would change as the business case for climate change has continued to rapidly strengthen since the Paris Agreement. Leaders affirmed that serious discussions on how to reduce emissions had only begun more recently, in the wake of the Paris Agreement, and that stakeholders had not completed their deliberations on appropriate actions. Leaders also affirmed that it was unclear how the accelerating decarbonisation of the global economy would affect tourism, particularly in terms of changing cost structures.

Even though there was a general consensus on the need for deep emissions cuts, tourism stakeholders expressed a general belief that the sector would continue to grow in terms of international arrivals, passenger numbers or bed nights. This growth was not always seen to contradict decarbonisation needs, with emphasis being placed on the potential of new technologies, including alternative fuels, to reduce emissions. Other voices highlighted the limited pace of new technology market introductions, challenges associated with research and development and upscaling of (sustainable) alternative fuel production, and the still limited interest of the sector to act on climate change. These voices emphasised the need for a science-based approach to measure and monitor the sector's contribution to greenhouse gas emissions, and to work with governments to introduce market-based measures to increase the cost of carbon in order to incentivise innovation sector wide.

The experts agreed that leadership was needed on various levels to reduce climate change risks for tourism, to decarbonise tourism in line with other economic sectors, and to ensure tourism's contribution to the UN Sustainable Development Goals. Tourism stakeholders asked for a greater role by leading tourism organisations in driving a low-carbon agenda for tourism, moving from ambitions to implementation and progress reporting. Leaders also agreed that business-led initiatives would have to be mutually supportive of governmental agendas that incentivise greener business models and that greater advocacy was needed to better align policy and investment strategies.

Opinion was varied with regard to the role of government and climate policy. While it was generally acknowledged that business-led initiatives might not be far-reaching enough, ideas varied as to the best policy approaches. Even though not a desirable option for businesses, leaders agreed that fuel and carbon prices were instrumental and perhaps indispensable to raise interest and incentivise decarbonisation, forcing all stakeholders to act and rewarding early movers. They agreed that frameworks for decarbonisation had to be defined and set by governments. Individual respondents highlighted the need to increase pressure on the aviation, cruise, automotive, and accommodation sectors. Leaders also expressed a general preference for governments to support research and development, for instance with regard to the intensified development of alternative aviation fuels that are integral to the future of all travel and tourism, and to implement reward systems.

Leaders also articulated a number of challenges and barriers faced by tourism stakeholders to act on decarbonisation and climate resilience, including: the challenge of steep emissions cuts; an uncertain contribution to mitigation that is to come from technology; rapidly evolving, but unresolved climate policy that offers ambivalent positions on decarbonisation in some jurisdictions; the absence of a global carbon price

signal; and the disinterest in climate change of some CEOs and boards, and limited engagement among tourism management authorities and tourism departments in most countries. At the same time, leaders saw great potential to align the climate change agenda with Sustainable Development Goals. The development and introduction of low-carbon technology, research and development of sustainable fuels, investments into measures working against deforestation and forest degradation, and climate resilient planning and development were all considered mechanisms for more sustainable, green growth. The future of tourism will develop by default or by design and the leaders were universal in their call for bold, partnered action to accelerate the low-carbon, climate-resilient transition in travel and tourism.

Leadership for climate-ready tourism

Interviews with global tourism leaders revealed a broad consensus that a +4-5°C world of unmitigated climate change represents a cataclysm for society, and that tourism must act boldly to reduce its emissions in line with IPCC recommendations for the wider economy. It is the view of the authors that there can be no sustainable tourism, unless it can be decarbonised. The benefits of preparedness for the decarbonised and climate-resilient economy include: business continuity, cost savings, reputational benefits (investor and consumer confidence), co-benefits to the SDG 2030 Agenda, and competitive advantage for early movers. Importantly, the World Bank (12), IPCC (10), ICAO (55), have all emphasised that early responses to climate risks are more cost effective than recovery and remediation.

"One of the most significant, and perhaps most misunderstood, risks that organisations face today relates to climate change … The large-scale and long-term nature of the problem makes it uniquely challenging … many organisations incorrectly perceive the implications of climate change to be long term and, therefore, not necessarily relevant to decisions made today."

Task Force on Climate-related Financial Disclosures (June 2017) – www.fsb-tcfd.org/publications/final-recommendations-report

The strong consensus on the imperative to act on climate change highlights the importance of governments to rapidly devise tourism-specific policies that would enable industry leadership to operationalise the strategies and investments needed to accelerate emissions reductions and climate resilience. As expert interviews and the previous review by OECD and UNEP (73) revealed, such climate governance does not currently exist for tourism. Priority actions to create the foundation of climate readiness and future-proof European and global tourism include our following recommendations:

- We encourage strengthened sector-wide engagement and support for emissions reduction targets and adaptation goals of the Paris Agreement.
- We encourage all countries to proactively engage in decarbonisation on the basis of Nationally Determined Contributions (NDC) in order to impart a collective tourism voice in policy development and investment in the transition to a decarbonised economy and to assess the differential implications of alternate emissions pathways for tourism.
- We encourage all tourism operators to adopt an internal price of carbon for all operations and strategic planning decisions, with a minimum initial price guided by International Energy Agency price projections for 2020 and national 'best practice' guidance.
- We encourage all major tourism operators to measure and disclose emissions according to 'best practice' guidelines, and establish emissions reduction targets consistent with targets set out in their country's NDC.
- We encourage all Parties of the Paris Agreement to review policy and research and development programmes to build new partnerships with the tourism industry (not solely aviation) and science organisations to accelerate the development of commercially scalable, sustainable low-carbon fuels for aviation.
- We encourage all countries to accelerate the deployment of 'best practice' energy-efficiency retrofits and renewable energy investment in the accommodation sector.

- We encourage the development of new decision support tools by tourism organisations that incorporate climate change mitigation and adaptation considerations into destination management planning, and scale up 'best practice' strategic planning and partnerships for implementing low-carbon and climate-resilient pathways.
- We encourage all national tourist organisations (NTOs) and destination marketing organisations (DMOs) to consider the implications of new market developments. Tourism should be developed on the basis of spending or length-of-stay, with a view to seek growth from closer markets.

Consistent with the principle of 'common but differentiated' responsibilities enshrined in the UN Framework Convention on Climate Change, we further encourage all European countries to:

- Take a global leadership position to develop and implement a tourism sector emissions monitoring system so that progress could be reported on during the 2023 global stocktaking cycle of the Paris Agreement. We further encourage all European countries to collaborate with other parties to the Agreement to design emissions monitoring systems that could be expanded globally.
- Establish, under the auspices of the ETC or another body, an expert panel/task force to assess how the transition to a decarbonised tourism economy can be accomplished over the next 50 years. The panel should include industry, policy leaders and scientists, and develop a policy framework to enable this transformation and assess the differential regional implications and associated inequalities. This would include consideration of transnational impacts and responses that will influence European strategic tourism interests, such as the implementation modalities of ICAO's carbon neutral growth 2020 strategies.

Like the Internet revolution, decarbonisation represents the next major transformation of the tourism system. The challenge is formidable and the stakes are nothing less than the future sustainability and prosperity of the tourism economy in many parts of Europe and the world. As the world's largest international tourism market and global leaders in combating climate change, Europe must boldly act to lead tourism into the decarbonised economy of the mid-21st century.

REFERENCES

1. UNWTO, UNEP, & WMO (2008). *Climate Change and Tourism: Responding to Global Challenges.* Madrid & Paris: UNWO, UNEP.
2. IPCC (2013). Summary for Policymakers. In *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (T. F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S. Allen, J. Boschung, … & P. Midgley, eds.). Cambridge: Cambridge University Press.
3. USGCRP, 2017: Climate Science Special Report: A Sustained Assessment Activity of the U.S. Global Change Research Program [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 669 pp. www.nytimes.com/packages/pdf/climate/2017/climate-report-final-draft-clean.pdf?mcubz=1
4. Blunden, J., and D. S. Arndt, Eds., 2017: State of the Climate in 2016. *Bull. Amer. Meteor. Soc.*, 98 (8), Si–S277, doi:10.1175/2017BAMSStateoftheClimate.1.
5. McMillan, M. et al. 2016. A high-resolution record of Greenland mass balance. Geophysical Research Letters. 43(13), 7002–7010
6. Olivier J.G.J., Janssens-Maenhout G., Muntean M. and Peters J.A.H.W. (2016), Trends in global CO_2 emissions; 2016 Report, The Hague: PBL Netherlands Environmental Assessment Agency; Ispra: European Commission, Joint Research Centre.
7. International Energy Agency (2016) Decoupling of global emissions and economic growth confirmed. www.iea.org/newsroom/news/2017/march/iea-finds-co2-emissions-flat-for-third-straight-year-even-as-global-economy-grew.html
8. NOAA 2016. www.noaa.gov/news/record-annual-increase-of-carbon-dioxide-observed-at-mauna-loa-for-2015
9. Raftery, A., Zimmer, A., Frierson, D., Startz, R., Liu, P. (2017) Less than 2C warming by 2100 unlikely. Nature Climate Change, 7, 637-641.
10. IPCC. (2014a). Climate change 2014 synthesis report summary for policymakers. Geneva: Author.
11. World Economic Forum. (2016). The global risks report 2016 (11th ed.). Davos: Author. Retrieved 30 April 2016 from http://www3.weforum.org/docs/GRR/WEF_GRR16.pdf
12. World Bank (2013). *Turn Down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience.* Washington DC: World Bank.
13. OECD (2014). A call for zero net emissions. Retrieved 1 March 2015, http://oecdinsights.org/2014/01/24/a-call-for-zero-emissions/
14. United Nations World Tourism Organization. (2011). Tourism Towards 2030: Global Overview. UNWTO General Assembly, 19th session.
15. Scott, D., Gössling, S., Hall, C.M. (2012) International Tourism and Climate Change. *Wiley Interdisciplinary Reviews – Climate Change*, 3 (3), 213-232.
16. World Travel and Tourism Council (2017) Understanding the critical issues for the future of travel and tourism. www.wttc.org/tourism-for-tomorrow-awards/newsletter/2017/march-2017
17. World Bank (2016) Climate action does not require economic sacrifice. Retrieved 30 March 2016, from: http://blogs.worldbank.org/climatechange/climate-action-does-not-require-economic-sacrifice
18. UNWTO (2017). Tourism Highlights. 2017 Edition. Available: www.e-unwto.org/doi/pdf/10.18111/9789284419029 (accessed 8 September 2017)
19. World Travel and Tourism Council (WTTC) (2015a). *Travel & tourism 2015. Connecting global climate action. Executive summary.* London: Author.
20. United Nations (2016). United Nations Treaty Collection Chapter XXVII Environment, 7.d Paris Agreement, Paris, 12 December 2015 (C.N.92.201). New York: United Nations. Retrieved 1 April 2016, from: https://treaties.un.org/doc/Publication/CN/2016/CN.92.2016-Eng.pdf
21. Climate Action Tracker. (2015). *Climate pledges will bring 2.7°C of warming, potential for more action.* Retrieved 1 April 2016, from: http://climateactiontracker.org/news/253/Climate-pledges-will-bring-2.7C-of-warming-potential-for-more-action.html
22. European Commission Joint Research Centre (2015). *Analysis of scenarios integrating the INDCs.* Retrieved 1 April 2016, from: www.indcforum.org/wp-content/uploads/2015/10/Analysis-of-scenarios-integrating-the-INDCs_201510_JRC97845.pdf
23. International Energy Agency (IEA) (2015). *World Energy Outlook Special Briefing for COP21*. Retrieved 1 April 2016, from: www.iea.org/media/news/WEO_INDC_Paper_Final_WEB.PDF

24. UNEP Finance Initiative (2015). Fiduciary Duty in the 21st Century. Retrieved 1 April 2016, from: www.unepfi.org/fileadmin/documents/fiduciary_duty_21st_century.pdf

25. Drijfhout , S., Bathiany, S., Brovkin, V., Claussen, M., Schedffer, M., Sgubin, G., Swingedouw, D. (2015). Catalogue of abrupt shifts in Intergovernmental Panel on Climate Change climate models. *Proceedings of the National Academy of Sciences,* 112(34), E5777–E5786.

26. Scott, D., Hall, C.M., Gössling, S. (2016) The Paris Climate Change Agreement and its Implications for Tourism: Why we will always have Paris. *Journal of Sustainable Tourism, 24/7, 933-948.*

27. Task Force on Climate-related Financial Disclosures (2017) Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures. https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Report-062817.pdf

28. United Nations Environment Program. (2012) Tourism in the green economy _ background report. Retrieved 1 June 2015. https://www.e-unwto.org/doi/pdf/10.18111/9789284414529

29. UK Committee on Climate Change (2009). Meeting the UK aviation target _ options for reducing emissions to 2050. London: Author.

30. UNEP (2009). Towards sustainable production and use of resources: Assessing biofuels (No. ISBN 978-92-807-3052-4). Paris: Author.

31. IPCC (2014). Climate change 2014: mitigation of climate change. In: Edenhofer, O., Pichs- Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., Kriemann, B., Savolainen, J., Schlömer, S., von Stechow, C., Zwickel, T., Minx, J.C. (Eds.), Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

32. Lee, D.S., Fahey, D., Forster, P., Newton, P., Wit, R., Lim, L, … Sausen, R. (2009). Aviation and global climate change in the 21st century. Atmospheric Environment, 43(22), 3520-3537.

33. Gössling, S., Scott, D., & Hall, C.M. (2013). Challenges of tourism in a low-carbon economy. *Wiley Interdisciplinary Reviews – Climate Change*, 4(6), 525-538.

34. Peeters, P., Szimba, E. und M. Duijnisveld (2007): Major environmental impacts of European tourist transport. Journal of Transport Geography, 15, S. 83–93.

35. European Environment Agency, EASA and Eurocontrol (2016). European Aviation Environmental Report 2016. Available: https://ec.europa.eu/transport/sites/transport/files/european-aviation-environmental-report-2016-72dpi.pdf Accessed 12 September 2017.

36. World Bank, Ecofys and Vivid Economics (2016). State and Trends of Carbon Pricing 2016 (October), by World Bank, Washington, DC.

37. Carbon Disclosure Project (CDP) Tracking Corporate Climate Progress - 2016. www.cdp.net/ja/research/global-reports/tracking-climate-progress-2016

38. Bobes, L. and Becken, S. (2016) Proving the Case: Carbon Reporting in Travel and Tourism. www.amadeus.com/web/amadeus/en_1A-corporate/Amadeus-Home/Resources-and-downloads/Research-reports/carbon-reporting-travel-and-tourism/1319560217334-Page-AMAD_DetailPpal?assetid=1319696025021&assettype=AmadeusDocument_C&parent=1319609444141

39. Gössling, S. (2013). National emissions from tourism: an overlooked policy challenge? Energy Policy 59: 433-442. doi:10.1016/j.enpol.2013.03.058

40. Scott, D., Hall, C.M. and Gössling, S. (2016). A report on the Paris Climate Change Agreement and its implications for tourism: why we will always have Paris. Journal of Sustainable Tourism, http://dx.doi.org/10.1080/09669582.2016.1187623

41. Scott, D., Gössling, S., Hall, C.M. and Peeters, P. (2015). Can tourism be part of the decarbonized global economy? The policy costs and risks of carbon reduction strategies. Journal of Sustainable Tourism, http://dx.doi.org/10.1080/09669582.2015.1107080

42. Organisation for Economic Co-operation and Development & United Nations Environment Program (2011). *Sustainable tourism development and climate change: Issues and policies.* Paris: OECD.

43. Durand, A., Hoffmeister, V., Roberts, J. et al. (2016) Financing Options for Loss and Damage: A Review and Roadmap. Brown University International Centre for Climate Change and Development. www.climatedevlab.brown.edu/uploads/2/8/4/0/28401609/browncdl-icccadfinancinglossanddamagepaperdraft.pdf

44. Gössling, S. and Peeters, P. (2015). Assessing tourism's global environmental impact 1900-2050. Journal of Sustainable Tourism, 23(5): 639-659. DOI:10.1080/09669582.2015.1008500

45. UNWTO (2017) Hotel Energy Toolkit. http://cf.cdn.unwto.org/sites/all/files/docpdf/finalreport.pdf

46. D'Aprile, P., Newman, J., and Pinner, D. (2016) The new economics of energy storage. www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/the-new-economics-of-energy-storage

47. Olivié, D.J.L., Cariolle, D., Teyssedre, H., Salas, D., Voldoire, A., Clark, H., Saint-Martin, D., Michou, M., Karcher, F., Balkanski, Y., Gauss, M., Dessens, O., Kof , B., Sausen, R. (2012). Modeling the climate impact of road transport, maritime shipping and aviation over the period 1860–2100 with an AOGCM. Atmospheric Chemistry and Physics 12 (3), 1449–1480.

48. Dargay, J., Gately, D., Sommer, M. (2007). Vehicle ownership and income growth, worldwide: 1960–2030. The Energy Journal 28 (4), 143–170.

49. Sperling, D., Gordon, D. (2009). Two Billion Cars: Driving toward Sustainability. Oxford University Press, Oxford.

50. ATAG (Air Transport Action Group) (2016). Facts & Figures. Accessed 12 September 2017. Available: http://www.atag.org/facts-figures.html

51. Peeters, P., Higham, J., Kutzner, D., Cohen, S., & Gössling, S. (2016). Are technology myths stalling aviation climate policy? *Transportation Research Part D: Transport and Environment, 44*, 30-42.

52. Bows-Larkin, A., Mander, S. L., Traut, M. B., Anderson, K. L., & Wood, F. R. (2016). Aviation and Climate Change–The Continuing Challenge. Encyclopedia of Aerospace Engineering, DOI:10.1002/9780470686652.eae1031

53. Owen, B., Lee, D. S., & Lim, L. (2010). Flying into the future: aviation emissions scenarios to 2050. Environmental Science and Technology 44(7): 2255-2260.

54. Macintosh, A., & Wallace, L. (2009). International aviation emissions to 2025: Can emissions be stabilised without restricting demand? *Energy Policy*, 37(1), 264-273.

55. ICAO (2016) 2016 Environmental Report. www.icao.int/environmental-protection/Pages/env2016.aspx

56. Brasseur, G. P., Gupta, M., Anderson, B. E., Balasubramanian, S., Barrett, S., Duda, D., & Halthore, R. N. (2016). Impact of Aviation on Climate: FAA's Aviation Climate Change Research Initiative (ACCRI) Phase II. *Bulletin of the American Meteorological Society*, 97(4), 561-583.

57. Lyle, C. (2017) Beyond CORSIA: Towards a robust strategy for mitigation of international air transport emissions. www.greenaironline.com/news.php?viewStory=2397

58. EC (2017). EU climate action. Available. https://ec.europa.eu/clima/citizens/eu_en

59. ICAO (2017). What would be the impact of joining CORSIA? www.icao.int/environmental-protection/Pages/A39_CORSIA_FAQ3.aspx

60. EC (European Commission) (2015). 2030 Energy Strategy. Available at: https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/2030-energy-strategy

61. EEA (European Environment Agency) (2015). Evaluating 15 years of transport and environmental policy integration. EEA Report No 7/2015. Available at: www.eea.europa.eu/publications/term-report-2015

62. EC (2017). Reducing emissions from aviation. Available: https://ec.europa.eu/clima/policies/transport/aviation_en - Accessed 11 September 2017.

63. EC (2011). Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM (2011) 144 final. European Commission, Brussels.

64. OECD (2010) Effective Carbon Rates on Energy. www.oecd.org/tax/tax-policy/effective-carbon-rates-on-energy.pdf

65. HM Treasury (2006). Protecting the Environment. Chapter 7 in: *Pre-budget Report 2006: Investing in Britain's Potential: Building our long-term future* (pp. 155-180). London, UK: HM Treasury. Retrieved from http://webarchive.nationalarchives.gov.uk/20100407010852/http://www.hm-treasury.gov.uk/d/pbr06_chapter7.pdf

66. Seely, A. (2012). *Air passenger duty: introduction – Commons Library Standard Note* (SN/BT/413). London: House of Commons Library. Retrieved from UK Parliament website; www.parliament.uk/briefing-papers/SN00413

67. Gössling, S., Lohmann, M., Grimm, B. and Scott, D. (2017). German holiday transport patterns: Insights for climate policy. Case Studies in Transport Policy, https://doi.org/10.1016/j.cstp.2017.10.001

68. Gössling, S., Ring, A., Dwyer, L., Andersson, A.-C. and C.M. Hall. (2015). Optimizing or maximizing? A challenge to sustainable tourism. Journal of Sustainable Tourism, http://dx.doi.org/10.1080/09669582.2015.1085869

69. Gössling, S., Scott, D., and Hall, C.M. (2015). Inter-market variability in CO_2 emission-intensities in tourism: Implications for destination marketing and carbon management. Tourism Management 46: 203-212 doi:10.1016/j.tourman.2014.06.021

70. UNWTO (2017). Tourism and the SDGs. Available from: http://icr.unwto.org/content/tourism-and-sdgs - accessed on 27 September 2017.

APPENDIX A - INTERVIEW RESPONDENTS

Global tourism
- UNWTO (Dr. Taleb Rifai)
- OECD (Peter Haxton)
- UNEP (Helena Rey)

Global airlines
- IATA (Paul Steele)
- Air Transport Action Group (Michael Gill)

Global cruises
- Cruise Lines International Association (Bud Darr)

European Commission
- Unit Tourism and Creative Industries (Iulia-Gabriela Aluas)

European destinations
- Germany (Olaf Schlieper)
- Iceland (Ólöf Ýrr Atladóttir)

Large European tour operator
- TUI (Jane Ashton)
- Thomas Cook (David Ville)

Platforms
- Amadeus (Lucas Bobes)

Private Sector Leaders
- Emirates (Shannon Scott)
- Etihad (Linden Coppell)
- Intrepid Travel (Darrell Wade)
- Mandarin Oriental (Peter Lofgren)
- Ryanair (Juliusz Komorek)

APPENDIX B – ADDITIONAL TABLES/FIGURES/PICTURE THEMES FOR CONSIDERATION

Table 1. Regional climate change risk and projected tourism growth

Tourism region	International arrivals market share (% in 2014) (1)	Projected annual growth (%) 2020-2030 (2)	CVIT score (3)
Africa	**4.9**	**4.6**	**93.4**
North Africa	1.7	4.0	90.1
Sub-Saharan Africa	3.2	5.4	93.7
Americas	**18.0**	**2.2**	**87.3**
North America	10.6	1.4	70.3
Caribbean	2.0	1.7	92.9
Central America	0.8	4.5	90.0
South America	2.5	3.9	83.3
Asia and the Pacific	**23.2**	**4.2**	**88.7**
North-East Asia	12.0	4.2	77.8
South-East Asia	8.5	4.3	87.4
Oceania	1.2	2.0	91.5
South Asia	1.5	5.3	92.0
Europe	**51.4**	**1.8**	**67.6**
Northern Europe	6.3	1.4	57.8
Western Europe	15.4	1.4	60.2
Central-Eastern Europe	10.7	2.5	70.2
Southern-Mediterranean Europe	19.0	1.9	73.4
Middle East	**4.5**	**4.0**	**90.0**

(1) Data source: UNWTO 2015
(2) Data source: UNWTO 2011
(3) Average of countries with CVIT scores in each UNWTO tourism region