WORLD ECONOMIC FORUM

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TOWARDS A LOW CARBON TRAVEL & TOURISM SECTOR

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1. EXECUTIVE SUMMARY

The Travel and Tourism (T&T) sector's current contribution to global greenhouse gas (GHG) emissions is 5% of global anthropogenic emissions:

- *Travel and Tourism*, excluding aviation, is responsible for about 3% of GHG emissions [1]. It is estimated that CO_2 emissions from tourism (excluding aviation) will grow at 2.5% per year until 2035.
- *Aviation* contributes 2% of total manmade CO_2 emissions [2]. But the recent decline in air traffic, due primarily to the global recession, means that by 2012 aviation-related CO_2 emissions from aviation will recede to 2005 levels [3]. After the global economy recovers, it is estimated that air traffic will grow at an annual rate of 5% in the subsequent 15 to 20 years; however, annual increases in carbon emissions will be limited to about 2.7% because of expected load factor gains and more fuel efficient planes, which will replace existing fleets.

The T&T sector is committed to emissions reduction targets to lower its impact on climate change. For example, the air transport cluster forecasts a 25% improvement in fleet fuel efficiency by 2020, using 2005 as the baseline year [4]. And public aviation agencies are working with carriers to implement more efficient air traffic management systems, such as NextGen in the United States and Single European Sky in Europe. Similar activity is going on in other parts of the T&T sector as well, including upgrades to existing hotels to make them more energy efficient; measures to minimize fuel consumption in cars, railways, airplanes and cruise ships; and the development of eco-tourism destinations.

However, while these and other efforts will keep emissions low, they will not be sufficient to achieve a CO_2 neutral Travel and Tourism sector, a long-term goal of the industry. Although recognizing that mobility is a fundamental need of society, T&T companies are committed to collaborate with government and international institutions to develop appropriate measures that deliver significant emissions reductions, bringing the sector closer to that goal. Beyond the current initiatives to minimize GHG, several additional and promising measures were identified through multi-stakeholder workshops (from June 2008 until April 2009) and the Aviation Travel & Tourism (ATT) Governors Meeting on climate change at Davos, Switzerland in January 2009. These initiatives must be accelerated over the next 10 to 15 years to greatly reduce emissions from the Travel and Tourism sector:

Most promising T&T sector-specific emissions mitigation measures:

1. **Encourage modal-shift from cars to mass-transit systems (bus and rails)**, promote traffic management technologies (e.g. GPS, Telemetrics), and alleviate infrastructure bottlenecks. Simultaneously, accelerate the decarbonization of car transport by deploying cleaner fuels, more efficient vehicles and changing consumer behavior.
2. **Acceleration of fleet renewal with more fuel efficient planes** through appropriate market-based incentives to be set by regulators.
3. **Removal of infrastructure inefficiencies in the airspace and air-traffic management** such as the implementation of the Single European Sky and the US NextGen Air Transport System.
4. **Integration of international aviation in the post-Kyoto climate change agreement at a global sector level** to avoid a patchwork of conflicting national and regional policies, and the use of positive economic measures to reduce aviation emissions (e.g. global Emissions Trading Scheme). A proportion of funds generated from any fiscal or economic measures (e.g. ETS) should be re-invested in aviation industry specific green initiatives and sustainable tourism projects.
5. **Acceleration of hotel refurbishment to support the highest degree of energy efficient** heating, cooling, lighting and building technology through incentives for energy efficient investments or mandatory energy efficiency certificates.

Most promising cross-sector [5] emissions mitigation measures:

1. **Accelerated development and deployment of low carbon sustainable fuels in the aviation sector** as a joint initiative between governments, aircraft and engine manufacturers, airlines, energy companies, universities and research institutes. The sustainable fuels must not impact global

agriculture and/or must not lead to rain forest depletion, and should be evaluated on a life-cycle emissions impact basis.

2. **Accelerated deployment of renewable energy in the accommodation cluster** as a joint initiative among destination governments, hotel chains, and energy and utility companies.
3. **Improvements in cruise ship fuel efficiency** through increased collaboration with engine manufacturers and ship builders, building on the decarbonization strategy of the logistics and cargo shipping industry.
4. **Removal of mass-transit inefficiencies** by linking major airports to city-centers by dedicated railway lines and by locating airports on national/regional railway networks, especially those with high speed trains. In addition, railways and air-transport services must be better integrated (e.g. shared ticketing and scheduling, and secure and seamless transfer of luggage from one mode to another).
5. **Generate consensus on global and regional sustainability standards and metrics** for measuring and reporting carbon emissions in the T&T sector, and establish green benchmarks for tourism destinations and travel products, enabling travelers to make carbon-conscious choices. Ensure that new initiatives are measured against life-cycle emissions and their overall sustainability.
6. **Pro-active leverage of various funding mechanisms** to finance the massive infrastructure "upgrade" needed to achieve long-term T&T sustainability (e.g. attracting existing commercial private-sector funds, establishment of a not-for-profit T&T Green Foundation and allocation of the financial stimulus package for T&T infrastructure).

The development, implementation and large scale deployment of these measures will require significant financial investments. The implementation of NextGen in US will cost about $30 billion [6] and result in annual abatement of 34 MtCO_2 by 2030, according to the International Air Transport Association (IATA). Similarly, the commercialization of sustainable biofuels in the aviation sector would entail a massive investment of $300 billion, which would reduce aviation emissions by 9% (117 MtCO_2) by 2030 [7].

For the accommodation cluster, reductions in carbon emissions will primarily be driven by the use of existing mature technologies in lighting, heating and cooling that can significantly improve hotel energy efficiency. The Inter-governmental Panel on Climate Change (IPCC) estimates that globally by 2020 about 29% of emissions in commercial buildings (including hotels) can be eliminated cost-effectively (i.e. the investment pays for itself through life cycle energy savings) by implementing energy efficient solutions. An additional 3% of emissions (14 MtCO_2) could be reduced in the accommodation cluster for an investment of $300 million (at an average abatement cost of $20 per ton of CO_2) by 2020 [8]. However, large scale adoption of accommodation abatement measures is only possible by removing market barriers (e.g. misaligned incentives between hotel operators/managers and property owners). In the cruise industry, 15% to 20% of emissions can be reduced cost-effectively by 2020 (i.e. the investment pays for itself through life cycle energy savings) and an additional 10% emissions reduction (6 MtCO_2) in that period would require $430 million of investment (at an average abatement cost of $75 per ton of CO_2) [9].

This report assess the contribution of the T&T sector to the socio-economic development of nations, analyses the carbon emissions baseline (2005) and forecast (2035) for all T&T clusters, and identifies the most promising T&T sector and cross-sector emissions mitigation measures. Furthermore, the report highlights the critical role that can be played by cross-sector innovative partnerships, both within the T&T sector and with other industrial sectors (for example, energy), in accelerating the deployment of emissions abatement measures.

Note to policy makers

For policy makers, it's important to recognize that various T&T clusters [10] are at different stages of organizational development, and hence require different policy approaches to accelerate their decarbonization (see Chapter 5 for detailed implications for policy makers). For example, the global air transport cluster is highly organized, regulated by international aviation rules, and quite advanced in monitoring emissions around the world. On the other hand, the accommodation cluster is fragmented (more than 80% of capacity is owned by independent small to medium-sized enterprises), has few regulations and those that exist differ greatly from one nation to the next, and lacks a system and agreed metrics to monitor global emissions. Meanwhile, the cruise line industry is highly concentrated in the hands of four key players; moreover, a majority of cruise tourism activity is regional, especially around the Mediterranean and Caribbean coast. The railway industry, by contrast with the other clusters, is nationalized in most regions of the world and was opened only recently to deregulation in Europe.

CONTENTS

2. OBJECTIVE AND MULTI-STAKEHOLDER PROCESS

2.1 Objective of the Study

The study was initiated at the request of the World Economic Forum, Aviation, Travel & Tourism community, as a reflection of its growing concern about the effect that the Travel & Tourism sector has on climate change, particularly given the potential impact of climate change on a T&T destination's socio-economic growth.

The study was developed over a one-year period as a multi-stakeholder process in which industry, international organizations, NGOs, governments and industry associations involved with the sector have come together to jointly conduct an analytical analysis of the impact of the Travel and Tourism sector on CO_2 emissions and develop a framework for reduction of CO_2 emissions by the sector as a whole.

The study aims to:

- Illustrate the importance of T&T in achieving the UN Millennium Development Goals (MDGs) and in delivering sustainable growth to developing countries and small island states [11].
- Provide an overview of carbon emissions of various clusters in the Travel and Tourism sector;
- Highlight cluster-specific emissions reduction measures; and
- Emphasize the innovative cross-sector partnerships and financing mechanisms required to accelerate the deployment of emissions reduction measures in the T&T sector.

The key new contributions of this study are:

- Estimates of carbon footprint and emissions forecast for T&T clusters;
- Identification of cluster-specific emissions mitigation measures; and
- Identification of the most promising cross-sector emissions mitigation measures.

This study will be of particular interest to T&T industry leaders, relevant international and national T&T organizations, industry associations as well as national policy makers, tourism and climate change experts from OECD countries, developing countries and small island states.

2.2 Travel and Tourism (T&T) Sector Defined

The UNWTO (United Nations World Tourism Organization) defines the Travel and Tourism (T&T) sector as including:

"… the activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited"

This study adopts the UNWTO definition of Tourism and refers to it as "Travel and Tourism" sector. All traveling activities such as commuting or other personal activities usually involving transportation; for example, shopping, taking children to school, etc. are not included in this study to be consistent with the definition of T&T.

For carbon footprint analysis and forecast (2005-2035), the T&T sector is divided into five clusters:
1. Land transport
2. Air transport
3. Water transport
4. Accommodation
5. Tourism activities

Each cluster contributes both direct and indirect GHG emissions *(for detailed emissions by cluster, see Chapter 4)*. However, in this study only direct emission contributions were considered.

Furthermore, it's important to note that the T&T sector is not considered a specific sector within the United Nations Framework Convention on Climate Change (UNFCCC), which only includes standard supply-based sectors such as Air transport, Surface transport, Energy, and Buildings. T&T does not fit into this category because it encompasses as well the demand-side component of the T&T value chain. The benefit of analyzing the T&T sector from a total value-chain perspective is that such an approach clearly highlights the risks and opportunities of specific actions – the unintended consequences of policy decisions – often overlooked in vertical T&T industry analyses. For example, stringent aviation CO_2 mitigation policies in developed countries, the major source of international outbound tourism, can have profound implications for destinations that heavily depend on travel and tourism for their economic sustainability [12]. In addition, a holistic value-chain analysis emphasizes the potential role of cross-sector innovative partnerships within the T&T sector or with non-T&T sectors (such as energy) in accelerating the deployment of emissions abatement measures.

2.3 Multi-stakeholder Process

This study is one of the first multi-stakeholder reports on climate change in the Travel and Tourism sector. Under the auspices of the convening platform of the World Economic Forum, industry leaders, international organizations, governments, civil society, and climate change experts took part in a series of working sessions between spring 2008-spring 2009 with the objective to identify the most promising carbon abatement options within the T&T sector.

The international organizations and industry associations involved in the dialogue included United Nations World Tourism Organization (UNWTO), United Nations Environmental Programme (UNEP), International Civil Aviation Organization (ICAO), International Air Transport Association (IATA), World Travel & Tourism Council (WTTC), and International Hotel & Restaurant Association (IH&RA) and Airport Council International (ACI). In addition, several key representatives in the Travel and Tourism value chain – airlines, aircraft and engine manufacturers, hotels, tour operators, cruise lines, car rental companies, and policy makers – participated in the workshops.

3. CONTRIBUTIONS OF T&T SECTOR

3.1 Socio-Economic Contributions of T&T

As a major driver of economic growth and employment worldwide, the T&T sector is a critical component in the global economy. It provides economic benefits by connecting countries to international markets, encompassing people, capital, and resources. Moreover, T&T transport networks – especially air and rail – are essential economic assets for more than just transporting people; these networks also form the backbone for cargo shipments, thereby increasing regional or global economic activity. In addition, the T&T sector breaks down cultural barriers and links people from various nations, while at the same time it contributes to the development of regional communities by building partnerships among local residents, organizations, and businesses.

The importance of the sector worldwide is demonstrated by the liberal business environment that exists in most countries, with more than 130 World Trade Organization (WTO) members having made commitments to open up their tourist industry – more than any other service sector [13].

According to the World Tourism Organization (UNWTO), in 2007 international tourist arrivals reached 903 million and tourism receipts rose to US$856 billion, a growth rate of 5.6 percent in real terms compared with 2006 (tourism demand slowed in the second half of 2008, however, due to the deteriorating international economic situation). By 2010 international arrivals are expected to reach 1 billion and ten years later, 1.6 billion [14]. The World Travel & Tourism Council (WTTC) estimates that in 2008 the T&T sector accounted for 10.9% of global GDP, 12.2% of world exports, and 9.4% of world investment, from direct and indirect activities [15].

3.2 T&T as a Critical Enabler of the UN's Millennium Development Goals (MDG)

The T&T sector can play a critical role in meeting the MDGs [16]. In particular, the sector can make a significant contribution (especially in Least Developed Countries and Small Island Developing States) in raising living standards and alleviating poverty by facilitating the creation of jobs, boosting local economies and helping to build up foreign currency reserves. Currently, about 50 least developed countries largely depend on Travel and Tourism for their economic development and job creation. Recent empirical studies suggest that between a fifth and one-third of total tourist turnover in these destinations is captured by the poor [17].

The T&T sector can be a catalyst for the preservation of environmental resources and is increasingly adopting environmentally-conscious positions due to stringent carbon regulations, and energy price volatility. Moreover, greater consumer awareness about sustainability is rapidly turning green strategies into good business practice. Companies and tourism destinations that pro-actively work on sustainability initiatives will be better positioned than their competitors to survive under future environmental regulations. Simultaneously, greater consumer awareness about sustainability and climate change will likely result in non-sustainable destinations incurring a loss in market share. Tourists from major markets such as Western Europe and the U.S. are becoming increasingly environmentally conscious, and are willing to alter their travel behavior to reduce impact on climate change. It should be noted that non-sustainable destinations will not be able to capitalize on the high-growth opportunity in eco-tourism, which is growing at a phenomenal rate of 15% per annum [18] (four times faster than traditional tourism).

4. TRAVEL and TOURISM'S IMPACT ON CLIMATE CHANGE

4.1 Carbon Footprint Approach

For the purpose of estimating carbon emissions contribution from each economic activity, this study segments the T&T sector into five distinct clusters:

1. Land transport
2. Air transport
3. Water transport
4. Accommodation
5. Tourism activities.

Each cluster contributes both direct and indirect GHG emissions (see Figure 1) as listed below:

1. **Direct carbon emissions**: Carbon emissions from sources that are directly engaged in the economic activity of the T&T sector are considered direct emissions. These are, for example, emissions from the usage of electricity by hotels and resorts and emissions from passenger aircrafts and railways. All direct emissions have been included in estimating emissions baseline and forecast for the T&T sector.

2. **Indirect carbon emissions**: Indirect carbon emissions are produced as a consequence of the activity of the companies in the T&T value chain, but occur from sources not directly engaged in the economic activity within the T&T sector. For example, emissions from electricity usage in airline or travel agent offices, and emissions from transportation of hotel consumables, such as food or toiletries. Indirect emissions are beyond the scope of this project. Indirect emissions have not been included in the emissions baseline and forecast for the T&T sector.

Figure 1: Direct and Indirect Carbon Emissions Sources for each T&T Cluster

Clusters *(Direct Emitters)*	**Direct Emissions**[1] *(in scope)*	**Indirect Emissions**[2] *(out of scope)*
Land Transport	• Passenger rail, use of cars and bus for travel & tourism	• Use of rail, cars and bus for commuting, rental car offices, and railway stations
Air Transport	• Emissions from commercial airlines	• Airports, Maintenance centres, Offices of passenger airline companies
Water Transport	• Cruise lines, River cruises, Recreational boats	• Transportation of food and other consumables to cruise lines
Accommodation	• Emissions due to energy consumption in Hotels, Lodges and Resorts	• Transportation & production of hotel consumables (e.g. food, toiletries)
Tourism Activities	• Amusement parks, Ski areas, etc	• Transportation & production of activity equipments (e.g. skis)

For each T&T cluster, with the exception of tourism activities, a detailed emissions baseline (2005) and forecast methodology (2005-2035) [19] was developed. T&T activities (e.g. amusement parks, ski resorts, golf resorts) were not included in the carbon footprint study as there is very limited reliable emissions data for these activities at a global level.

The carbon emissions forecast for the T&T sector is based on business-as-usual assumptions – that is, assuming that there is no serious climate-interventionist policy and that future business operations are similar to what they have historically been. Due to the global nature of the study, some clusters, such as Accommodation, have limited available emissions data [20], while others, such as Air transport, have quite advanced statistics. A more comprehensive assessment of T&T carbon footprint would need to improve data reliability for some sectors and include emissions from indirect and induced effects of the Travel and Tourism sector – such as the carbon footprint involved in supplying products for tourists' consumption at destinations. However, such an assessment would require a detailed understanding of all product imports into tourism destinations and the share of those imports used in the T&T sector, which was not available at the time of this study.

The following sections detail current emissions estimates and forecasts for each T&T cluster:

4.2 Land Transport

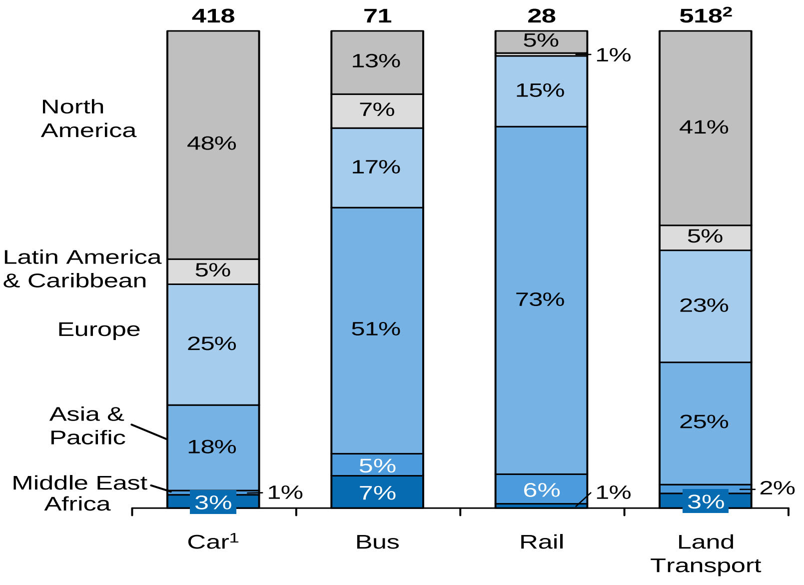
Land transport emissions data is based on the global transport energy consumption study Sustainable Mobility Project (SMP) conducted by the World Business Council on Sustainable Development's (WBCSD) and International Energy Agency (IEA) database. The study estimated global land transport emissions from cars, buses and rails. The estimates of T&T's share of Land transport emissions were based on the MusTT study to European Commission (DG Environment) on European tourism transport; the US National Household Travel Survey; and 2005 Japan inter-regional travel survey.

The land transport carbon emissions are driven by three key levers:

- Passenger kilometers driven for each mode (Car, Bus, Rail);
- Energy intensity per km for each mode; and
- Emission factors for the fuel source mix used for each mode.

Figure 2 shows the T&T carbon footprint for car, bus and rail, and how they breakdown across six major regions in the world.

Figure 2: T&T Land Transport Emissions - 2005
(MtCO2)



1) Car emissions include emissions from 2-3 wheelers, mini-vans
2) Transport emissions may not exactly add up to 518 due to rounding of numbers
Source: WBCSD, IEA, Booz & Company analysis

Primary findings from the emissions baseline results *(see Figure 2)* are:

- There is significant variation in the use of cars and mass transit (bus & rail) between OECD and non-OECD countries.
- North America, Europe and Asia-Pacific combined contribute to ~90% of T&T land transport emissions.

- North America accounts for almost half of the car emissions, followed by Europe and Asia-Pacific (25% & 18% respectively).
- Europe & Asia-Pacific use significant amounts of mass transit for T&T, whereas North America's overall use of mass transit is significantly lower (13% in bus and 5% in rail)
- On a global level, 16%-20% of total passenger miles in car transport are estimated to be for travel and tourism; the rest is for commuting and personal use [21].

Forecasting future land transport carbon emissions is a complex process driven by three main levers:

- Evolution of vehicle fuel consumption rates by regions;
- Growth in vehicle ownership & sales; and
- Changes in fuel mix for land transport across major regions of the world.

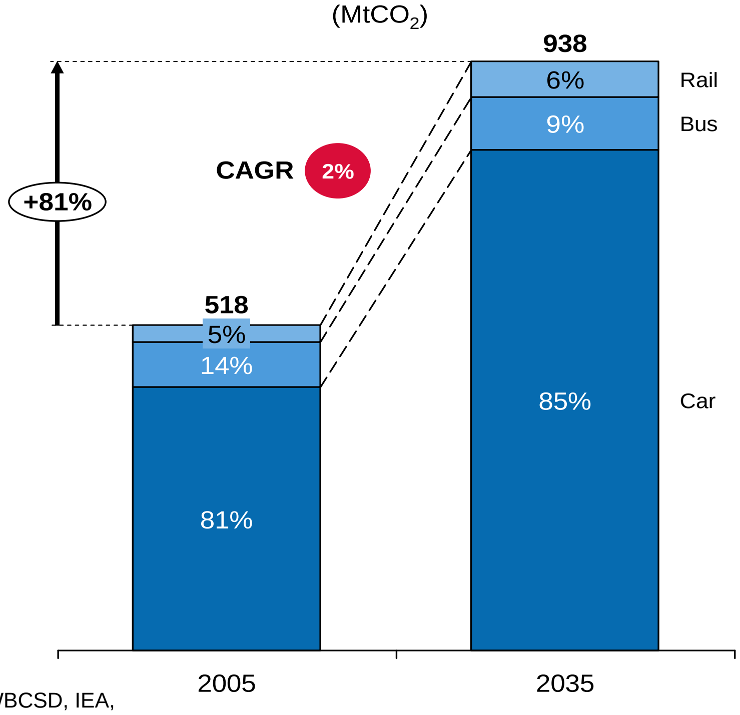
This study builds on the comprehensive forecasting model developed by World Business Council on Sustainable Development's (WBCSD) Sustainable Mobility Project (SMP) and International Energy Agency (IEA). The following approach was used in forecasting future land transport carbon emissions:

– Fuel consumption rates by region – Existing fuel consumption programs (policy legislation) are included in the projection until the year they end, and a return to historical (non-policy-driven) trends is assumed after that.
– Vehicle ownership & sales – Vehicle ownership is based on GDP per capita and population growth; sales are estimated based on vehicle stock levels, average turnover, and vehicle age.
– Changes in fuel mix – Road vehicles are assumed to use small, fairly constant amounts of alternative fuels (mainly diesel & biofuels).

T&T Land transport emissions are forecast to grow at 2% per annum through 2035. *(See Figure 3)*.

Figure 3: Land Transport Emissions - 2035

($MtCO_2$)



Source: WBCSD, IEA, Booz & Company analysis

Cars will continue to be the dominant land transport mode for travel and tourism under business-as-usual assumptions. In fact, the share of emissions from cars will increase to 85% by 2035 from 81% in 2005. It's important to note that under business-as-usual assumptions emissions from busses will actually decrease from 14% in 2005 to 9% in 2035. The declining carbon contribution of busses is largely driven by a drop in traffic, the result of their general lack of popularity as a means of travel and tourism in most developed countries.

4.3 Air Transport

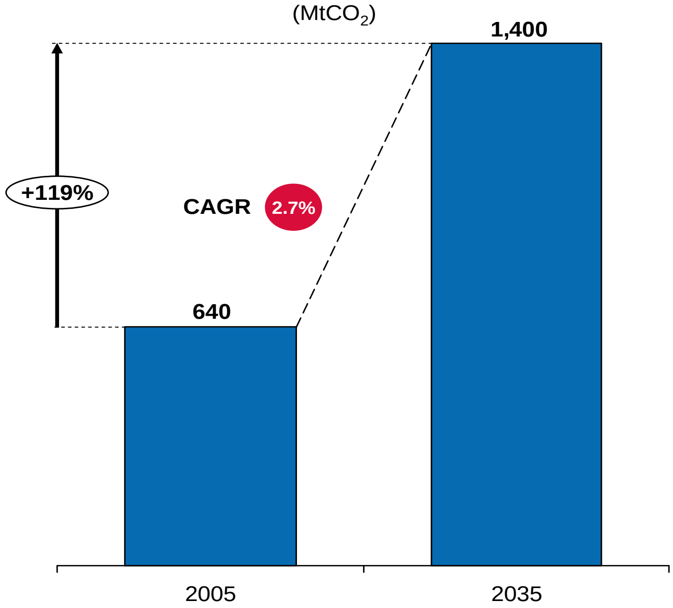
The baseline for air transport carbon emissions are based on a comprehensive analysis conducted by International Air Transport Authority (IATA) and International Civil Aviation Organization (ICAO). The major inputs for the model are:

- "Bottom-up" FESG (Forecasting and Economic Analysis Sub Group) fleet and traffic data from ICAO;
- Air traffic flows matched against aircraft types by seat categories;
- Normal fleet renewal and load factor increases; and
- Fuel burn based on average flight of particular aircraft models.

Using these drivers, Air transport carbon emissions are estimated to grow at an annual rate of 2.7% per year, reaching 1400 $MtCO_2$ by 2035 *(see Figure 4)*, despite the fact that air traffic passenger volume (revenue passenger kilometers) is expected to increase by as much as 4.2% a year from 2006-2030.

Figure 4: Air Transport Emissions - 2035

($MtCO_2$)



Source: IATA, ATAG, ICAO

The significantly lower growth in carbon emissions relative to traffic volume gains is driven by the replacement of old planes with fuel efficient models and an increase in load factor due to better yield management by airlines. Even beyond this, the aviation industry is undertaking several initiatives to lower its impact on climate change by improving aircraft fuel efficiency (average fuel use per passenger km). (For a detailed discussion of these initiatives, see chapter 5).

It should be noted that air transport carbon emissions correspond to overall commercial aviation – that is, passenger airlines (including belly cargo) and dedicated cargo freighters. The dedicated cargo freighters is about 10% of global fleet and expected to double in number by 2025[22]. Moreover, several airlines carry cargo in their belly to earn additional revenue and utilize excess capacity. Due to limited data availability and lack of well-developed methodology, it is currently difficult to attribute emissions from commercial flights to passengers and belly cargo separately. A more detailed assessment needs to produce such distinct estimates.

4.4 Water Transport

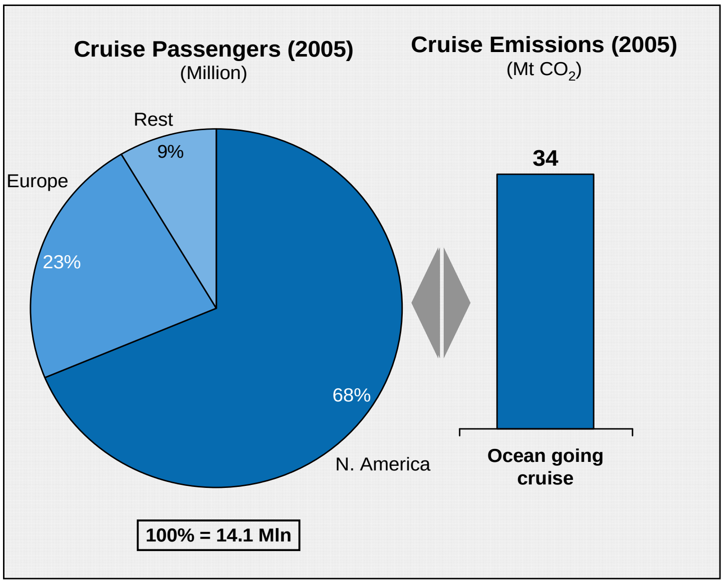
Travel and Tourism related water transport carbon emissions estimates include only global ocean-going cruise lines, which account for ~ 5% of global shipping emissions. Limited reliable data is available for river-going cruises and passenger ferries, and hence they are not considered in the footprint study. The key drivers for ocean-going cruise emissions are:

- Number of ocean going cruise ships;
- Annual operating days;
- Fuel consumption rate; and
- Emission factors for fuel mix used in cruise ships.

North America and Europe contribute to ~90% of the cruise ship traffic. These cruise ships are highly concentrated in the Mediterranean & Caribbean region, and the same ships are moved across key regions around the world to take advantage of seasonal traffic.

Global ocean-going cruise emissions for 2005 were estimated at 34 $MtCO_2$ which is less than 5% of the global shipping emissions (*see Figure 5*).

Figure 5: Water Transport Emissions - 2005
($MtCO_2$)



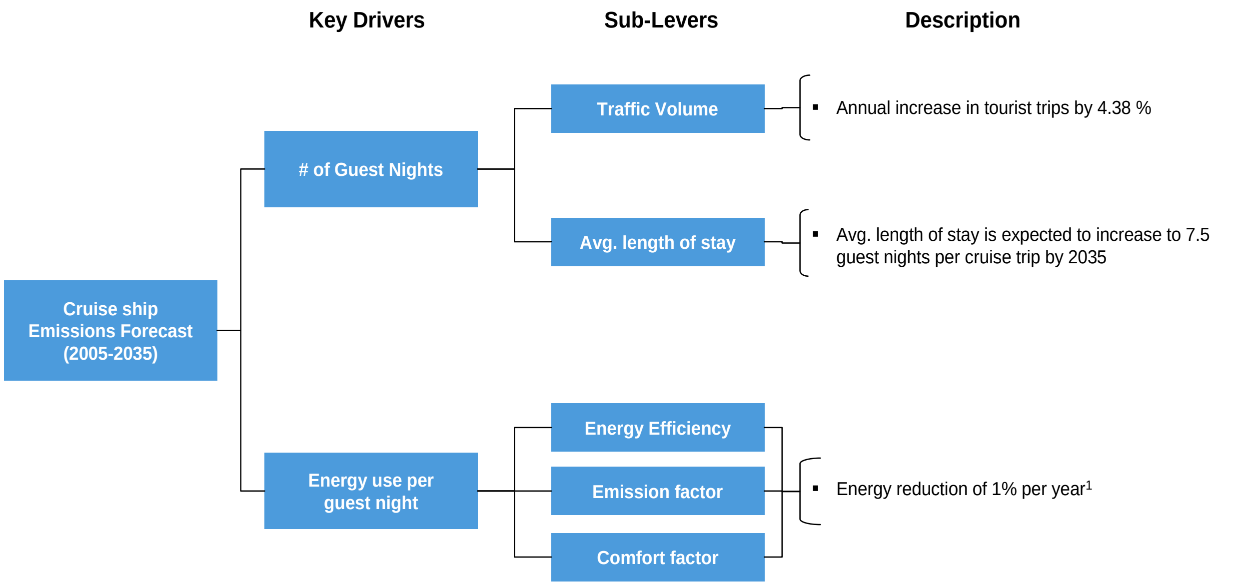
1) Endresen – Modeling Past, Present and Future Ship emissions

Source: UNWTO World Wide Cruise Ship Activity, Booz & Company analysis

Forecasting water transport emissions is a complex process primarily dependent on two parameters – guest nights and changes in energy use per guest night *(see Figure 6):*

- Guest nights include traffic volume, which is expected to grow annually by 4.4%, and average length of stay, which is expected to increase to 7.5 nights per cruise trip by 2035.
- Energy use per guest night depends on the future trends in energy efficiency, comfort factors and emission factors. The latter will vary over time and largely be determined by changes in fuel mix used to power cruise lines.

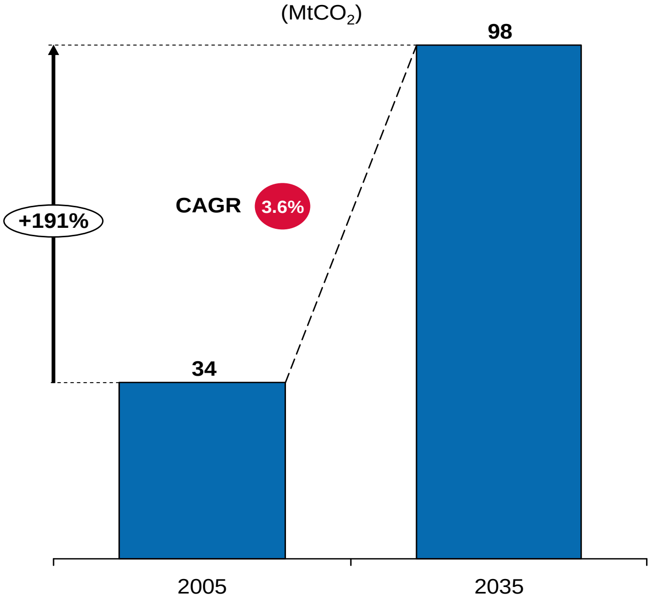
Figure 6: Ocean going Cruise Ship Forecast Approach
(2005-2035)



Source: Corbett, Endresen (Modeling Past, Present and Future Ship emissions), Booz & Company analysis

Using the above drivers, emissions for ocean-going cruises are estimated to rise by 3.6% per year, reaching 98 $MtCO_2$ by 2035 (see figure 7) – almost tripling in the next three decades. A high tourism growth rate of 4.4% per year and an increase in average length of stay by cruise line tourists are the chief variables.

Figure 7: Water Transport Emissions - 2035
($MtCO_2$)



Source: UNWTO, CLIA, Tony Peisley, Booz & Company analysis

4.5 Accommodation

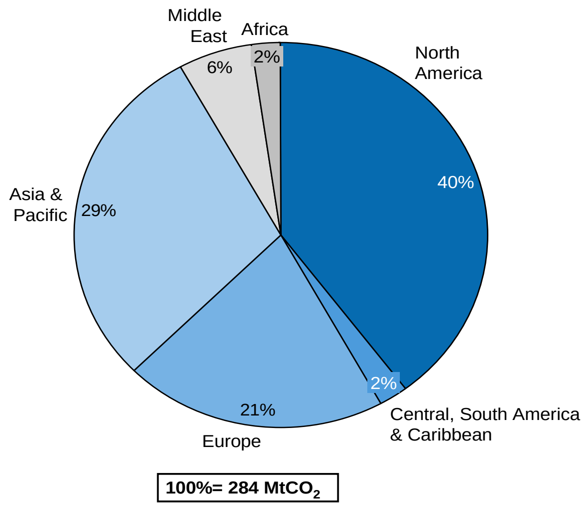
The accommodation cluster is segmented into two categories:

- Hotels and similar establishments, such as lodges and motels; and
- All other types of accommodation (for example, vacation homes, staying with friends and relatives and camps).

The accommodation cluster carbon emissions are calculated as the product of tourism volume (guest nights); energy use per guest night; and emission factors per energy unit for power and heat. For 2005, worldwide accommodation emissions are estimated at 284 $MtCO_2$ (see Figure 8), less than 5% of global building emissions.

Figure 8: Accommodation Emissions - 2005

($MtCO_2$)



1) IPPC Fourth Assessment Report estimated global building emissions at 8Gt CO_2

2) Emissions estimate might be slightly higher due to conservative estimates of energy use per guest night from Green Globe Benchmarks

Source: UNWTO, WRI, IEA, Booz & Company analysis

Carbon emissions estimates for the Accommodation cluster are based on UNWTO tourism statistics, IEA benchmarks and other reputed databases as listed in the following table:

Emissions Driver[1]	Data Source	Baseline data (2005)	Limitations
Guest nights	World Tourism statistics from ***UNWTO***	▪ Guest nights for six major regions of the world derived from country level UNWTO tourism data ▪ Guest night data available for two accommodation types: Hotels and Others (Vacation homes, VFR)	▪ Non-availability of hotel guest nights by hotel types (budget, medium, five-stars, etc) for all regions of the world
Energy use (per guest night)	Energy use per guest night from ***Green Globe benchmarks and IEA benchmarks***	▪ Energy use per Hotel guest nights for six major regions of the world is based on *Green Globe benchmarks* ▪ Energy use per guest night for other accommodation is based on residential energy consumption from IEA energy benchmarks	▪ Hotel energy use is the average of baseline & best practice numbers from Green globe since baseline numbers were too high when compared with other independent academic sources
Emission factors (per energy unit)	Emission factors from ***WRI and IEA*** **benchmarks**	▪ Emission factors based on the country level data from *WRI and IEA* emissions factor benchmarks ▪ Emissions factors vary significantly by region due to different energy sources (Oil, Coal, Gas, Hydro)	▪ None ▪ The WRI/IEA factors were further validated by comparing with WBCSD data

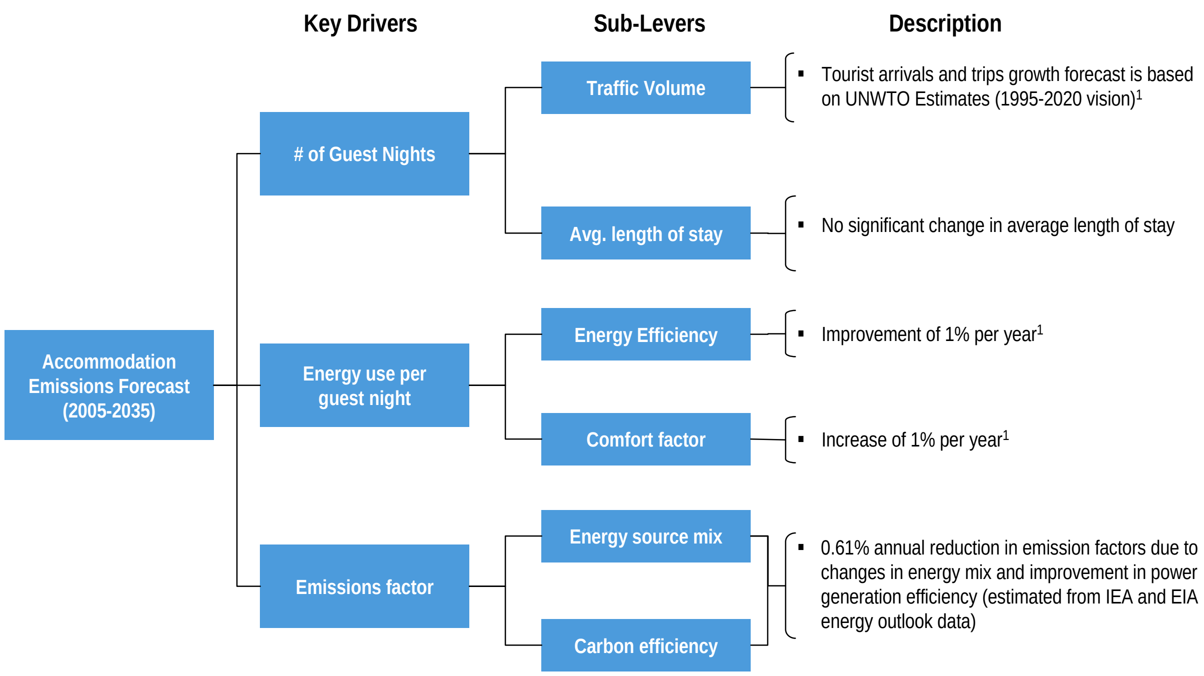
1) Accommodation CO_2 Emissions = (Guest nights)*(Energy use per guest night)*(Emission factors per unit of energy)

Principal insights from the carbon footprint analysis of the Accommodation cluster include:

- **Worldwide accommodation emissions are only 3.5% of global building emissions**, however, they have a significant impact on the overall T&T sector's footprint (>15%).
- **Significant regional variation is observed in energy use per guest night** and emission factors for power & heat generation. North America, Europe and Asia & Pacific combined contribute ~90% of global destination building emissions.
  - North America is the largest contributor to building emissions (40%) driven by high energy use per guest night due to larger room size, and high emission factors for power and heat generation due to use of coal for ~50% of its power generation capacity;
  - Although Europe has a large volume of tourism (30% of total guest nights), it contributes only 21% to accommodation emissions, due to more efficient energy use and cleaner sources of power generation, including hydroelectric, natural gas & nuclear;
  - Asia & Pacific emissions (29% in 2005) are lower than the United States but are expected to grow significantly in the future and become the dominant source of emissions (36%) by 2035;
  - Central & South America contributes the least to accommodation greenhouse gases because of significantly lower global tourism traffic (<10%) and a large share of hydroelectric power (relatively low emissions) in the power generation;
- **Energy use per guest night varies significantly by accommodation types** with hotels and similar establishments consuming more energy than, for example, vacation homes and camps.

The forecast of accommodation emissions is determined by three key levers:
- Tourism guest nights;
- Energy use per guest night; and
- Changes in emissions factors *(see Figure 9)*:

Figure 9: Accommodation Emissions Forecast Approach (2005 - 2035)

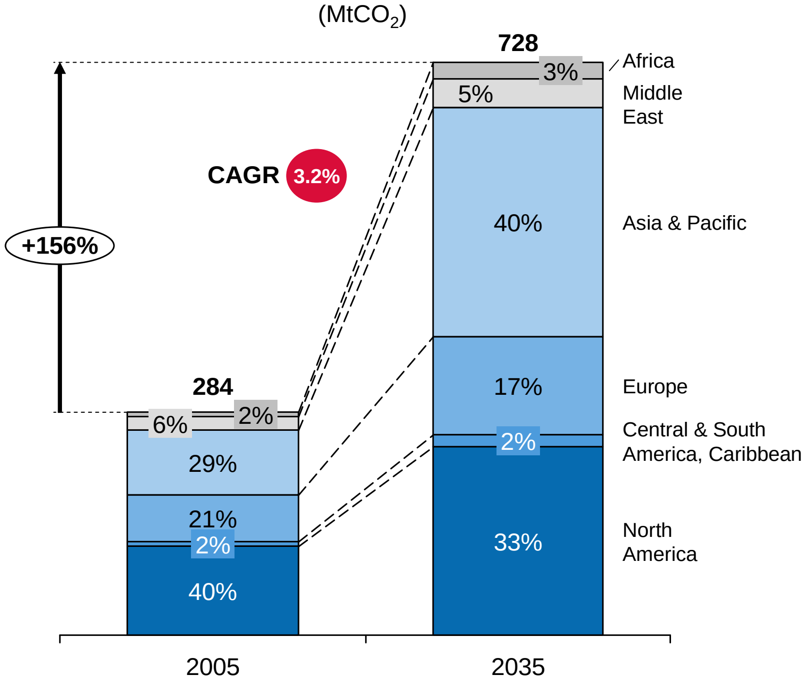


1) EIA International Energy Outlook 2008
2) Based on interviews with Tourism experts, UNWTO Travel and Tourism Climate Change study
Source: Booz & Company

Based on the above drivers, Accommodation cluster carbon emissions are forecast to grow at 3.2% per year, reaching 728 $MtCO_2$ by 2035 *(see Figure 10)*:

Figure 10: Accommodation Emissions - 2035

($MtCO_2$)



Source: UNWTO, WRI, IEA, Booz & Company analysis

Accommodation emissions are estimated to increase by 156% by 2035. The biggest growth in emissions will occur in Asia-Pacific whose share of emissions will increase by ~10% in the next 30 years (from 29% in 2005 to 40% in 2035). Although the hospitality sector is growing rapidly in the Middle East, its share of emissions will continue to be small (~5%). North America and Europe will together contribute to about 50% of global accommodation emissions in 2035 (down by 10% compared to 2005).

5. ROADMAP TO SUSTAINABLE GROWTH

This section highlights pragmatic emissions mitigation measures for specific clusters in the T&T sector and innovative cross-sector measures to significantly reduce the sector's impact on climate change. Cross-sector emissions mitigation measures focus on emissions reduction opportunities that require collaboration between two or more clusters within the T&T sector (e.g. railways and air transport network), or collaboration with other sectors beyond T&T (e.g. partnership between the energy sector and accommodations on renewable energy). It's important to recognize that various T&T clusters are at different stages of organizational development. For example, the global air transport cluster is highly organized, regulated by international aviation rules, and quite advanced in monitoring emissions around the world. On the other hand, the accommodation cluster is fragmented (more than 80% of capacity is owned by independent small- to medium-sized enterprises), has few regulations and those that exist differ greatly from one nation to the next, and lacks a system and agreed metrics to monitor global emissions. Meanwhile, the cruise line industry is highly concentrated in the hands of four key players; moreover, a majority of cruise tourism activity is regional, especially around the Mediterranean and Caribbean coast. The railway industry, by contrast with the other clusters, is nationalized in most regions of the world and was opened only recently to deregulation in Europe.

5.1 Most promising T&T sector specific emissions mitigation measures

Carbon emissions mitigation measures for the Travel and Tourism sector have been identified through multi-stakeholder workshops undertaken between June 2008 and April 2009 (see appendix for details). The following section outlines the most promising emissions abatement opportunities for each T&T cluster, prioritizes them by emissions abatement cost and emissions abatement potential, and highlights the key enabling policies to increase the adoption of emissions abatement options beyond the business-as-usual scenario.

5.1.1 Land Transport Cluster [23]

The land transport cluster comprises three modes of transportation: car, bus and rail. Car is the preferred means of transport for travel and tourism, and sometimes the only option for certain types of tourism (e.g. visiting remote natural destinations). Since cars contribute more than 80% of emissions in land transport, this section focuses primarily on the emissions abatement options for car transport. However, mass transit modes such as rail and bus transport are likely to play in the future a more significant role in reducing emissions for T&T trips, particularly because the majority of inter-city traffic is for T&T purposes (e.g. business or leisure). In terms of emissions per passenger-km, bus and rail are more desirable than cars. Indeed, assuming the same power train technology, cars emit as much as five times more CO_2 than busses. Hence, the modal-shift from cars to mass-transit systems (bus and rail) is a promising and pragmatic way to reduce emissions and traffic congestion on highways and in urban areas. Rail emissions are highly dependent on the type of fuel used for power generation as well as passenger load factors. Hence, decarbonization of power generation infrastructure is critical for a long term carbon neutral rail industry. Furthermore, more "life-cycle" studies will need to be conducted to fully assess the emissions impact on land use changes from the construction of new rail infrastructure or upgrades to existing lines.

However, Travel and Tourism only accounts for about 16% to 20% of global passenger automobile miles [24]. Most cars are used for commuting and personal purposes, such as shopping, taking children to school, etc, which are out of the scope of this study. Hence, automobile innovation will be largely driven by the need to minimize fuel expenditures and carbon footprint in activities other than Travel and Tourism, and the T&T sector will play a limited role in influencing policy makers. However, carbon efficient technologies in automobiles have the direct benefit of reducing the T&T sector's impact on climate change. Therefore, the sector strongly encourages the automotive industry and regulators to define policies that will accelerate the decarbonization in the land transport cluster.

The automotive industry is pursuing three main levers – more efficient vehicles, cleaner fuels and smart driving choices – to reduce the impact of car emissions on climate change. It's important to note that emissions mitigation measures for cars are equally applicable to busses and coaches due to commonality in power train technology.

Key CO_2 abatement options for Automotive

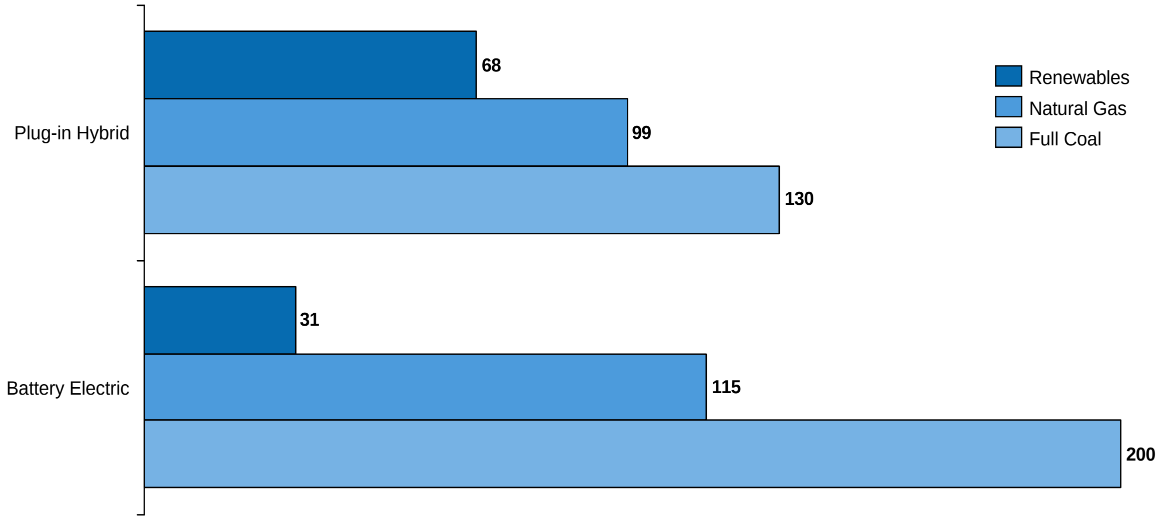
Emissions Reduction Levers		Abatement Measure	Abatement Potential [1]	Abatement costs [2]	Which policy measures or market mechanisms can increase the adoption of emissions abatement options?
Supply	Operational & Technical measures to reduce energy use	Reduced drag and tire rolling resistance	Low	Low	▪ Tax deduction for energy efficient investments ▪ Stimulate joint R&D initiatives ▪ Mandatory measures, e.g. fuel consumption / emission restrictions
		Transmission efficiency	Low	Low	
		Weight reduction	Medium	Low	
		Future gasoline engine	Medium	Low	
		Future diesel engine	Medium	Medium	
		Future hybrid engine	Medium	Medium	
		Plug-in Hybrid	High	Medium	
	Change in Energy Source	Bio-fuels	High	Medium	
		Fuel Cell	High	High	
		Electric vehicle	High	High	
		Hydrogen	High	High	
Demand	Change in Consumer Behavior	Purchase of low-carbon emitting cars within class	Medium	Low	▪ Incentives (e.g. subsidies, tax deduction etc) for customers to buy low emitting cars
		Efficient driving techniques	Medium	Low	▪ Government / industry campaigns on energy awareness

1) Abatement potential (i.e. % CO_2 reduction per vehicle) whenever a single measure is implemented for a vehicle: Low 0-10 %, Medium 10-30 %, High >30%. Whenever a group of measures is implemented single abatement potentials might not add-up due to interdependencies
2) € per tonne CO2 reduction: Low <60, Medium 100-250, High >250
3) Plug-in hybrid abatement potential depends on the energy mix used for electricity generation
Source: M.I.T., King Report, World Economic Forum – Automotive Climate Change Project, Booz & Company analysis

A rapid decarbonization of cars is central to a long term target of carbon neutral Travel and Tourism sector. The current landscape of emissions abatement options for car transport are along three key levers – cleaner fuel, more efficient vehicles and changes to driving behavior:

- **Development of more efficient vehicles**: Technology for conventional cars that can reduce up to 30% emissions (on a like-for-like basis) is already close to market and can become a standard in 5 to 10 years [25] (e.g. direct injection, variable valve actuation, regenerative braking). However, several supply-side and demand-side barriers need to be overcome to accelerate the roll-out of these technologies. In addition, better traffic management will also help, using intelligent telemetrics and smart traffic management systems to reduce traffic congestion (e.g. GPS based dynamic routing).
- **Adoption of cleaner fuels**: In the short- to medium-term, the auto industry is focusing on developing more efficient hybrids, plug-in hybrids and to a degree the limited use of biofuels. In the longer term the industry is developing a very low emissions car powered by electricity, fuel cells or hydrogen. The fuel alternatives for car transport must be measured against life-cycle emissions impact ("well-to-wheel") and not just "tailpipe" emissions. Moreover, it's important to recognize that clean cars are dependent on clean power generation *(see Figure 12)*. Therefore, making progress on decarbonizing power generation can have significant long term impact on reducing emissions from car transport, and making them environmentally as sustainable as bus and rail transport.
- **Promoting changes to consumer behavior**: Promoting changes in consumer behavior is the most effective way to reduce carbon emissions. It is estimated that 10% to 15% of carbon emissions could be reduced over the next few years [26], for example, by choosing the most fuel-efficient vehicles, use of public transports, more car sharing, etc. Currently, the consumers heavily discount (or fail to take into account) the impact of life-time fuel savings when making purchasing decisions for cars [27].

Figure 12: GHG Emissions in Car Transport per Electricity Production Mode
(2008, gCO_2e per km)



Source: On the road in 2035, MIT, Booz & Company analysis

Implications for policy makers:

- **Set consistent emissions standards and targets** to ensure that the industry can invest in and bring emissions reduction technologies to market with certainty. These emissions targets should capture the complete life-cycle emissions impacts from production, disposal and the fuels used by car.
- **Work toward developing a globally carbon and sustainability reporting methodology** for transportation fuels including the life-cycle impact of production, transportation and combustion.
- **Make display of CO_2 emissions labels compulsory on all vehicles**, including comparative information on CO_2 emissions and fuel economy, and the potential fuel cost savings over the life of the vehicle from choosing a more fuel efficient vehicle.
- **Setting up highway and city traffic infrastructure policy to promote use of intelligent telemetrics,** smart traffic management systems and infrastructure improvement projects to reduce traffic congestion (e.g. GPS based dynamic routing) and to increase capacity of existing highway infrastructure. In addition, charging infrastructure for electric cars is urgently needed if these vehicles are to become a commercially viable option.

5.1.2 Air Transport Cluster

Emissions mitigation measures for air transport are divided into five key dimensions: fleet renewal, retrofitting airframe and engine technology, sustainable fuels, operations and infrastructure. (see Table: Key CO_2 Abatement Options for Air Transport). The abatement potential column assesses the extent to which each dimension can reduce total air transport emissions in 2035 beyond the business-as-usual scenario. The scale of abatement potential available from these measures is consistent with achieving the 25% fleet fuel efficiency (average fuel use per passenger km) target by 2020 established by the air transport cluster. Capital costs for these measures are extremely high. However large cost savings, particularly from reduced fuel usage, can also be realized. The abatement cost assessment column therefore includes amortized capital and operating costs minus any savings from reduced fuel or other costs. In some cases this leads to low net abatement costs.

Key CO_2 abatement options for Air Transport

Emissions Reduction Levers	Abatement Measure	Abatement Potential [1]	Abatement Costs [2]	Which policy actions or market mechanisms can increase the adoption of emissions abatement options?
Fleet renewal & load factor change	▪ Introduction of next generation fuel efficient aircraft engines & airframe design in new fleet ▪ Higher capacity utilization of airline fleet	High	Medium	▪ Market-based incentives to airlines to accelerate fleet renewal e.g. wrecking bonus for airlines, advantageous depreciation tax regimes ▪ Earmarking a portion of funds collected from economic or fiscal measures (e.g. ETS) to finance the fleet renewal
Retro-fit of aircrafts with airframe & engine technology	▪ Retrofit wingtips on aircraft ▪ Reduced speed with redesigned aircraft ▪ Retrofit drag reduction enhancements ▪ Retrofit/upgrades to current engines	Low	High	▪ Increased public/private R&D funding for technology development ▪ Tax credits and subsidies to promote implementation of new fuel efficient aircraft designs ▪ Market based incentives to accelerate fleet turnover (e.g. wracking bonus) ▪ Increased public/private R&D funding for technology development ▪ Tax credits and subsidies to promote implementation of next-generation engine technologies
Sustainable fuels	▪ Development and deployment of second generation bio-fuels (e.g. Algae, Jatropha)	High	Medium	▪ Setting appropriate market incentives to promote production and adoption of second generation biofuels ▪ Recognition and inclusion of second-generation biofuels in the carbon credit market
Operations	▪ Optimizing cost index for flight path calcs ▪ Use of ground power instead of APU ▪ Use of fuel cells for on-board energy supply ▪ Taxiing with some engines shut down ▪ Cabin weight reductions ▪ Enhanced Pilot Technique ▪ Efficient Takeoff and Landing Procedures ▪ Center of Gravity optimization ▪ No fuel tankering ▪ Reduced speed operation with current aircraft	Medium	Low	▪ Fuel price already creates financial incentive ▪ Best practice sharing across industry can help bridge information gap (IATA 'Green Teams' provide this service)
Infrastructure	▪ US ATM Improvements ('Next Gen') ▪European ATM Improvements ▪Flexible flight tracks across North Pacific ▪Reduced Vertical Separation Minima in China ▪Reduced Vertical Separation Minima in Russia ▪Pearl River Delta airspace improvements ▪Airspace China redesign ▪Flexible Usage of Military airspace ▪Gulf region airspace enhancements	Medium	Low	▪ Political impetus to accelerate airspace enhancement projects. ▪ Information campaign about potential benefits of implementing these levers to bring public pressure to bear

1) CO_2 saving from industry baseline by 2035; Low 0-3%, Med 3-7%, High >7%
2) EUR per tonne CO_2 reduction net of fuel savings; Low <20, Medium 20-100, High >100
Source: IATA, ATAG, ICAO, Industry Partners, Booz & Company analysis

The following promising air transport cluster-specific emissions mitigation measures were identified during multi-stakeholder meetings as they require urgent attention of policy makers to accelerate their deployment in the T&T sector.

(A) Acceleration of fleet renewal with more fuel efficient planes

The average service-life of an aircraft is based on its type-specific retirement (survivor) curves which takes into account number of pressurization cycles (take-offs and landings), length of cruise mission, and other critical variables. Currently, the average age of the world fleet (including both passenger and freighter) is around 13 years. However, a plane remains in service much longer and more than 11.2% of the current world fleet (2000 aircrafts) are more than 25 years old [28]. Accelerating the fleet replacement would mean that lower percentages of the older planes will remain in service and can be an effective and pragmatic way to reduce emissions in the aviation sector. Retiring planes 16% faster than the normal rate would require an additional investment of $114 billion and result in annual abatement of 16 $MtCO_2$ by 2030.

Note that decisions on aircraft fleet renewal and respective investments are taken as part of the long-term fleet and network planning of airlines, which is in itself a very complex and strategic process, often determining the long term success of an airline. As the airline industry's profits have been under severe strain for many years, the current economic downturn will likely further exacerbate the challenges in securing funds for fleet renewal. Therefore, the airline industry will require special incentives and support for financing.

Currently, the aircraft maintenance and refurbishment companies undertake the recycling of planes, and must be more closely engaged while launching this initiative to ensure sufficient recycling/waste management capacity. Airline fleet renewal will have an additional positive environmental benefit when a comprehensive strategy is developed to manage waste from discarding old planes. Several of the basic aircraft materials (e.g. metals, plastics, wires, glass) and serviceable parts can be recycled and used in aviation or other industries. The benefit of supplying these materials at lower environmental cost should be factored in the overall business case for fleet renewal. The recent PAMELA project undertaken by Airbus to develop and implement environmental best practices for decommissioning and dismantling aircraft has demonstrated that up to 85% of an aircraft (in weight) can be recycled or re-used.

Implication for policy makers:

- **Accelerate replacement of old aircrafts with more fuel efficient planes through appropriate market-based incentives that take into account the process and decision criteria of airlines when making capacity decisions.** A “wrecking bonus” i.e. an incentive or payment to airlines to take out old aircrafts (e.g. >15years old), and to disassemble/ recycle those aircrafts should be explored. In addition, developing a favorable accelerated depreciation tax regime will provide additional benefits to airlines to replace fuel inefficient planes.
- **Earmark a portion of funds collected from fiscal or economic measures (e.g. ETS funds, Carbon taxes) to finance the fleet renewal.** This will ensure that the money raised from ETS is re-invested to drive sustainability within the aviation sector.

(B) Reduce infrastructure inefficiencies in airspace management

Improvements in air-traffic management present a major opportunity for fuel and CO_2 reductions in the near term in the aviation sector. By addressing airspace inefficiencies, governments and infrastructure providers could eliminate 8% to 12% of CO_2 emissions from aviation, according to the Inter-government Panel on Climate Change (IPCC).

Historically, one of the challenges in achieving a unified air-space has been the lack of a common political will to develop a coordinated approach. Hence, the implementation of the Single European Sky and the US NextGen Air Transport System should be the top priority for the progressive harmonization of global airspace management [29]. Flexible airspace access must also become a reality, especially in Asia where traffic growth is particularly strong. Moreover, re-allocation of airspace from military to civil purposes should be considered to increase capacity for civil services. The upgrade of existing infrastructures combined with next generation of air traffic management technologies and processes should be accelerated (e.g. European SESAR program). It is also important to realize that some of the major airports are capacity constrained which leads to higher emissions (e.g. due to longer holding patterns in air), and it can become an even worse bottleneck in future.

Implications for policy makers:

- **Adopt national and regional policies to reduce airspace inefficiencies by half over the next five years**, thereby saving 40 $MtCO_2$ emissions per year [30]. It will require progressive and coordinated political action across nations, and re-allocation of airspace for military and civilian purposes.
- **Implement performance based navigation systems (e.g. ICAO’s Global Air Navigation Plan)** at the regional level and prioritize the development of regional action plans to eliminate inefficiencies and harmonize global airspace management.

(C) Global climate agreement on international aviation emissions

There is a general agreement within the aviation sector that the most effective way to reduce emissions directly associated with commercial aviation is through the implementation of technological, operational and infrastructure modernization measures to increase fuel efficiency within the industry.

The use of market based mechanisms help to drive the economics of abatement measure implementation, but there is concern that, economic measures, if not properly designed, may impede the sector’s efforts to reduce emissions. Properly designed economic measures for aviation (e.g. emissions trading, carbon taxes, or other similar mechanisms) should be cost-effective and non-discriminatory, implemented at a global level, and provide full and open access to a global carbon market. A critical criteria for an effective economic measure is to ensure that the sector operators be charged only once for the emissions independent of where the emissions occur (international or domestic flight).

The global aviation industry has responded less enthusiastically to the legislation to include aviation emissions (from all flights starting and landing in the EU) into the EU ETS from 2012, since a regional implementation of aviation ETS creates competitive distortions on a global level, and may result in 'carbon leakage' (i.e. overall emissions continue to grow as operations move to other regions). In addition, several countries are unilaterally making policy decisions to constrain aviation sector emissions, such as expensive departure duty taxes levied on air passengers traveling from UK airports and the recently rescinded tax at Amsterdam Schiphol airport.

One of the drivers for proliferation of several national and regional policies directed at limiting aviation emissions is the exclusion of international aviation emissions in the Kyoto climate treaty targets. However, in December 2009 governments will meet again in Copenhagen to agree on the new international post-Kyoto climate treaty (the Kyoto treaty expires in 2012). At that conference, **international aviation must be integrated in the post-Kyoto climate change agreement at a global sector level to avoid patchwork of conflicting national and regional policies** [31].

Achieving an international aviation agreement would require progressive political leadership and a willingness to consider innovative solutions. Any global aviation climate deal has to consider the following key principles to work effectively:

(1) **A reconciliation of the following ICAO & UNFCCC principles is required** The fair and equitable treatment of all airlines around the world in accordance with the Chicago convention on International Civil Aviation; and the UNFCCC principle of common but differentiated responsibilities amongst countries which subjects developing countries to less stringent targets as compared to developed countries. ICAO's GIACC process is working towards resolving this conflict. Its mandate is to recommend an aggressive ICAO action program on international aviation and climate change, in preparation for the United Nations Framework Convention on Climate Change (UNFCCC) Copenhagen meeting in December 2009.

(2) **Access to and stability in market based mechanisms** ***(***also known as 'flexible mechanisms') developed under the successor Kyoto treaty, such as the Clean Development Mechanism (CDM), Joint Implementation (JI) and Emissions Trading. Recognizing legitimate aviation projects under the CDM scheme would integrate the aviation sector into global carbon markets and provide an important funding mechanism to implement promising emissions reduction projects in the aviation sector of developing countries (e.g. better air traffic management systems, ground operations improvement at airports). To the extent economic measures are employed, governments should ensure that the carbon markets are appropriately regulated and that price ceilings are imposed so industries may make their emissions-reducing investment within reasonably stable carbon market conditions, while being mindful that the stability of the oil market is closely interrelated.

(3) **Earmarking a portion of funds collected from fiscal or economic measures (e.g. ETS, carbon taxes, offsets) to be invested back in the aviation,** and the broader Travel and Tourism sector. This can provide much needed project funding for promising sustainable T&T initiatives especially in the developing countries (e.g. airport infrastructure improvement, R&D for next generation aircraft technologies, and low carbon sustainable aviation fuels development and production). Earmarking such funds for investment in the T&T sector will lower carbon abatement costs for Travel and Tourism. This reinforcing positive feedback mechanism will provide appropriate incentives for the aviation industry to be involved in ETS, especially in the developing countries.

Implications for policy makers:

- **Integrate international aviation in the post-Kyoto climate change agreement at a global sector level** to avoid a patchwork of conflicting national and regional policies. The key challenge would be to generate consensus on emissions compliance requirements for developed and developing countries.
- **Integrate the aviation sector in the global carbon credits market**, providing access to market-based mechanisms, such as CDM/JI, under the Kyoto treaty. This will foster innovation and provide much needed funding for promising aviation sustainability initiatives in the developing countries.
- **Earmark funds from fiscal and economic measures (e.g. ETS funds, carbon taxes) for reinvestment in the air transport cluster** to lower the emissions abatement costs.

(D) R&D Innovation to develop new long-term technology options which could further reduce emissions

The aviation sector has an impressive track record in technological innovation. In fact, the air transport cluster has improved fuel efficiency by 70% per passenger km over the past forty years [32]. Technological innovation can deliver significant long term improvements (beyond 2020) in airframes, engines, and alternative fuels.

Some of the post-2020 technologies are radically new airframe and engine concepts that diverge significantly from the current conventional tube and wing configurations and classical ("Brayton cycle") gas turbine engines. These concepts could lead to a completely different technology development curve, and as such may provide even greater emissions saving potential in the future. The most significant aircraft efficiency gains are expected from new engine system architectures, and airframe technologies (see Figure 13). Most of the technologies are not very mature yet, so they could take more than two decades to be implemented on commercial aircraft. As a result, further investigation is needed to quantify the benefits and drawbacks. Significant investments in research and development is needed to commercialize these technologies beyond 2020[33].

Figure 13: Technologies applicable to new aircraft designs after 2020

Area	Technologies	Fuel Burn Reduction [1]
▪ Airframe Technologies	▪ Hybrid-wing-body ▪ Truss-braced wing ▪ Morphing airframe ▪ Solid Oxide Fuel Cell (SOFC) ▪ Wireless Flight Control Systems (WFCS)	▪ 10-25% ▪ 10-15% ▪ 5 -10% ▪ 1-5% ▪ 1-3%
▪ Engine Technologies	▪ Advanced core (3rd GEN) ▪ Adaptive/active flow control ▪ Variable cycle (2nd GEN) ▪ Ubiquitous composites (2nd GEN) ▪ Pulse Detonation	▪ 15-25% ▪ 10-20% ▪ 10-20% ▪ 10-15% ▪ 5-15%
▪ Alternative Fuels[2]	▪ Liquid Hydrogen	▪ Negative to 100%

1) Fuel burn reduction is based on a 120-passenger aircraft with an approximate take-off weight of 600 Tons & fuel capacity of 24k litres

2) The CO2 benefits of alternative fuels are considering the entire fuel life cycle. Negative CO2 reduction values can occur if during the lifecycle of the fuel net CO_2 emissions are higher than for current kerosene.

Source: The IATA Technology Roadmap Report, December 2008

5.1.3 Water Transport (Cruise ships) Cluster

Emissions mitigation options for the water transport cluster are categorized in two main dimensions: 1) operation and technical measures to reduce energy use; and 2) change of energy source to power cruise lines:

Key CO_2 abatement options for Cruise/Passenger ferries

Emissions Reduction Levers		Abatement Measure	Abatement Potential [1]	Abatement costs [2]	Which policy measures or market mechanisms can increase the adoption of emissions abatement options?
	Operational & Technical measures to Reduce Energy Use	Route optimization	Medium	Low	▪ Tax deduction for energy efficient investments ▪ Mandatory measures & regulation e.g. limitations on ship emissions or emissions trading scheme ▪ Use of GPS based navigation systems to optimize routing
		Cruise ship energy efficiency improvement (e.g. efficient lighting, HVC systems)	Medium	Low	
		Engine efficiency improvements (e.g. fuel injection, compression, turbo charger)	Medium	Medium	
		Machine condition / efficiency monitoring	Low	Medium	
	Change in Energy Source	Marine Diesel Oil (MDO) instead of Heavy Fuel Oil (HFO)	Medium	Medium	▪ Reduced excise-tax on low emission fuels ▪ Tax deduction for energy efficient investments ▪ Subsidies on energy efficient appliances (e.g. solar panels)
		Liquefied Natural Gas instead of MDO	Medium	High	
		Gas Piston Engines (Switching from Diesel to Natural Gas)	High	High	
		Fuel cell for auxiliary engine	Medium	High	
		Fuel cell for auxiliary and propulsion engine	High	High	
		Solar panels for auxiliary engines	High	High	

1) % CO_2 reduction per cruise ship when a single measure is implemented for a vehicle: Low 0-3 %, Medium 3-7 %, High >7%
Whenever a group of measures is implemented single abatement potentials might not add-up due to interdependencies
2) € per tonne CO_2 reduction: Low <20, Medium 20-100, High >100
3) Penetration in cruise ship industry: Low < 10%, Medium 10%-40%, High >40%
Source: Interview with shipping experts, Industry Partners, Booz & Company analysis

Emission abatement gains in the cruise industry will chiefly come from leveraging carbon reduction strategies developed by logistics and shipping companies *(for a detailed discussion of these potential emissions abatement practices, see Section 5.2.3).*

5.1.4 Accommodation Cluster

The accommodation cluster is highly fragmented with ~80% of global capacity managed by independent small-medium enterprises (SMEs) or single building operations. Accommodation real estate owners are typically different from those managing operations and leasing hotel properties. Hence, the degree of (global) organization of the accommodation cluster is relatively low compared to the airline sector and that has led to a nearly complete lack of globally accepted standards and agreed-upon emission targets or metrics to measure sustainability improvements. Without globally agreed sustainability benchmarks hotels are ill-equipped to use carbon reduction as a differentiation strategy or for competitive advantage [34].

Despite these limitations, a series of promising abatement options for the accommodation cluster have been identified, including operational and technical measure to reduce energy use; changes in energy sources; and changes in consumer behavior *(see Table: Key CO_2 Abatement Options for Accommodation)*.

Key CO_2 abatement options for Accommodation

Emissions Reduction Levers		Abatement Measure	Abatement Potential [1]	Abatement costs [2]	Which policy measures or market mechanisms can increase the adoption of emissions abatement options?
Supply	Operational & Technical measures to reduce energy use	Insulation (e.g. wall, solar films in windows)	High	Medium	▪ Tax deductions for, – energy efficient investments, or – eco-labels or third party certifications ▪ Subsidies on energy efficient appliances ▪ Mandatory measures, e.g. – Stringent building codes – Obligation on energy efficiency certificates ▪ Proactive role of governments in providing information and tools for energy management (e.g. European Commission providing free of charge Hotel Energy Management Software) ▪ Adoption of sustainability measurement initiatives such as Global Sustainable Tourism Criteria directed at accommodation sector
		Standard operating procedures to decrease energy use by employees	High	Low	
		Building Energy Management System	Medium	High	
		Motion detectors / sensors	Medium	Medium	
		Efficient lighting, appliances & office equipment	High	Medium	
		Change in room temperature (1ºC)	Medium	Low	
		Building design for new buildings	High	Low	
	Change in Energy Source	Solar Thermal (water heating)	High	High	
		Solar PV (electricity)	Medium	High	
		Biomass / Bio-fuel	High	Medium	
		Combined Heat Power (CHP) & Tri-Generation	High	Medium	
		Sourcing Green Electricity	High	Low	▪ Cooperative sourcing of Green Energy by industry
Demand	Change in Consumer Behavior	Increased energy awareness	High	Low	▪ Government campaigns on energy awareness ▪ Incentives for tour operators offering Green tourism
		Incentives for customers that use less than average energy (e.g. Eco-lodges)	High	High	▪ Tax deduction for investments in energy tracking systems

1) Abatement potential (i.e. % CO_2 reduction per hotel) whenever a single measure is implemented at hotel level: Low 0-3 %, Medium 3-7 %, High >7%.
Carbon abatement potential from various measures is not cumulative due to interdependencies
2) € per tonne CO_2 reduction: Low <20, Medium 20-100, High >100
Source: IH&RA, UNWTO, Industry Partners, Booz & Company analysis

The following promising accommodation cluster-specific emissions mitigation measures were identified during multi-stakeholder meetings as they require urgent attention of policy makers to accelerate their deployment in the T&T sector.

(A) Acceleration of hotel refurbishment

The accommodation cluster is responsible for significant environmental impact in areas like green house gas emissions, water and land-use, and impact on biodiversity. The need to improve service quality and remain competitive mandates that hotel building and installations are maintained to the highest standards. However, because of the high cost of HVAC (heating, ventilation, and air-conditioning) and of building renewals (like window replacement), hotels are typically refurbished only every 20 to 30 years. Thus accelerating the refurbishment of existing hotels can be a promising opportunity to significantly reduce emissions in the Accommodation cluster [35]. As SMEs typically have little access to capital to continuously upgrade or refurbish their facilities policy makers will have to develop new programs and incentives to accelerate the deployment of sustainability investments in the Accommodation cluster.

Implications for policy makers:

- **Develop new global build guidelines or adapt existing ones** – No single global building standard such as LEED, European Energy Passport, etc would seamlessly fit the hospitality sector. It is therefore preferable to adapt existing ones (i.e. ITP Environmental Management Guidelines and ITP Sustainable Siting, Design and Construction Guidelines) to incorporate regional variations reflecting reflect different climatic zones. In addition, these guidelines should be easily implemented, especially by SMEs, and access costs should be minimal.

- **Define which international organization (e.g. WTTC, UNWTO or ITP) should take the lead** to globally adapt existing build guidelines and to establish metrics for the Accommodation cluster – The global build guidelines should aim to draw on existing initiatives, and incorporate regional variations. Moreover, setting basic energy efficiency parameters for buildings, and voluntary schemes such as eco-labels can play a significant role in accelerating refurbishment of hotels.
- **Consider further incentives to promote energy efficiency** – Support the highest degree of energy efficient heating, cooling, lighting and building technology **through appropriate incentives to the hospitality sector** and accommodation builders; for example, tax deductions or accelerated depreciation of investments in energy efficient technologies or mandatory energy efficiency certificates. In order to ensure the wide-spread adoption of sustainability practices by SME, there should be special incentives which would allow SMEs to refurbish or retrofit their properties.
- **Remove market barriers by aligning incentives** in Accommodation cluster – Real estate owners are typically not the same groups that manage hotel operations and lease hotel properties. Hence, they have little incentive to make energy efficient investments since the benefits in terms of lower energy bills accrue mostly to hotel operators.
- **Ensure that sustainable hotel management education** is an essential part of the accommodation cluster education and school curriculum.

5.2 Most promising cross-sector emissions mitigation measures

There is an emerging need to form cross-sector partnerships in the Travel and Tourism sector to stimulate innovation. This is driven by several external drivers such as increasingly stringent carbon regulations with major cost impacts on the industry, energy price volatility, energy security, and growing pressure from consumers and investors for environmentally sustainable practices. The cross-sector emissions mitigation measures focus on emissions reduction opportunities that require collaboration between two or more clusters within the T&T sector (e.g. railways and air transport), or collaboration with other sectors beyond T&T (e.g. partnership between the energy sector and the Accommodation cluster on renewable energies). Several promising cross-sector opportunities to accelerate the deployment of emissions reduction measures were identified through multi-stakeholder workshops and dialogue with major industries throughout 2008 and 2009. The most promising opportunities are:

5.2.1 Low carbon sustainable fuels for the aviation sector

The aviation sector is actively looking at low carbon sustainable fuels (e.g. next-generation biofuels) to significantly reduce its impact on climate change. In the short to medium term the aviation sector relies on next-generation biofuels as the only viable alternative energy source; by contrast, land transport has several other options, like fuel cells and electric cars. The true environmental benefit of sustainable fuels lies in its lower carbon impact under life-cycle considerations as compared to conventional kerosene-based jet fuel. While CO_2 emissions from combustion are offset by those absorbed in the growing of feedstocks, there can be significant emissions associated with farming (particularly the direct and indirect land use changes, the mechanization and the use of fertilizers), production and transportation of biofuels.[36] Lower life-cycle carbon emissions impact (than conventional jet fuel) is an important sustainability requirement for low carbon sustainable fuels to be widely adopted by the air transport cluster.

For instance, next-generation aviation biofuels (e.g. Jatropha & Algae) have three substantial advantages over earlier attempts to replace traditional jet fuel and these technologies warrant further exploration:

- Next-generation aviation biofuels do not compete with conventional food crops for land use and water resources when arable land is not used for their cultivation.
- Airline/aircraft manufacturer tests have found that no significant aircraft engine modification is required to use next-generation biofuels due to their comparable energy density to kerosene jet fuel. Hence, several aviation companies (e.g. Air New Zealand, Rolls-Royce, Airbus and Boeing) are collaborating with the energy sector to speed up the development of biofuels.
- Significantly greater amounts of aviation fuel are produced by processing feedstock from next-generation biofuels as compared to the first generation, which translates into lower land/water usage requirements.

However, several challenges need to be overcome before these biofuels can become “mainstream” aviation fuel:

1. **Limited large scale commercialization of cultivation and manufacturing** – Currently there is scant understanding of cultivation and manufacturing processes to standardize oil yields and to produce fuel reliably on a large scale. The manufacturing technology is still in its infancy. For example, suppliers of next-generation biofuels are primarily small companies, and hence lack in capital and other resources to rapidly develop cost effective biomass-to-kerosene conversion technologies. In addition, there are concerns about the availability of biofuels feedstock.
2. **Higher processing costs compared to conventional jet fuel**: For next-generation biofuels to be widely adopted by the aviation industry, substantial production cost reductions are required (at the right specs). The expense of extracting and manufacturing kerosene from algae is still several orders of magnitude (4-7 times) higher than conventional jet fuel. Significant R&D investments would be needed to develop advanced and cost-effective manufacturing technologies.
3. **Few market incentives**: The producers of next-generation biofuels may find **other more lucrative markets for biofuels than the relatively small jet aviation industry** (e.g. energy sector, ground transport). Similarly, the large energy producers have not actively pursued biofuels for the aviation sector due to the relatively low profits they would earn from this sector.
4. The cultivation of biofuel crops may impact global agriculture output (e.g. through competition with food crops for arable land) and may lead to increased deforestation with concomitant CO_2 releases.

Implications for policy makers:

- **Set appropriate market incentives** to foster the adoption and technological exploration of next-generation biofuels by fuel producers and the energy sector. Given the above mentioned structural constraints, the adoption of biofuels in the aviation sector may remain relatively meager in the short to medium term without market incentives. These incentives could be investment incentives for energy companies to manufacture aviation biofuels and favorable tax regimes for customers who buy such fuels. Provision of such incentives should be closely linked with the application of sustainability criteria.
- **Foster and support cross-sector (private or public-private) partnerships to accelerate R&D** and technological exploration for large scale commercialization.
- **Recognize and include sustainable fuel (e.g. next-generation biofuels) projects in the carbon credit market** to attract private capital for R&D and the manufacturing of aviation biofuels.
- **Develop international trade regimes to enable seamless flow of next-generation biofuel feedstock** from developing countries (e.g. India, China, and Africa) to Western Europe and United States.
- **Create a simplified but verifiable certification approach for low carbon sustainable fuels by aviation authorities** to accelerate the introduction of new fuels and to lower the risk for suppliers.

5.2.2 Accelerated deployment of renewable energies in accommodation cluster

Accommodation owners and managers have recognized the need for change and have already made certain improvements in deploying environmentally sustainable measures in hotels. So far, these initiatives have been adopted by only a relatively small proportion of players (often large hotel chains or big tour operators) and have typically addressed only a small portion of the myriad measures available to significantly reduce emissions by, for example, more than 50% – such as, sensor based lightning, room-key activated central power switches, efficient HVC systems and BMS control tools, etc. Due to the highly disbursed nature of the sector (see Chapter 5.1.4) initiatives are less coordinated and very heterogeneous.

More drastic reduction in accommodation emissions will require large scale deployment of renewable energies alongside the adoption of low-emission building technology. Any renewable energy technology must meet efficiency criteria and the high service-level requirements of the hospitality sector, which requires a reliable and continuous source of power. While on-site solar energy harvesting is a promising alternative power and heat source in most parts of the world, wind energy is more difficult to apply on-site. Geothermal energy and fuel cells seem to be also promising technologies – fuel cells in particular as they can simultaneously produce electricity, heating and cooling. However, to implement these alternative energy approaches, investments are extremely high and the pay-back time is still 20+ years. Despite that, national stimulus packages like the German renewable energy law combined with tax incentives to foster innovation, production and usage of these technologies have led to a modicum of innovation and adoption even in private properties.

A large scale development and implementation of effective renewable energy solutions will likely require the formation of new, **primarily regional partnerships** between local communities, the travel and tourism sector (accommodation/real estate owners, hotel managers, airport building operators etc.), energy companies and utility suppliers to drive sustainability initiatives. These initiatives could include:

- ***Deployment of highly efficient electricity networks*** with less CO_2 intensive electricity production (e.g. high mix of solar, geothermal, wind) with "next generation" electricity management principles, including smart grid technology, special meters, utilization-based pricing and yield management. Electricity-based ground transport systems could be considered as an integral part of a redesign of the electricity production system. A combined car/energy supply system would create additional benefits for a shared green electricity infrastructure.
- ***Blended heat and power generation (CHP***), in which the excess heat (by-product) from power generation is used for heating purposes.

Initiatives to improve the sustainability of local heating, cooling, and electricity infrastructures are of course destination specific and the benefit of these initiatives will be shared with the entire local community. Hence, in many destinations (e.g. industrial areas, metropolis) the local community has to be the driver of these initiatives while T&T related buildings like hotels, airports, or tourism event areas (e.g. amusements parks) will benefit from these initiatives. On the contrary, in those destinations where T&T is the major driver of local employment and business activity, the T&T sector has to take the lead to initiate and drive cross-sector sustainability initiatives.

In order to increase the adoption of renewable energies, the T&T sector should be given incentives at the local and international level to invest in renewable energies – among them, tax exemptions on capital expenditures, similar to incentives offered to private home owners, hospitals and government buildings.

Implications for policy makers:

- **Local/regional governments should play a pro-active role in creating incentives to promote adoption of renewable energies and to foster local/regional collaborative sourcing of renewable energies between the T&T sector, real-estate, and energy/utility companies**. For example, in tourism destinations local government may take the initiative to create appropriate incentives to develop the process between the Travel and Tourism sector and other required parties to set-up renewable energy plants. Local and national laws and guidelines have to be adopted accordingly.
- **A vibrant international debate is required to determine how** regulatory laws could set the right incentives to create a positive business case for the deployment of renewable energies.

5.2.3 Improvements in cruise/ferry ship fuel efficiency by building on the decarbonization strategy of logistics and cargo shipping industry

Although cruise/ferry industry is a small contributor to the T&T sector carbon footprint, it is the most carbon intense way to travel per passenger km and per guest night. In cruise lines, the potential to reduce carbon emissions varies significantly between old ships and new ships. According to IPCC, the potential of technical measures to reduce CO_2 emissions are estimated at 5% to 30% in new ships and 4% to 20% in old ships [37]. However, the vast majority of ocean-going cruise ships have diesel engines, with a typical service life of 30 years or more. It will therefore be a long time before technical measures can be implemented on a significant scale across the cruise industry. This implies that operational emissions abatement measures, such as load optimization, speed reduction, maintenance, route and fleet planning, on existing ships would be critical to achieve short-to-medium term emissions reductions. In addition, structural modifications and enhancements also generate energy savings. For example, new optimized hull shapes and advanced propulsion systems can save up to 8% of energy usage versus conventional systems, and the latest technology for hull coatings can save as much as 5% of fuel usage for propulsion [38].

A significant shift from a primarily diesel-only fleet to a fleet that uses alternative fuels and energy sources cannot be expected until 2020, as most of the promising alternatives are not yet tested to the extent that they can compete with diesel engines [39]. However, switching from diesel to natural gas has the potential to cut CO_2 output by 20% and is being pursued as a promising opportunity in Norway for inland ferries and offshore supply vessels. Another benefit of switching to natural gas is reduction in SOx and NOx emissions from vessels in the vicinity of ports. The key obstacle to large scale implementation is access to LNG (Liquefied Natural Gas) and high investment and operating cost as compared to traditional diesel fuel.

More than 90% of maritime traffic is driven by logistics and cargo demands. As a result, the cruise/ferry industry should develop its decarbonization strategy based on innovations in the cargo shipping industry and policy makers should encourage collaboration between these two industries.

Implications for policy makers:

- **Retro-fit existing ships with better hull and propeller designs**, and other energy efficient technologies (e.g. efficient room lighting in cruise liners). There is potential synergy with the accommodation cluster in implementing similar energy efficient solutions; for example optimization of HVAC systems. After all, a cruise liner is merely a floating hotel).
- **Promote R&D innovation** by fostering collaboration between energy companies and cruise liners to explore the possibility of using alternative fuels (e.g. fuel cells for on-board energy needs, large scale deployment of LNG).
- **Create educational campaigns directed at both passengers and crew** to optimize the on-board energy consumption.
- **Upgrade port infrastructure to higher sustainability standards** and for the delivery of renewable energy supplies to major world ports.

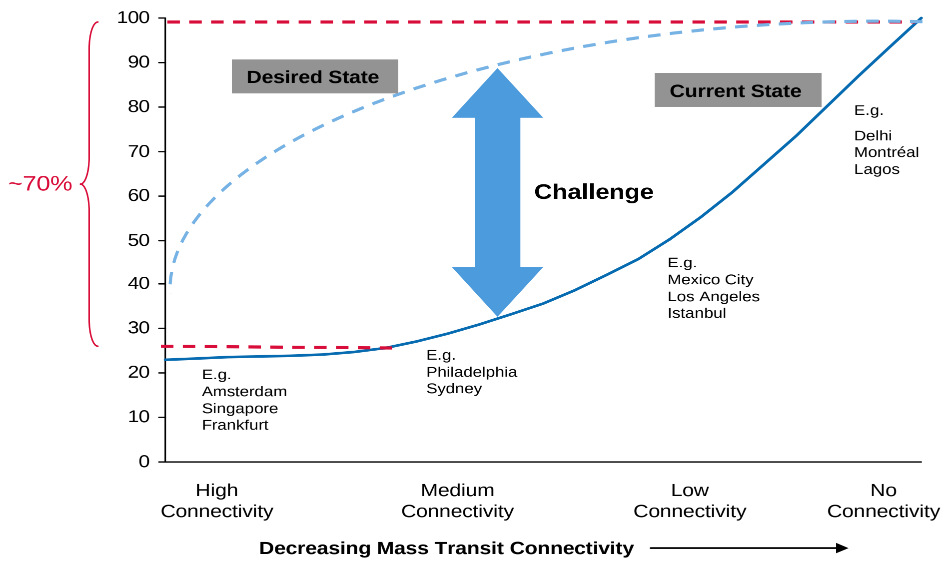
5.2.4 Removal of mass-transit inefficiencies by integrating railway infrastructure and air transport

Traditionally, railways and air transport have been viewed as independent modes of transportation with little commonality and possibility of cooperation. However, railways infrastructure in general and high speed trains in particular can play an important role in the broader air transport network and lead to benefits in overall CO_2 emissions reduction. The integration between railways and air transport can exist at two levels [40].

The first level of cooperation is the use of railways as **the primary means of transport to access airports in large metropolitan cities**. The advantage of using railways is twofold. First, it is a reliable mode of transportation with high capacity (the mass-transit connectivity of major world airports with the city centers is abysmally low) and secondly, it reduces road congestion and air pollution around the airport, when railways substitute for personal cars and taxis. About 70% of the world's 100 largest cities lack or have only limited mass transit links between airports and downtown *(see Figure 15)*.

Figure 15: Airport to City Centre Mass Transit Connectivity

100 largest cities worldwide(1)



1) Based on population size
Source: UN, World Airport Guide, Booz & Company analysis

Developing countries are particularly in need of mass transit systems to connect airports to urban city centers, where population and tourism traffic is expected to significantly increase in the next 15-20 years. As developing countries construct new airports, careful urban planning is critical to ensure strong railway connectivity to airports. One of the key success factors that drive usage of railways as a preferred means to access airports is co-location of railway stations and airports to enable fast and seamless transfer from the train to the plane and vice-versa.

The second level of cooperation is integration of railways into the broader air transport network i.e. viewing railways not just as a means to provide access to airports but as an integral part of extended air transport network. In such an integrated model, the distinction between railways and air transport disappear, as they together provide a complete transport service [41]. For example, with the advent of high speed trains, airlines can offer rail as an alternative mode of transportation from main (hub) airports to nearby destinations. Several progressive airlines and railway companies, especially in Europe, have formed joint ventures to fully leverage the potential of railways and airline integration[42]. The environmental benefit of modal shift from air transport to rails is highly dependent on the energy mix for power generation and passenger load factors. Hence, decarbonization of the power generation infrastructure is critical for a long term carbon neutral rail industry.

Both railways and airlines could benefit from such an integrated model. Airlines benefit from the release of valuable slots (and aircraft) from their short haul operations and less congested airports [43]. The rail operators benefit from higher load factors at marginal cost (i.e. less dependence on public money) and the potential to increase service frequency to cater to new demand. These benefits can be realized only when railways and air transport networks are fully integrated including coordinated time tables, common reservation and ticketing systems, and seamless transfer of luggage from the origin to final destination. In terms of infrastructure planning, it is important to locate airports on the main railway lines radiating from the city center. This ensures that there is not only an efficient airport-city center connection but also that airport is well connected to the rest of the railway network and neighboring cities (e.g. Amsterdam Schiphol airport, Frankfurt, and Paris Charles De Gaulle airport).

Implication for policy makers:

- **Foster mass-transit connectivity between major city centers and hub airports through dedicated railway lines** to substitute for the personal cars and taxis.
- **Transport policy at the national/regional level should encourage green railway infra- structure in general and high speed trains in particular as an opportunity to complement air transport networks**, especially for short-medium haul destinations (< 800 km) from the main (hub) airports. Driving integration of transport infrastructures will help achieve socio-economic benefits and reduced environmental costs. A critical success factor would be **infrastructure planning of the national and regional railways network to ensure that airports are located on the main railway lines** radiating from nearby city center.
- **Setting appropriate market incentives** is essential to encourage the modal shift from personal cars and taxis to railways as a preferred mode of access to the airports.
- **Share global best practices to develop a more sustainable and carbon neutral railway infrastructure** by considering the life-cycle emissions impact.

5.2.5 Development of "sustainability standards and metrics" in the T&T sector

Currently, several sustainability benchmarking standards exist but as yet there is no credible and globally agreed way to fairly compare the sustainability performance of various players in the tourism industry. The proliferation of benchmarks is mainly driven by several national, private and regional efforts to develop their own sustainability benchmarks. Thus, the development of common standards, metrics and methodologies to measure and report carbon emissions in the Travel and Tourism value chain (airlines, hotels, cruise ships, etc.) is a critical success factor to drive and measure the success of emissions reduction initiatives. Development of common standards should be based on the existing promising initiatives with the T&T sector; for example, the Global Sustainable Tourism Criteria (GSTC) has been developed in consultations with international organizations (UN Foundation, UNWTO, UNEP, Rainforest Alliance, IUCN, Federation of Tour Operators, and Sustainable Tourism International) over a period of over two years, and was launched in October 2008 [44].

The lack of a common global standard makes it also difficult for consumers making travel decisions (either for leisure or business) to make educated choices based on the sustainability of different suppliers and travel products, such as different modes of transportation or different types of accommodation. Simultaneously, it is almost impossible for innovative suppliers to leverage sustainability as a competitive advantage. Thus, common sustainability standards will provide a strong foundation to objectively compare individual suppliers and products, ensuring that future environmental regulations and also customer decisions appropriately penalize lagging companies.

Implications for policy makers:

- Enable the global **harmonization of national standards by appropriate global actions** e.g. adoption of Global Sustainable Tourism Criteria (GSTC). The partnership of the GSTC is working together with other key stakeholders toward the creation of a Sustainable Tourism Stewardship Council, which would function as the guardian and developer of global standards and as an accreditation body for the existing certification systems. There is a need for the development of globally recognized standards for the T&T sector including "tourism services" (e.g. travel intermediaries/agencies and tour operators, hotels, recreational services). The global standard should aim to harmonize the existing sustainability standards such as the European Committee for Standardization (Comité Européen de Normalisation – CEN), European Eco-Label for Tourist Accommodation Services, Green Tourism Business Scheme (GTBS), International Tourism Partnership (ITP), ISO 14001, Travelife Sustainability System and Green Globe. These eco-standards should be transparent and objective, easily measurable, and should account for regional differences [45].
- **Explore possibility of using the grading schemes** (both statutory and proprietary) for integrating environmental management standards in the criteria. Establishing a global sustainability standard for the T&T sector (e.g. "Basic"/"Gold" Standards) will ensure that early adopters can differentiate on sustainability in the market-place.

5.2.6 Funding options for the travel and tourism sustainability projects

The access to private and public capital is critical to create the transformational change required to develop sustainable Travel and Tourism sector. The development and deployment of environmentally sound technologies across the T&T sector will require massive private and public investment. For example, commercialization of sustainable biofuels in the aviation sector would entail an investment of $300 billion, which would reduce aviation carbon emissions by 9% (117 MtCO_2) by 2030 [46]. In the accommodation cluster, IPCC estimates that 29% of emissions can be reduced cost-effectively (i.e. the investment pays for itself through life cycle energy savings) through the implementation of energy efficient solutions and an additional investment of $300 million would be needed to reduce emissions by 3% (14 MtCO_2) by 2020 [47]. In the cruise industry, 15% to 20% of the emissions can be eliminated cost-effectively by 2020, and an additional 10% emissions reduction (6 MtCO_2) by 2020 would require $430 million of investment (at an average abatement cost of $75 per ton of CO_2) [48]. Since several tourism destinations are developing countries and small island states, they would need special financial support to implement T&T sustainability projects. Even in the current economic situation when capital flow is severely restricted, the T&T sector can leverage three funding options to finance the sustainability projects:

1) ***Funding by Private Capital***
2) ***Funding by Non-Profit Organizations***
3) ***Public funding***

1) ***Funding by Private Capital:*** The first option for funding is to attract private capital (e.g. venture capital, private equity) to invest in sustainable T&T projects by creating special financial incentives and by ensuring sufficient/attractive financial returns. Currently, private investments are limited in the high-impact sustainable T&T projects due to insecure or lower financial returns and high risks (e.g. cultivation of next-generation biofuels, R&D investment to develop next-generation biomass-to-kerosene conversion technologies, etc). **However, creating special incentives** – such as tax exemptions for capital investments in energy efficient technologies, allowing the sale of carbon credits from sustainability projects in the aviation sector – **will prioritize the investments of commercial investors towards T&T sustainability projects**.

2) ***Funding Non-Profit Organisations:*** The second source of funding is to participate in or even to establish “non-profit” foundations (e.g. T&T Green Foundation) that amass endowments from the private sector, consumers, civil society and governments to invest in technically sound and cost-effective T&T sustainability projects. These foundations may invest in sustainability projects that normally would not attract private capital (due to lower financial returns) and that have limited government priority (e.g. preservation of bio-diversity in tourism destinations). Such a T&T Green Fund can be professionally managed in a fashion similar to other foundation funds such as the Environmental Defense Fund and Energy Saving Trust, where endowment money is selectively invested in decarbonization projects in energy and other sectors. Until now, various players in the T&T sector (i.e. airlines, hotels) have attempted to set-up emissions off-setting funds. However, majority of these funds have been unsuccessful due to low consumer participation, because they are viewed as an additional opportunity for revenues and not as sincere efforts to reduce emissions. The T&T Green Fund, collectively funded by a range of private and public interests, could be a promising off-setting opportunity for tourists who are conscious of their emissions impact and otherwise have limited credible organizations through which to endow T&T sustainability projects. Such projects could include ground transportation “upgrades” at a destination to new green standards, development of eco-lodges at destinations, and the investment in projects in other sectors where significant emissions reduction can be made.

3) ***Public Funding***: The third funding option is to use public funds; for example, by pro-actively engaging national and international funding organizations (e.g. IMF, World Bank) to support T&T sustainability projects within their investment portfolio. Recently, G20 group and several national governments have announced significant financial stimulus packages for infrastructure development in the developed and developing economies. This is a unique opportunity for the T&T sector to jointly encourage funding agencies to provide climate change adaptation and mitigation funding. **The T&T sector must engage national tourism ministries to seek funding within financial stimulus packages to “upgrade” T&T infrastructure to high sustainability standards**.

Implications for policy makers:

- Setting appropriate market incentives would be critical to stimulate private capital flow into sustainable projects in the T&T project. Incentives could be in the form of public money as seed capital for high investment-high risk projects, or tax breaks on sustainable investments.

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[45] For example, a global standard for building design and certification is impractical due to climatic differences across regions. Global guidelines can be developed with climate specific benchmarks.
[46] IATA.
[47] Accommodation cluster working group and Booz & Company.
[48] Booz & Company.

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