

# UNEP BRIEFING PAPER

## Tourism's global resource use



### Executive summary

**T**here is clear evidence that tourism's global resource consumption is growing rapidly, despite efficiency gains and the introduction of new and more efficient technologies. It is estimated that tourism's global resource use, including energy, water, land and food will at least double over the coming four decades. However, analysis as presented in this paper also suggests that it is possible to vastly improve resource efficiencies at negative cost through management measures and new technology, improving profit margins. Tourism stakeholders need to realize this, while policy makers need to establish legislation moving the sector in the direction of growing efficiencies and declining overall resource use.

### 1. Tourism's resource dependency: an overview

Tourism's resource use includes the consumption of energy, water, land, and food, and a corresponding output of solid waste, sewage and greenhouse gas emissions. Only few studies are available that estimate tourism's contribution to the use of these resources and environmental impacts on a global

scale. For instance, it was estimated that in 2001, tourism contributed to 5% of global energy use and associated emissions, and 0.5% of the Earth's biologically productive terrestrial area (Gössling 2002). These figures have since been confirmed by UNWTO-UNEP-WMO (2008) for energy use and emissions.

To assess tourism's past, current and future resource use with regard to water and food, to update consumption of energy and land, as well as to provide ranges of resource use intensities of different forms of holiday making, Gössling and Peeters (2015) developed the concept of resource use intensities (RUI) for tourism. RUIs are defined as the amount of resources needed to sustain aspects of the tourism system, and calculated as the average amount of energy (or emissions), water, food or land needed per guest night, trip, or passenger-km (pkm). Based on a review of the existing literature, considerable ranges in consumption intensity were found (Table 1), though it needs to be noted that for some aspects, such as food use, only few studies are available, and minimum-maximum values may be lower/higher than the ranges provided. Average RUI estimates are thus indicative.

**Table 1: Summary of resource use intensities in global tourism, 2010**

Aspect	Range of estimates	Global average
Energy - per guest night - per trip (domestic & internat. average)	3.6-3,717 MJ 50-135,815 MJ	272 MJ 3,575 MJ
Emissions - per night (accommodation) - per trip (domestic and internat. average)	0.1 – 260 kg CO <sub>2</sub> <0.1 – 9.30 t CO <sub>2</sub>	13.8 kg CO <sub>2</sub> 250 kg CO <sub>2</sub>
Fresh water use, per tourist per day - direct (accommodation) - indirect (fuels, food) - combined	84-2,425 L 4,500-8,000 L 4,600-12,000 L	350 L 6,000 L 6,575 L
Land use, m <sup>2</sup> - including the hotels infrastructure, per bed - Infrastructure & activities, per tourist	30-4,580 m <sup>2</sup>	42 m <sup>2</sup> 11.7 m <sup>2</sup>
Food use, grams per day - per tourist per day	2,200-3,100g	1,800g

**Source:** Bohdanowicz and Martinac 2007; Deyá Tortella and Tirado 2011; Eijgelaar et al. 2010; Gössling et al. 2015a; Hadjidakou et al. 2013; Lamers and Amelung 2007, UNWTO-UNEP-WMO 2008; Walnum 2011.

An important finding from this research is that there are huge differences in the resource input required to generate one unit of tourism services. For instance, depending on hotel type and standard, water consumption may vary between 84–2,425 L of water per tourist per day, and 3.6–3,717 MJ of energy or 0.1–260 kg CO<sub>2</sub> per tourist per day. Land use can amount to 30–4,580 m<sup>2</sup> per bed, and food consumption varies between 2–3 kg per tourist per day (in upscale accommodation; gross weight). Results consequently show that depending on the future development of tourism, i.e. the resource intensity of the individual tourism products developed, tourism’s overall resource use may either increase or decline.

Based on these average values, global total resource consumption can be calculated on the basis of arrival numbers, guest nights, and distances travelled by transport mode, and considering that RUIs are not constant over time. Given global growth in tourist arrivals, an anticipated 13.6 billion tourist trips result in 36.2 trillion passenger km by 2050 (Gössling and Peeters 2015). For these trips, based on average RUIs, and assumptions on future efficiency gains in tourism, tourism’s global resource consumption can be modelled (for details on the Global Tourism and Travel Model used, see Peeters 2013).

The outcome of the business-as-usual model run (Gössling and Peeters 2015) is summarized in [table 2](#), indicating that tourism may currently (2010) consume 16,697 PJ of energy, 138 km<sup>3</sup> of fresh water, 61,826 km<sup>2</sup> of land, 39.4 Mt of food, while causing emissions of 1.119 Mt of CO<sub>2</sub>. By 2050, these values would rise to 44,110 PJ of energy (+164%), 265 km<sup>3</sup> of water (+92%), 178,731 km<sup>2</sup> of land use (+189%), 82 Mt of food (+108%), and 2,957 Mt of CO<sub>2</sub> emissions (+164%). Within the coming four to five decades, resources needed to maintain the global tourism system would thus double (water, food), or triple (land, energy, emissions). Further research is needed to confirm these results, however.

In 2010, tourism’s global energy consumption amounted to 16,697 PJ, equivalent to the total annual energy use of Japan and Russia combined (US Energy Information Administration 2014). Corresponding emissions of 1,119 Mt CO<sub>2</sub> are about equal to total national emissions from Canada and Mexico combined (US Energy Information Administration 2014). Total water consumption in tourism (138 km<sup>3</sup>/year) corresponded to approximately the total freshwater withdrawal (surface water & groundwater) of Argentina, Bangladesh, Belgium, Netherlands, Poland, and Spain combined (FAO 2014). Tourism’s global land use is equivalent to the size of Sri Lanka (Worldbank 2014).

## 2. Energy use and emissions

[Figure 1](#) illustrates growth in energy consumption in tourism for the period 1900 to 2010, and as a scenario up to 2050. The figure distinguishes accommodation, air travel, car travel and other energy use, which is about equivalent to emissions of CO<sub>2</sub>. In the Business-as-usual scenario (shown are also a Global Growth and an Economic slowdown scenario), energy consumption in tourism will double by 2035–2040, compared to 2010. Notably, the scenario does not include day trips, which were estimated to have been in the order of five billion in 2005, compared to less than one billion trips involving at least one overnight stay in the same year (UNWTO-UNEP-WMO 2008).

With regard to SIDS, few studies have investigated overall tourism related resource use or environmental impacts. It is evident, however, that SIDS will often be particularly resource intensive due to their peripheral location and limited manufacturing possibilities, necessitating transports of tourists and imports including energy, food, supplies and even labour over considerable distances. Tourism in SIDS is also often upscale in character, and hence more resource intense.

**Table 2: Global environmental impact of tourism, 2010 and 2050**

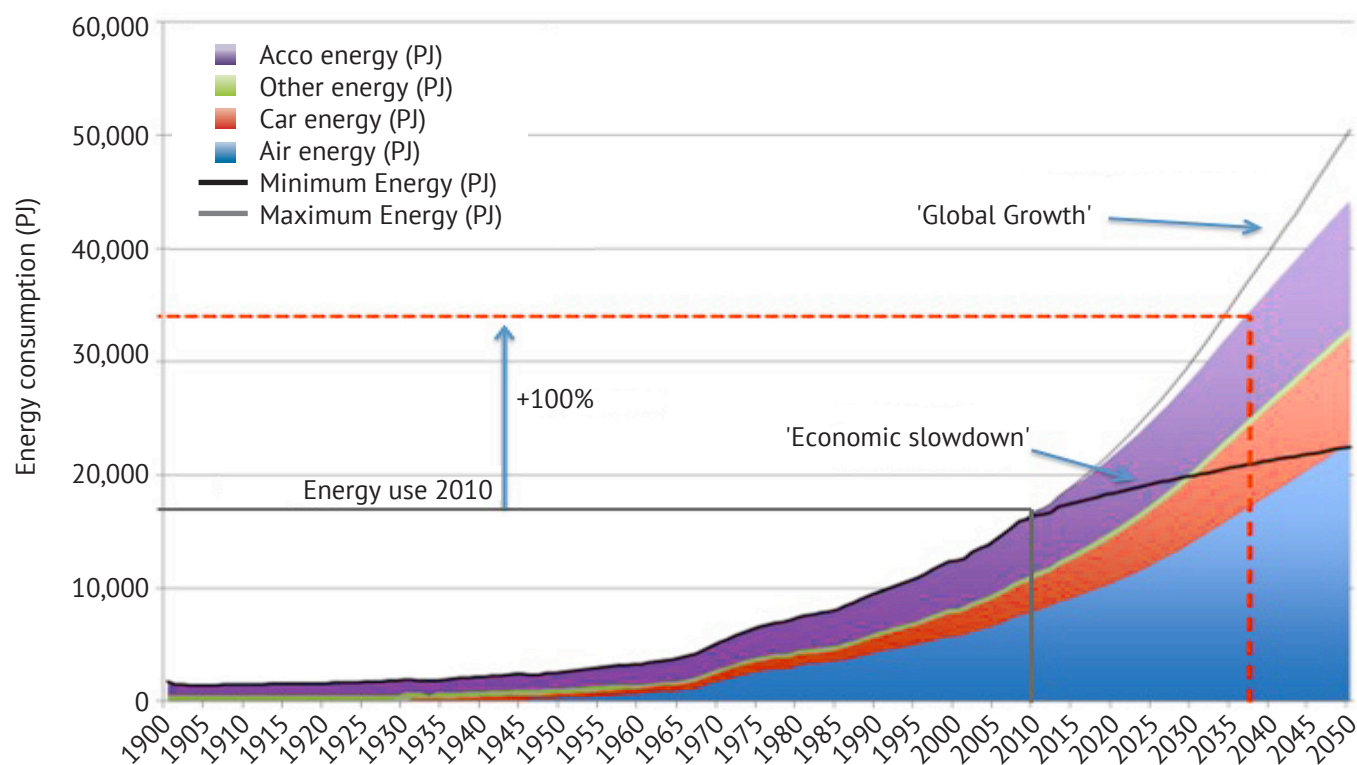
Aspect	Global total 2010	Global total 2050, BAU scenario	Growth factor 2010-2050	Corresponding to (in 2010)
<b>Energy</b>	16,697 PJ	44,110 PJ	2.64	Japan and Russia
<b>Emissions</b>	1,119 Mt CO <sub>2</sub>	2,957 Mt CO <sub>2</sub>	2.64	Canada and Mexico
<b>Fresh water</b>	138 km <sup>3</sup>	265 km <sup>3</sup>	1.92	Argentina, Bangladesh, Belgium, Netherlands, Poland, and Spain
<b>Land use</b>	61,826 km <sup>2</sup>	178,731 km <sup>2</sup>	2.89	Sri Lanka
<b>Food use</b>	39.4 Mt	82.0 Mt	2.08	-

Source: Adapted from Gössling and Peeters 2015.

The resource-intensive character of tourism in SIDS has been illustrated on the basis of various studies into energy use and emissions. For instance, a study comparing the USA, Spain, China, Malaysia, Turkey, Maldives, Seychelles, South Africa, Singapore, New Zealand and the Bahamas found that the average weighted distance covered by each international tourist to these destinations varied between 1,602 and 8,712 km, entailing emissions of between 0.37 and 1.83 t CO<sub>2</sub> per tourist arrival, with the highest value found for arrivals from Switzerland to New

Zealand (3.93 t CO<sub>2</sub> per arrival, transport only; Gössling et al 2014). Destinations depending on more peripheral markets are thus generally more resource intensive, as also illustrated in table 3, for a sample of SIDS. Average weighted emissions in this study varied between 635 kg CO<sub>2</sub> (Jamaica) to 1,873 kg CO<sub>2</sub> (Seychelles) per tourist arrival (Gössling et al. 2008). Note that average emissions are a function of market composition – for instance, Samoa has low emissions per tourist due to a large share of tourists (36%) arriving from close-by New Zealand.

**Figure 1: Energy consumption required to maintain the tourism system, 1900-2050**



Source: Gössling and Peeters 2015

**Table 3: Air travel related emissions per tourist arrival in selected islands**

Country	Avg weighted emissions per tourist, air travel (return flight; kg CO <sub>2</sub> )*	Internal tourist arrivals (2005)	Total emissions, air travel ('000 ton CO <sub>2</sub> )	Emissions per tourist, main market (return flight; kg CO <sub>2</sub> ) and percentage share of total arrivals*
Anguilla	750	62,084	47	672 (USA; 67%)
Bonaire	1,302	62,550	81	803 (USA; 41%)
Comoros	1,734	17,603**	31	1,929 (France; 26%)
Cuba	1,344	2,319,334	3,117	556 (Canada; 26%)
Jamaica	635	1,478,663	939	635 (USA; 72%)
Madagascar	1,829	277,422	507	2,159 (France; 52%)
Saint Lucia	1,076	317,939	342	811 (USA; 35%)
Samoa	658	101,807	67	824 (New Zealand; 36%)
Seychelles	1,873	128,654	241	1,935 (France; 21%)
Sri Lanka	1,327	549,309	729	606 (India; 21%)

Notes: \* Calculation of emissions is based on the main national markets only, using a main airport to main airport approach (in the USA: New York; Canada: Toronto; Australia: Brisbane); \*\* Figures for 2004 Source (tourist arrivals): UNWTO, *Compendium of Tourism Statistics*, Madrid: UNWTO, 2007; and UNWTO, *Yearbook of Tourism Statistics*, Madrid: UNWTO, 2007.

Source: Gössling et al. 2008

Yet another study investigated the share of tourism-related emissions in overall emissions, as these are usually ‘overlooked’ in national greenhouse gas assessments, which do often omit bunker fuels (Gössling 2013). The study found that tourism emissions, if calculated as an equivalent share of ‘official’ national emissions and consequently considering bunker fuels, accounted for in between 4% (Suriname) and 150% (Turks and Caicos) of national emissions (Figure 2), concluding that if a major share of emissions in SIDS is not to be ignored, climate policy needs to consider bunker fuels on a national basis. Notably, high emissions also reflect energy dependencies and corresponding vulnerabilities. Many destinations are more energy dependent than they appear to be on the basis of fuel import statistics, as fuels for aviation and shipping needed to maintain national tourism systems are bunkered elsewhere, i.e. in the markets (Gössling 2013).

### 3. Water use

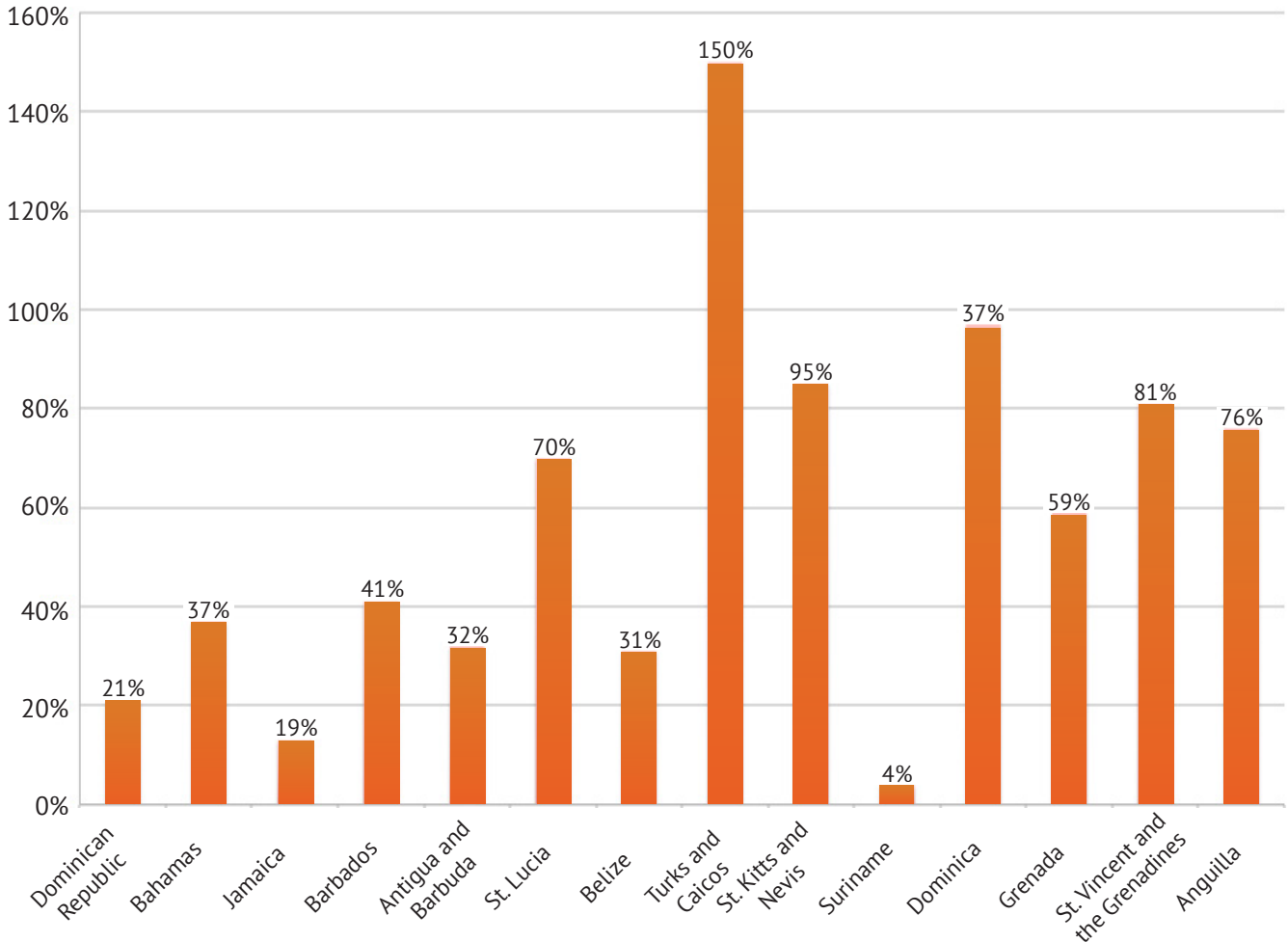
With regard to water, table 4 shows inter-relationships between tourism economics and resource use. While the total share of tourism in domestic water use

(this does not consider agricultural or industrial water use) is below 10% in most of the world’s top tourism destinations, it reaches 13% in Barbados, 14% in Malta, 19% in Cyprus and 40% in Mauritius. Compared to tourism’s share in GDP, up to 26% in these countries, this suggests a high economic dependency on water resources that may not be readily available in the future.

### 4. Vulnerabilities

Vulnerabilities arise out of interrelated structures of exposure to a threat (such as rising resource costs, as well as their overall availability), sensitivities (such as the amount of resources needed per tourist per day, reflecting RUIs; or tourist demand responses to changes in price levels; spending per tourist, profit margins, leakage and multipliers; destination loyalty and the share of returning visitors), as well as adaptive capacities (e.g. social and economic capital, new markets, possible reductions in RUIs). In the longer term, these vulnerabilities are also embedded in socio-demographic change, such as population growth, economic development, climate change, and resulting socio-economic (in)stabilities.

Figure 2: Tourism emissions in Caribbean islands as equivalent share of national emissions



Source: Gössling 2013

As outlined, vulnerability assessments of resource use intensities do not exist as yet on a broader basis, but developments in energy use intensities have been studied for a number of countries. Figure 3 (next page) shows the development in energy- and emission intensities on a per tourist basis for eleven countries for 1995 and 2010 (Gössling et al. 2015a). Over the 15-year period studied, average emissions per tourist have declined in some countries, including New Zealand, Maldives, Seychelles, Malaysia, and Singapore, all of which have benefitted from the development of closer markets in Asia. As the example of the Seychelles demonstrates, arrivals from the country's main markets (France, Italy, Germany, the UK and South Africa) have lost some importance, declining from 66% of arrivals in 1995 to 60% in 2010. New markets include India, United Arab Emirates, and the Russian Federation. Because of these changes in market composition, with overall arrival numbers remaining about constant, average

per tourist emissions declined from 1.58 t CO<sub>2</sub> in 1995 to 1.45 t CO<sub>2</sub> per international tourist in 2010. Consequently, the Seychelles has become less bunker fuel dependent (or resource use intense), despite maintaining constant arrival numbers.

In other tourism economies, such as the USA, China, Turkey and South Africa, average emission intensities per tourist have gone up, as their market composition has changed to include a greater number of more distant markets. In the case of the USA, arrivals from distant markets including Korea, Australia, China, India, Brazil and Israel all increased by 50 - 100% between 1995 and 2010. As a result, the average distance per incoming tourist to the USA has grown from 4,831 km in 1995 to 7,394 km in 2010 and averaged per tourist emissions have grown by more than 50%, from 1.02 t CO<sub>2</sub> in 1995 to 1.57 t CO<sub>2</sub> in 2010. Every tourist arrival thus requires a considerably greater energy input, representing growing energy vulnerabilities in case of fluctuations in price or availability.

**Table 4: Tourism sector direct water use in major destination countries**

	Domestic tourism share of domestic water use (1)	International tourism share of domestic water use (1)	Total tourism share of domestic water use (1)	Tourism % GDP in 2010 (2)
Top 10 International Destinations (by Arrivals)				
<b>France</b>	6%	4%	10%	3.6%
<b>United States</b>	2%	<1%	2%	1.3%
<b>Spain</b>	6%	6%	12%	5.2%
<b>China</b>	3%	<1%	4%	1.7%
<b>Italy</b>	4%	2%	6%	3.2%
<b>Turkey</b>	3%	1%	4%	3.6%
<b>Germany</b>	4%	1%	5%	3.5%
<b>United Kingdom</b>	4%	2%	6%	3.5%
<b>Russia</b>	1%	<1%	1%	2.4%
<b>Thailand</b>	5%	1%	6%	9.5%
Major SIDS and Semi-Arid Region Destinations				
<b>Mauritius</b>	20%	20%	40%	16.8%
<b>Cyprus</b>	2%	17%	19%	15.2%
<b>Malta</b>	2%	12%	14%	17.9%
<b>Barbados</b>	3%	10%	13%	26.0%
<b>Greece</b>	4%	5%	9%	5.9%
<b>Cape Verde</b>	3%	3%	6%	26.3%
<b>Israel</b>	5%	1%	6%	3.4%
<b>Morocco</b>	2%	1%	3%	8.7%
<b>Egypt</b>	2%	<1%	2%	4.6%
<b>Mexico</b>	1%	1%	2%	1.7%

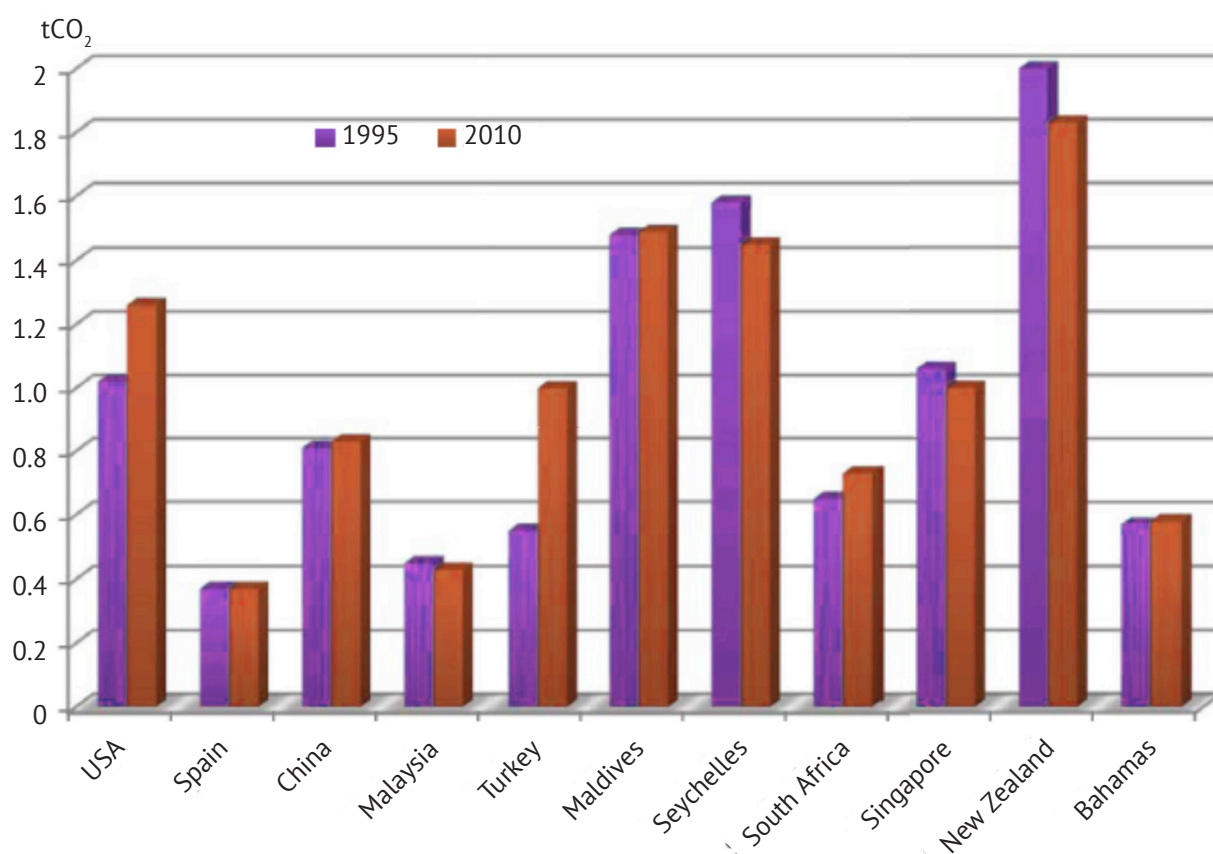
(1) Adapted from Gössling et al. 2012

(2) **Source:** World Economic Travel and Tourism Competitiveness Index (2013), Data Analyser (<http://www.weforum.org/issues/travel-and-tourism-competitiveness/ttci-platform>)

**Source:** Gössling et al. 2015b



Figure 3: Per tourist emission intensities 1995 and 2010



Source: Gössling et al. 2015a

## 5. Conclusions

Tourism’s global resource use is considerable, and growing. This is a) because of a rapidly growing number of human beings participating in tourism, and b) because average resource consumption per tourist trip is becoming more resource intense. These processes may be particularly relevant in SIDS, which more often rely on arrivals of tourists from more remote markets, with above-average RUIs typical for upscale tourism. Yet, given vast differences in RUIs, it should be possible for tourism to de-materialize: evidence suggests, for instance, that savings of energy and water in the order of up to 50% are economically feasible in accommodation businesses - i.e. investment costs equaling savings over a 10 year period -, without jeopardizing quality (Bohdanowicz and Martinac 2007; Gössling 2010; Gössling et al. 2015b). Notably, this will not only reduce RUIs, but also reduce future vulnerabilities related to resource costs and availability.

1. To reduce RUIs and overall resource consumption in tourism is difficult, because the sector has a generally high purchasing power in relation to other economic sectors and private consumption, specifically in developing countries. This is compounded by the sector’s limited understanding

of the economics of resource use, as many small and large businesses appear to have no interest in resource savings, even though these make good sense economically, as for instance shown by Soneva Resorts (2013) or Kuoni (2013). To reduce RUIs and to reduce growth in the overall consumption of resources, it is thus necessary:

2. To clearly define and monitor targets for resource use intensities and overall resource use in tourism; i.e. to communicate current average values and desirable/best practice standards.
3. To introduce policies to support resource efficiency by promoting efficient use of energy, water, and waste. Various policies have been used to achieve the positive trends in energy and water consumption, as well as a range of waste policies inspired by the Reduce, Reuse, Recycle (3Rs) philosophy. However, there is broad recognition that further progress can only be achieved through more integrated policy approaches that take account of the full life-cycle of tourism and its impacts in the biodiversity and conservation of destinations.
4. To increase the awareness of decision makers in public and private sectors on the impacts,

type and scale of tourism activities they are proposing. They need to understand resources are compatible with available resources, conservation and development objectives. There is a need to communicate that saving at least 10% and up to 50% of resources is cost neutral, on the basis of management measures and the introduction of new technology. There is ample evidence of companies that have significantly improved profit margins as a result of 'smart' resource use. As tourism products are characterized by huge differences in resource use intensities, there is scope to achieve tourism growth whilst reducing resource consumption, therefore optimizing its contribution to sustainable development.

5. To understand tourism consumption, lifestyles, values and infrastructures of different population segments, in different regions and contexts (e.g., urban/rural, developing/ developed/ emerging countries) and on different outreach and communication methods, strategies and messaging on sustainable consumption in tourism and raising awareness about the issue (i.e., climate and biodiversity). This is particularly important as very little research has been done in tourism to see how people can alter their consumption patterns for less resource intensive tourism products and services.
6. To achieve greater resource efficiencies, there is a need for green investment structures, and cross-sectoral synergies by introducing policy measures. For resources including specifically energy, these should include increased costs and carbon surcharges; government incentives for the introduction of technologies reducing resource use; standardized eco-labels for all tourism products; as well as regulations/legislation on resource efficiency. For water, price structures reflecting water scarcity and responsible water management need to be developed. Overall, considerable efforts are needed to raise awareness to the fact that resources are scarce, and that resource savings are making good economic sense.

## Recommendations

Without very significant action by policy makers and private sector, and supported by behavioral change by tourists, it is unlikely that tourism's current growth in resource consumption can be reversed in either relative (per tourist and trip) or absolute terms (the sector's total global consumption of resources).

However, as tourism is highly wasteful of resources, even very significant action to increase efficiencies in resource use is unlikely to negatively affect tourism. To the contrary, such action would reduce vulnerabilities and risks, as tourism is highly dependent on stable flows of resources such as energy or water. Moreover, saving resources is economically meaningful: efficiency gains in the order of 10-50% based on management and introduction of new technologies are economically cost neutral, and can help turning the sector from one with low resource productivity into one with higher resource productivity.

Research also indicates that in particular some SIDS with economies dependent on arrivals of tourists from distant markets show high resource use intensities (figure 2, 3), which may also contribute to these countries being less competitive economically. Yet, particularly SIDS could make use of strategic approaches to reduce their resource use intensities due to their clearly defined boundaries, and the ease with which statistics on imports of bunker fuels (shipping, aviation), tourist arrivals, etc. can be collected. In light of this, the following recommendations can help to dematerialize the tourism system, addressing economic concerns. Significant action towards low resource tourism systems would imply to:

### *For policy makers*

- Monitor and report on resource use intensity [minimum indicators] at national and/or local levels. Public and private institutions and organisations engaged in tourism planning, including tourism master plans, should make use of credible scientific methods and tools that will help stakeholders of the value chain understand their environmental and socio-cultural impacts and how they are using these resources.
- Introduce legislation to make energy, water, and other resource consumption progressively (steadily increases at the pace of decoupling) and foreseeably (implemented over longer periods of time) more expensive. For example, if the average efficiency of the car fleet rises by one per cent in one year, a corresponding increase of petrol prices would seem fair and tolerable. Moreover, the firm announcement of the continuation of such scheme will induce car manufacturers and traders as well as consumers to speed up efforts to reduce petrol consumption per kilometre or to avoid unnecessary trips (UNEP 2014).
- Financing from national and international organisations for investments in public

infrastructure related to tourism should estimate their resource use intensity/ impacts and adopt economic measures to compensate and offset unavoidable impacts.

- Engage business in national environmental reporting and compliance with given minimum standards;

*For the private sector*

- Embrace measuring and monitoring resource use and calculation of resource use intensities, in comparison to benchmarks and best practice;
- Develop and introduce carbon labels for various tourism products, to improve carbon literacy and to facilitate tourist demand choices (see Gössling and Buckley 2014);
- Substantially increase purchases of regional foods, including higher shares of low-water, low-carbon foodstuffs; and to communicate such action to guests;
- Introduce a 'sustainability' criterion in all ranking and rating systems for consumers to judge environmental performance as a key quality aspect;
- Assess the carbon and resource intensity of different markets and to favor those with lower resource intensities, adjusting marketing efforts accordingly;

*For tourists to*

- Engage in low-resource consumption, based on positive framing of low-resource futures, and various tools including the above mentioned.



## References

- Bohdanowicz, P., and Martinac, I. 2007. Determinants and benchmarking of resource consumption in hotels – case study of Hilton International and Scandic in Europe. *Energy and Buildings* 39: 82-95.
- Deyá Tortella, B. and Tirado, D. 2011. Hotel water consumption at a seasonal mass tourist destination. The case of the island of Mallorca. *Journal of Environmental Management* 92: 2568-2579.
- Eijgelaar, E., Thaper, C. and Peeters, P. 2010. Antarctic cruise tourism: the paradoxes of ambassadorship, last chance tourism' and greenhouse gas emissions. *Journal of Sustainable Tourism* 18 (3), 337 - 354.
- FAO (Food and Agriculture Organisation) 2014. Aquastat. Available from: <http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en>
- Gössling, S. 2002. Global environmental consequences of tourism. *Global Environmental Change* 12(4): 283-302.
- Gössling, S. 2010. Carbon Management in Tourism: Mitigating the Impacts on Climate Change. London: Routledge.
- Gössling, S. 2013. National emissions from tourism: an overlooked policy challenge? *Energy Policy* 59: 433-442.
- Gössling, S. and Buckley, R. 2014. Carbon labels in tourism: Persuasive communication? *Journal of Cleaner Production*, DOI: 10.1016/j.jclepro.2014.08.067.
- Gössling, S. and Peeters, P. 2015. Assessing tourism's global environmental impact 1900-2050. *Journal of Sustainable Tourism*, DOI:10.1080/09669582.2015.1008500.
- Gössling, S., Peeters, P., and Scott, D. 2008. Consequences of climate policy for international tourist arrivals in developing countries. *Third World Quarterly*, 29(5): 873-901.
- Gössling, S., Scott, D., and Hall, C.M. 2015a. Inter-market variability in CO<sub>2</sub> emission-intensities in tourism: Implications for destination marketing and carbon management. *Tourism Management* 46: 203-212.
- Gössling, S., C.M. Hall, and Scott, D. 2015b. *Tourism and Water*. Channel View Publications: Bristol, UK.
- Hadjikakou, M., Chenoweth, J. and Miller, G. 2013. Estimating the direct and indirect water use of tourism in the eastern Mediterranean. *Journal of Environmental Management* 114: 548-556.
- Kuoni 2013. Water Management Manual for Hotels. Available from: [http://www.kuoni.com/docs/kuoni\\_wmp\\_manual\\_0.pdf](http://www.kuoni.com/docs/kuoni_wmp_manual_0.pdf)
- Lamers, M., Amelung, B. 2007. The environmental impacts of tourism to Antarctica. A global perspective. In Peeters, P. M. (Ed.) *Tourism and climate change mitigation. Methods, greenhouse gas reductions and policies*, 51-62. Breda: NHTV.
- Peeters, P. 2013. Developing a long-term global tourism transport model using a behavioural approach: implications for sustainable tourism policy making. *Journal of Sustainable Tourism*, 21(7), 1049–1069.
- Roselló-Batie, B., Molá, A., Cladera, A. and Martinez, V. 2010. Energy use, CO<sub>2</sub> emissions and waste throughout the life cycle of a sample of hotels in the Balearic Islands. *Energy and Buildings*, 42, 547-558.
- Soneva Resorts 2013. Sustainability Report 2012-13. Available from: [http://www.soneva.com/uploads/wysiwyg/Soneva\\_Sustainability\\_Report\\_2012-13\\_v1.0\\_1.pdf](http://www.soneva.com/uploads/wysiwyg/Soneva_Sustainability_Report_2012-13_v1.0_1.pdf)
- UNEP 2014. Decoupling 2: technologies, opportunities and policy options. A Report of the Working Group on Decoupling to the International Resource Panel. Available from: [http://www.unep.org/resourcepanel/Portals/24102/PDFs/IRP%20DECOUPLING%20\\_Summary%20-%20web.pdf](http://www.unep.org/resourcepanel/Portals/24102/PDFs/IRP%20DECOUPLING%20_Summary%20-%20web.pdf)
- US Energy Information Administration 2014. International Energy Statistics. Available from: <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8>
- Walnum 2011. Energy use and CO<sub>2</sub> emission from cruise ships A– Methodological issues. Vestlandsforskning note 2/2011. Available at: <http://www.vestforsk.no/filearchive/vf-notat-2-2011-cruise.pdf> Accessed 30 January 2014.
- World Bank 2014. Land area. Available from: <http://data.worldbank.org/indicator/AG.LND.TOTL.K2>