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UN environment programme

Consumer Information Tools and Climate Change

Facilitating low-carbon choices in Tourism, Buildings and Food Systems

Guidance for Policy Makers and Business Leaders

ABOUT THE 10YFP CONSUMER INFORMATION PROGRAMME

This publication is an output of the Consumer Information Programme of the 10 Year Framework of Programmes on Sustainable Consumption and Production (known as the One Planet network). The Programme is a global platform supporting the provision of quality information on goods and services, to engage and assist consumers in sustainable consumption. It implements and supports projects; undertakes research; shares good practice and policies; and provides collaboration opportunities. The Programme is led by the Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMU), Germany; the Ministry of Environment and Forestry of Indonesia; and Consumers International. It brings together a network of public, private and third sector actors. More information, and ways to participate, can be found at: http://www.oneplanetnetwork.org/consumer-information-scp/, or contact: ciscp@un.org.

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The report was developed through a collaborative effort among four programmes of the One Planet network: Consumer Information, Sustainable Buildings and Constructions, Sustainable Food Systems and Sustainable Tourism, comprising a number of experts on the topic. The effort was led by UN Environment Programme who held a consultation workshop in November 2018.

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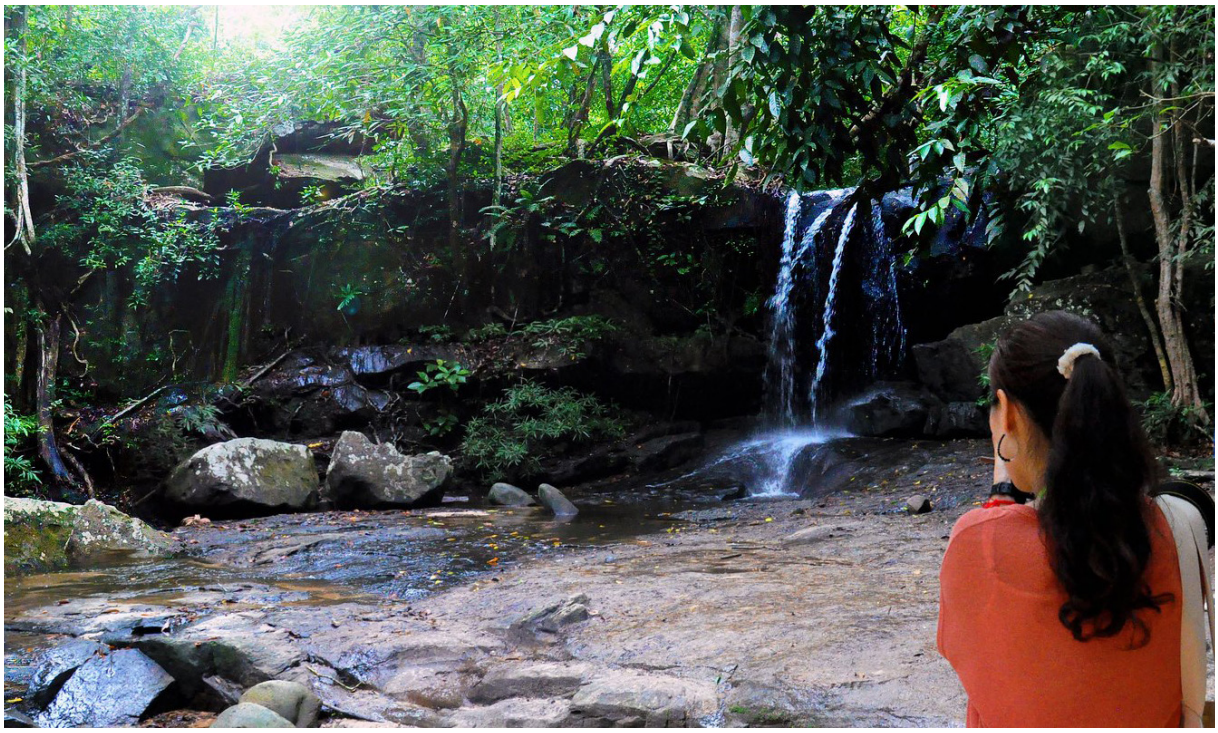
CONTENTS

ABOUT THIS REPORT

This report details how the use of **consumer information tools** can support greenhouse gas emission reductions in three industry sectors: tourism, buildings and food. Consumer information covers a range of tools and systems that seek to guide consumers to make more sustainable choices about goods and services (products), including in their use and end of life phase. Tools can take many forms, including certifications, voluntary standards, product declarations, ratings, marketing claims, foot printing, life-cycle assessments, product campaigns in store or on social media, and other ways of communicating with consumers on environmental and social issues connected to products (for instance through product design). They can be single- or multi-issue, and can follow a life cycle approach to provide a holistic perspective considering the impacts of every stage of the product development process, including how a product is used and how it is treated responsibly at end-of-life.

In this context, the report defines the climate change mitigation challenge for the tourism, buildings and food sectors within the framework of the Paris Agreement. It outlines the structure of the three sectors and details their supply chain specifics. The report then summarizes the state of the art on consumer behaviour, before it describes existing consumer information tools in each sector. Barriers to and solutions for their more widespread use are discussed along with recommendations for business and policy makers. The report also contains a number of best practice cases.

There is a growing insight that production-focused approaches to climate change mitigation will not be sufficient to stay within the 1.5°-2°C maximum warming guardrail. Voluntary action will be needed to support decarbonisation processes and to help countries meet their nationally determined contributions to emission reductions (NDCs). Consumer information tools can be an important mechanism to scale up mitigation efforts and to increase widespread interest and understanding of climate change, its driving forces, and the role of consumption in generating greenhouses gases. Based on recommendations as made in the report, businesses and policy makers will be able to adapt workable strategies to widen the use of viable standards and certifications.



SUMMARY FOR BUSINESS LEADERS AND POLICY MAKERS

Consumer information tools to advance climate change mitigation goals **are soft-policy instruments**. They help raising awareness of the impacts and costs of climate change to ecosystems, human communities and economies, to create **knowledge regarding the causes of climate change**, to inform about the **implications of various consumer choices** in terms as their contribution to global warming, and to **highlight opportunities for low-carbon cultures and lifestyles**. This contribution to **carbon literacy** is as important as immediate changes in consumer behaviour inspired by information tools. Consumer information tools also **help companies to adapt their production processes** by following criteria for certification schemes.

Climate change related consumer information tools **put emphasis on individual consumption choices**, opening up from contemporary mitigation perspectives focused on changes in production. This is an important shift as it becomes increasingly clear that there are **large differences in individual contributions to greenhouse gas emissions, to which food consumption, tourism, and buildings make significant contributions**. Information tools, such as rankings and ratings, standards, certifications, and dedicated websites help understanding these relationships, highlighting the importance of individual actions and choices.

As shown in a wide range of studies, **the effect of appeals on consumer choices is modest**. Information tools can make a contribution to mitigation, but **they cannot replace the market-based approaches** that will be necessary to meet emission reduction goals. Yet, the tools identified in this report have an effect on consumer choices, and they can be optimized, both in regard to their impact on behavioural change, as well as in terms of their contribution to carbon literacy.

The report suggests that six strategies could support the development, outreach and effectiveness of climate change-related consumer information tools. First of all, as **consumers perceive carbon information tools positively, carbon certifications should be introduced on a wider basis**. Along with this, **information tools should also be made available** to a broader audience, starting with air travel and food products, and allowing consumers to identify and compare products on the basis of embodied emissions. Third, to facilitate this comparison, there is a need to **harmonize existing consumer tools** on the basis of identical system boundaries/life cycle analyses, and considering CO_2-equivalent emissions. Fourth, as consumers continue to be insufficiently aware of climate change, **information on greenhouse gas emissions may be separated** from other aspects related to the Sustainable Development Goals. Fifth, there is considerable **potential to improve information tools** by associating these with personal benefits. Finally, **the range of carbon information tools could be extended**, including in particular rankings and contests, to support and highlight competitive aspects of decarbonization.

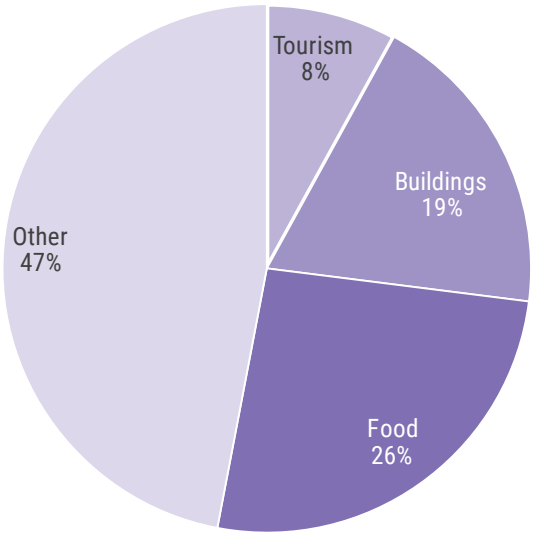
1. CLIMATE CHANGE AND THE 1.5°C CHALLENGE

The burden sharing of international climate change mitigation agreements is motivated by national differences in averaged per capita emissions. These were the basis for the Kyoto Protocol in 1997, which set binding reduction targets for high emitting countries known as Annex B parties under the principle of "common but differentiated responsibilities" (UNFCCC 2018a). In 2015, the Paris Agreement complemented the Kyoto Protocol, focusing efforts on nationally determined contributions (NDCs). Again, high-emitting countries - on a per capita basis - are expected to make more significant mitigation pledges and to implement "[…] absolute economy-wide reduction targets" (UNFCCC 2018b). Mitigating climate change is also one of the 17 Sustainable Development Goals (SDGs) that are the cornerstones of the UN 2030 Agenda for Sustainable Development (UN 2018) to reduce poverty, inequality, and environmental degradation, while achieving minimum living standards, peace and justice.

National approaches to mitigation have usually focused on production, i.e. measures designed to increase efficiency or to introduce new technologies. Yet, it has become increasingly obvious in recent years that these reduction strategies may not be significant enough to reduce global warming to 2°C, the international policy objective (Rogelj et al. 2018; UNEP 2018). The difficulty of reducing emissions to levels where this would prevent the world from dangerous interference with the climate system is considerable, and the IPCC (2018) has warned that human activities have already caused 1.0°C of global warming above pre-industrial levels: "Global warming is likely to reach 1.5°C between 2030 and 2051 if it continues to increase at the current rate". In other words, current NDC pledges are insufficient to meet decarbonization goals.

By 2050, the global economy has to reduce its carbon emissions by 85%, which will have to include all economic subsectors (ETC 2018; IPCC 2014). Changes in consumption patterns and dominant lifestyles are a crucial element of the solutions package to addressing climate change (Institute for Global Environmental Strategies, 2019). To achieve this goal, it is likely that a mix of command-and-control, market-based, and voluntary measures will be required. The focus of this report is on the soft policy measures that provide opportunities for mitigation on the basis of more climate-friendly consumer decisions. Essentially, these policy measures include information tools such as carbon certifications, rankings comparing business standards, or other educational tools such as dedicated websites. All of these have in common that they facilitate lower-carbon choices, while increasing carbon literacy. Differences exist, however, with regard to the relevance of soft policy measures for the three areas studied in this report, as consumer choices are characterized by different degrees of socioeconomic complexity and temporal characteristics: food purchases represent daily or weekly choices; tourism choices will be monthly or annual; decisions to buy a home, to renovate or retrofit (lighting, heating) a building, or to buy new appliances may represent even rarer choices. This has repercussions for the importance and design of climate mitigation support tools.

FIGURE 1.1: CO_2-EQ EMISSIONS FROM TOURISM, BUILDINGS (EXCLUDING CONSTRUCTIONS) AND FOOD

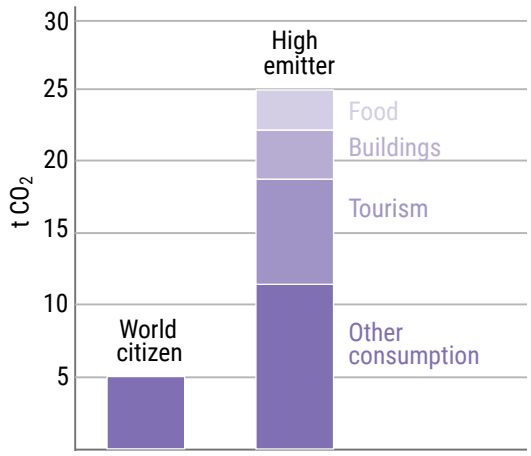


Source: Lenzen et al. 2018; Lucon et al. 2014; Poore and Nemecek 2018

As a growing body of research highlights differences in individual contributions to climate change (Chakravarty et al. 2009; Hubacek et al. 2017), demand-side approaches to decarbonization are becoming increasingly important (Creutzig et al. 2016). Consumption patterns are specifically problematic with regard to tourism, food, and buildings (excluding emissions related to the construction industry). These three sectors together account for about 53% of humanity's contribution to energy-related CO_2-eq emissions (Figure 1.1; Table 1.1).

There is much evidence that affluent population groups emit more, because these population groups consume additional services and products, including in particular transport & tourism (Ummel 2014). In all three categories studied in this report, emissions of high emitting individuals exceed global averages. For example, Hubacek et al. (2017) estimate that the world's top 10% income earners account for 36% of total CO_2-eq emissions, corresponding to 26.3 t CO_2-eq per capita per year. In comparison, the world average per capita and year is only 5 t CO_2-eq (World Bank 2018). This is shown in Table 1.1, which lists global and individual emissions in absolute terms and as a share of overall emissions. For high emitters, the assumption is that changes in tourism, food and building choices potentially affect 13 t CO_2-eq per person and year, i.e. about 52% of their annual emissions. Figure 1.2 depicts a high emitter's emissions in the three sectors studied here in relation to the world average.

FIGURE 1.2: EMISSIONS PER YEAR: HIGH EMITTER VERSUS WORLD AVERAGE CITIZEN



1.1 TOURISM

To further describe the three sectors studied, tourism now accounts for 4.5 $GtCO_2$-eq per year and is widely considered to be one of the fastest growing economic sectors (World Bank 2018). Since 1950, international tourist arrivals have grown from 25 million to 1.322 billion in 2017, representing a 7% growth in 2016 alone (UNWTO 2018). Notably, tourism's past growth rate has been around 4% per year since 2010, and is projected to grow at an average rate of 3.8% per year between 2010-2020. UNWTO estimates that there will be 1.8 billion international tourist arrivals in 2030. Growth in arrivals is expected to lead to a significant increase in emissions from the sector. A business-as-usual scenario that examined tourism emission trajectories projected a 169% increase between 2010-2050 (Gössling and Peeters 2015), indicating a widening gap between emission reductions and observed trajectories. This is depicted in Figure 1.3, showing the expected emission growth according to UNWTO-WTO-UNEP's (2008) lower emission growth scenario (135% to

TABLE 1.1 SUBSECTOR CONTRIBUTIONS TO CLIMATE CHANGE

Subsector	Tourism	Food	Buildings
Global emissions a)	4.5 $GtCO_2$-eq (8%)	13.7 $GtCO_2$-eq (26%)*	9.2 $GtCO_2$-eq (19%)
Per capita emissions b)	6 t CO_2-eq (24%)	3 t CO_2-eq (12%)	4 t CO_2-eq (16%)

a) CO_2-equivalent emissions and sector's share of total emissions of about 50 $GtCO_2$-eq in 2010.
b) CO_2-equivalent emissions; high emitter estimate (25 t CO_2-eq per year) and percentage share; not considering aviation's non-CO_2 contribution to global warming.
* The IPCC (Smith et al. 2014) suggests 5.5 $GtCO_2$-eq (11%) for the agricultural sector; estimate here based on a more recent estimate by Poore and Nemecek (2018), considering the entire value chain.

Source: Lenzen et al. 2018; Lucon et al. 2014; Smith et al. 2014; own estimate for individual emissions.

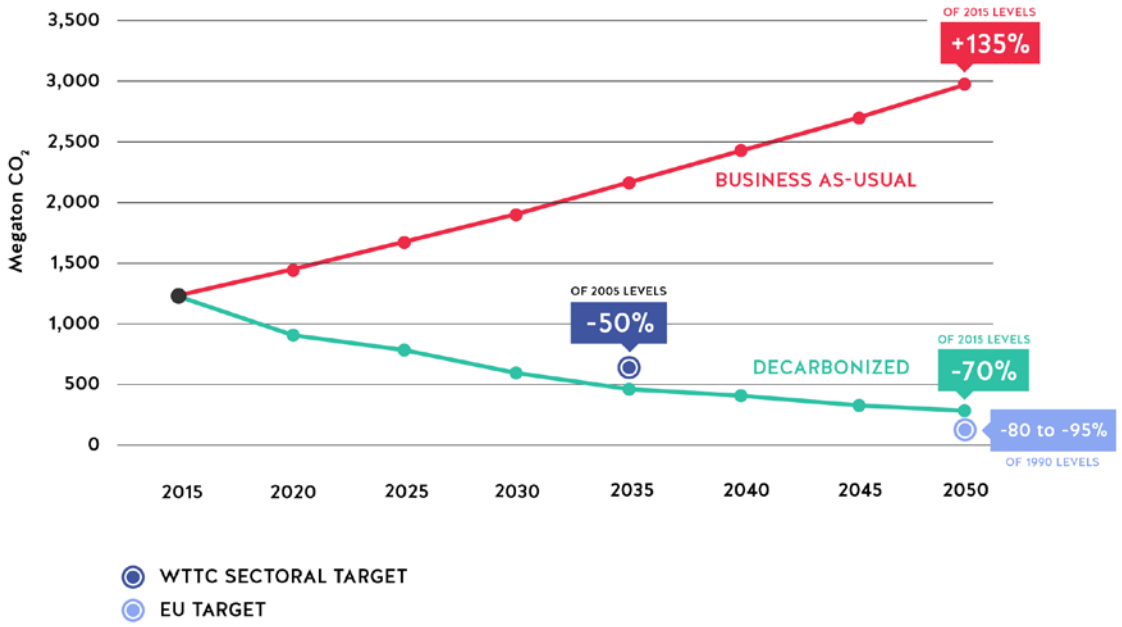
2050), and industry decarbonization ambitions as defined by the World Tourism and Travel Council's (WTTC) sectoral target (-50% by 2035) as well as the EU goal of -80% to -95% by 2050.

The Figure illustrates that the difference between actual and climatically sustainable emissions could exceed 2.5 $GtCO_2$ per year by 2050. To achieve a 70% emission reduction by 2050 from 2015 levels requires a 2.2% reduction in emissions every year (ETC 2018). This target will require fundamental changes in the global tourism system. As an example, TUI group, as one of the world's largest tour operators with 67,000 employees and 20 million guests, relies on 16 cruise ships, 150 aircraft and 380 hotels. TUI presented ambitious plans to reduce its carbon footprint through its Better Holidays Better World Strategy 2015-2020 (TUI 2017). The strategy's ambition is to reduce the carbon intensity of operations by 10% by 2020, i.e. by about 2% per year. While this is close to the global 2.2% reduction target, TUI already operates a highly efficient fleet of aircraft, and between 2016 and 2017, efficiency gains declined to 0.1%. This indicates that it will be (increasingly) difficult to maintain a 2% annual reduction in emissions, even in a situation where tour operators seek to decarbonize. More importantly, however, even though TUI is becoming operationally more efficient, the group's ***overall*** airline emissions ***increased*** by 5.6% between 2016-2017. The example illustrates that relative efficiency gains need to be distinguished from absolute emission developments, and calls for further action in the tourism sector to reduce emissions in line with 2°C decarbonization trajectories. This highlights the need to rethink the tourism system in far more fundamental ways, while also underlining the need to consider offsetting on vast scales. More data is needed for this, underlining the need for tourism businesses and in particular airlines and cruise ship operators to monitor their fuel consumption, and to make this data available publicly.

1.2 BUILDINGS

Greenhouse gas emissions from buildings (i.e., not accounting for construction) equalled 9.2 $GtCO_2$-eq in 2010, or 19% of global emissions (Lucon et al. 2014). However, if construction-related emissions are considered, the sector accounts for almost 39% of global energy-related CO_2 emissions (IEA and UN Environment 2018). A significant share of emissions comes from the energy necessary to produce materials, also referred to as embodied carbon. The very significant amount of emissions related to constructions underlines the importance of taking a life-cycle approach to the calculation of emissions from buildings & constructions (ibid).

FIGURE 1.3 GLOBAL TOURISM EMISSION TRENDS VIS-À-VIS DECARBONIZATION TARGETS



Source: ETC 2018

As outlined by Lucon et al. (2014), emissions from buildings doubled in the period 1970-2010. This growth is mostly a result of electricity use in residential and commercial buildings. Since 2010, electricity use has grown by 15%, equal to the total amount of electricity used by Korea and Japan in 2017. Final energy demand has increased by 5% with growth in floor area and population outpacing the impact of energy efficiency improvements between 2010 and 2017. A new area of concern is space cooling, where global energy use increased by more than 20% between 2010 and 2017, while electricity demand from appliances grew by 18%. Only space heating requirements decreased, by about 4% (IEA and UN Environment 2018). In the period 2010-2050, the IPCC expects energy use from global buildings to double or triple, depending on the share of the world population gaining access to adequate housing and electricity (Lucon et al. 2014). This development is in stark contrast to decarbonization pledges: even though 136 countries mention buildings and construction in their NDCs, many lack the needed ambition and the concrete measures and targets for the sector (UN Environment 2018).

A wide range of technological options, design practices for new buildings and demand-side changes could make contributions to reductions in energy use, with estimates that 50%-90% of energy use in new buildings, and 50%-75% in existing buildings could be avoided (Lucon et al. 2014). Prospective owners of buildings can influence energy requirements and emissions by choosing to refurbish, build or buy passive energy homes, zero energy, or plus-energy constructions, i.e. houses that generate more electricity over the course of a year than they require. User control can align building performance more closely with user needs and ensure lighting, heaters, and appliances are not in use when not needed. As the IPCC outlines (Lucon et al. 2014: 686), essential aspects of the design of low-energy buildings are: (1) building orientation, thermal mass, and shape; (2) high-performance envelope specification; (3) maximization of passive features (day-lighting, heating, cooling, and ventilation); (4) efficient systems meeting remaining loads; (5) highest possible efficiencies and adequate sizing of individual energy-using devices; and (6) proper commissioning of systems and devices. Notably, cost savings can offset the higher cost of such building standards. However, building envelope and heating efficiency improvements are not moving fast enough to offset growing demand (IEA and UN Environment 2018). Retrofits of existing houses are believed to achieve 25–70% savings in total energy use (Levine et al. 2007; Harvey 2009), though investments have long payback times. For residents and commercial users of buildings, energy management, as well as innovative design solutions or low-energy technology choices can vastly reduce use and maintenance energy demand, with opportunities to reduce emissions to near zero through purchases of renewable energy.

1.3 FOOD SYSTEMS

As the IPCC (Smith et al. 2014) outlines, greenhouse gas emissions from agricultural production in the period 2000–2010 are estimated at 5.0–5.8 $GtCO_2$-eq per year, to which emissions from land-use and land use change have to be added. These account for another 4.3–5.5 $GtCO_2$-eq per year, increasing the contribution from agriculture to 10-12 $GtCO_2$-eq per year. A more recent estimate by Poore and Nemecek (2018) even suggests that agriculture is responsible for 13.7 Gt of CO_2-eq, or 26% of anthropogenic greenhouse gas emissions. Most of this (61%) is production-related, i.e. caused directly at the farm (Poore and Nemecek 2018).

The IPCC (Smith et al. 2014) highlights that over the past 40 years, there has been a 1.4-fold increase in cattle, sheep and goat numbers, increasing emissions of methane (CH_4) from the sector, as well as a 1.6- and 3.7-fold growth in pig and poultry numbers, respectively. The trend over the past twenty years up to 2010 reflects a year-on-year growth in emissions by about 0.9%, with signs of an increase in growth rates after 2005 (Tubiello et al. 2013). Wollenberg et al. (2016) suggest that emissions from agriculture need to decline by about 1 Gt CO_2-eq per year by 2030, for global warming to stay below 2°C in 2100. Notably, even this ambitious scenario implies that the sector's emissions will continue to grow to 6.15–7.78 $GtCO_2$-eq per year by 2030. The IPCC (Smith et al. 2014) highlights that opportunities for mitigation include supply-side and demand-side options, with demand side reductions including food loss and waste minimization as well as changes in diets.

Food loss and waste reduction is a form of emissions avoidance and has received growing attention in the literature as an area with a very large potential for emission reductions (Papargyropoulou et al. 2016; UN Environment 2017). FAO, IFAD & WFP (2013) estimate that worldwide, some 1.3 billion tons of food are lost or wasted annually, mostly in developed countries (Buzby and Hyman, 2012; Parfitt et al. 2010). Much evidence suggests that food waste can be reduced along the entire food supply chain (Cinzia 2017; see also Curtis et al. 2016; Martinez-Sanchez et al. 2016; Wilewska-Bien et al. 2016). For this reason, target 12.3 of the Sustainable Development Goals agenda calls for countries to: "halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses", by 2030. This goal may be achievable if production and consumption practices both change (Beretta et al. 2013). Tourism has been identified as an area of consumption where food loss and waste are very significant issues (Gössling et al. 2011; Juvan et al. 2018; Wilewska-Bien et al. 2016).

Changes in diets are another major option for demand-side changes contributing to food system decarbonization. For example, Meier and Christen (2013) calculated that adjusting German diets to the recommendations of the German Commission on Diets (Deutsche Ernährungskommission) would reduce food consumption by 7% and greenhouse gas emissions by 11%, going along with cuts in blue water (-26%) and land use (-15%) requirements. Tom et al. (2016) postulated similar savings for adjusting US food consumption to calorically balanced diets (-9% in energy, greenhouse gas emissions and blue water use). Scenarios for the EU suggest that halving meat, milk, and egg consumption would reduce greenhouse gas emissions by 40%, and area use by 25% (Westhoek et al. 2014). Finally, in a global calculation of changes to vegetarian diets, Poore und Nemecek (2018) calculate an opportunity to almost halve greenhouse gas emissions (-49%), corresponding to 5.5-7.4 Gt of CO_2-eq per year for the entire agriculture supply chain. An even higher potential has been affirmed by the IPCC, which suggested options of cutting emissions in agriculture by as much as 7.2-11.0 $GtCO_2$-eq per year (Smith et al. 2014). This, however, would require very far-reaching management and demand-side changes.

Opportunities to reduce emissions in the global food system need to be seen in light of a world population growing by about 83 million people per year (UN 2017). It is expected that by 2100, there will be at least 11 billion people (Gerland et al. 2014), adding significant pressure on global agriculture (Godfray et al. 2010). For example, Springmann et al. (2018) expect that the food system's global environmental impact may increase by 50-90% between 2010-2050, unless there are major changes in diets, technology innovation and management, and reductions in food loss. As emphasized by the EAT-Lancet Commission on healthy diets from sustainable food systems, a global transformation towards plant-based diets will achieve the double-goal of reducing climate impacts and improving human health (Willett et al. 2019). For this, it will be necessary to provide more information on foods to consumers, and to

increase awareness of the importance of healthier, local, less processed foods, as well as food waste reduction to reduce emissions.

1.4 OVERALL CHALLENGE

The preceding sections have outlined that it will be increasingly difficult to achieve emission reductions at the scale required to limit climate change to 2°C, compared with pre-industrial temperatures. All sectors studied in the report are characterized by rapidly growing levels of emissions, contradicting efforts of decarbonization. Technology change alone will not be sufficient to achieve the very substantial year-on-year efficiency gains needed to support ambitious decarbonization trajectories. This highlights a new role for demand-side changes, which have significant potential for mitigation.

An example can illustrate the importance of distinguishing systemic, production-side decarbonization from individual, demand-side mitigation efforts that emphasize the importance of individual actions. A tour operator engaging in far-reaching efforts to reduce operational energy use and emissions may reduce specific energy use and emissions by 1-2% per year over a longer period, for instance by co-operation with a greener chain of hotels, or a "greener" airline environmentally outperforming others. Increases in customer numbers could lessen the reduction of emissions over time. In comparison, a tourist regularly embarking on long-haul holidays, may for climate reasons decide to only visit countries that can be reached by train. Compared to a business-as-usual scenario, such a decision will cut transport emissions by more than 90%, and probably more than half this tourist's annual tourist emissions. The example not only highlights the relevance of consumer choices, it also illustrates the challenge for tour operators (and destinations) to reconsider their tourism models, as average transport distances determine climate impacts (Gössling et al. 2015; 2017; 2019). This also suggests that in a world seeking to decarbonize rapidly, individuals, tour operators and destinations need to rethink their choices and actions. In particular destinations continue to be unaware of the challenges this implies, as well as the fact that very significant policies will be required to reverse trends of emission growth (UNWTO and UNEP 2018).

This is also true for the building and food sectors. The challenge is to radically transform economic systems, which will require production- as well as demand-side changes. For climate governance, this means that command-and-control as well as market-based measures need to be continued and enhanced. At the same time, greater emphasis has to be put on behavioural change as a key element in mitigation, while recognizing that the most significant progress on decarbonization can be made by addressing the most affluent population groups. It is also these groups that grow rapidly in per capita emissions, with evidence that they are likely to be more reluctant to change behaviour (Gössling 2019). Currently, there is little evidence of voluntary behavioural change at significant global scales, specifically among the high emitters.

1.5 CONCLUSIONS

- Nationally Determined Contributions (NDCs) as currently pledged are insufficient to meet the mitigation challenge;
- All three sectors studied in this report, tourism, buildings and food systems, are characterized by rapid growth in emission levels;
- To achieve emission reductions aligned with global 1.5°-2.0°C maximum warming goals will require fundamental changes in global consumption and production patterns;
- Differences in individual contributions to climate change require demand-side approaches to decarbonization (considering that affluent population groups emit more, in particular in transport & tourism sectors)
- There is a need to introduce demand-side measures alongside production-focused decarbonization efforts;
- Consumer information tools can stimulate behavioural change, the focus of this report.

2. TOURISM, BUILDINGS AND FOOD SYSTEMS: VALUE & SUPPLY CHAINS

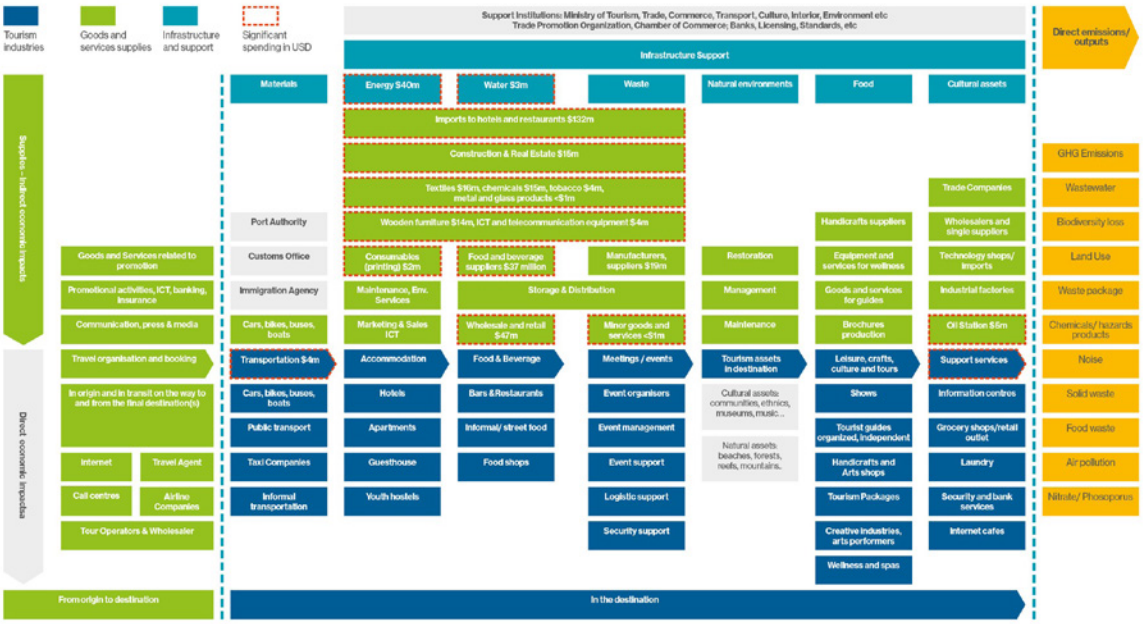
The three sectors studied in this report are characterized by different degrees of complexity in their production and value chains, all of which have repercussions for the identification of suitable mitigation strategies under consideration of the Sustainable Development Goals (SDGs). Any change in the three systems should consequently consider socio-economic and wider development outcomes, though acknowledging that climate change mitigation is an imperative.

As detailed in the following sections for each of the three subsectors, analysis of supply and value chains is generally complex, and often characterized by a lack of data. Furthermore, it may often be difficult to compare different elements of the chain, or to consider these in meaningful ways in their entirety, due to the incommensurability of effects (for example, the release of toxic substances cannot be compared to or be weighted against the effects of blue water consumption). Environmental impacts may often be related, however: Energy consumption entails water use; land use change is related to biodiversity loss and climate change. Supply chain flows also indicate that any change in one aspect of production can have great influence on overall effects. For example, emissions associated with the consumption of strawberries will to a considerable degree depend on production site (greenhouse or field) and transportation (long-haul/regional). These interrelationships are further discussed in the following sections for tourism, buildings and food systems.

2.1 TOURISM

The tourism value chain is complex, as each trip involves different subsectors of the tourism system, which in turn rely on their own value chains. In general terms, tourism depends on transportation, requires accommodation, and involves activities. Tourists also consume food, though their food choices are fundamentally

FIGURE 2.1: COMPLEXITY OF TOURISM SUPPLY AND VALUE CHAIN



United Nations Environment Programme (2019). Roadmap for low-carbon and resource-efficient tourism in the Philippines. p.12-13

different from those at home (Gössling et al. 2011). Figure 2.1 provides a detailed overview of aspects of the tourism value chain, showing the wide range of suppliers involved, as well as the differences in economic impacts related to tourism consumption. Consumer information on climate change can be relevant in different stages of the value chain, i.e. essentially whenever a decision regarding any specific aspect of the chain is made (transport, accommodation, food and beverages, shopping, arts and performances, etc.). However, not all of these aspects are equally important in terms of their relevance for climate change. Transportation is generally the major aspect determining the climate outcome of tourism activities, followed by accommodation (Gössling 2010). Hence, attempts to influence behaviour should have a focus on consumption that is particularly emission-intense.

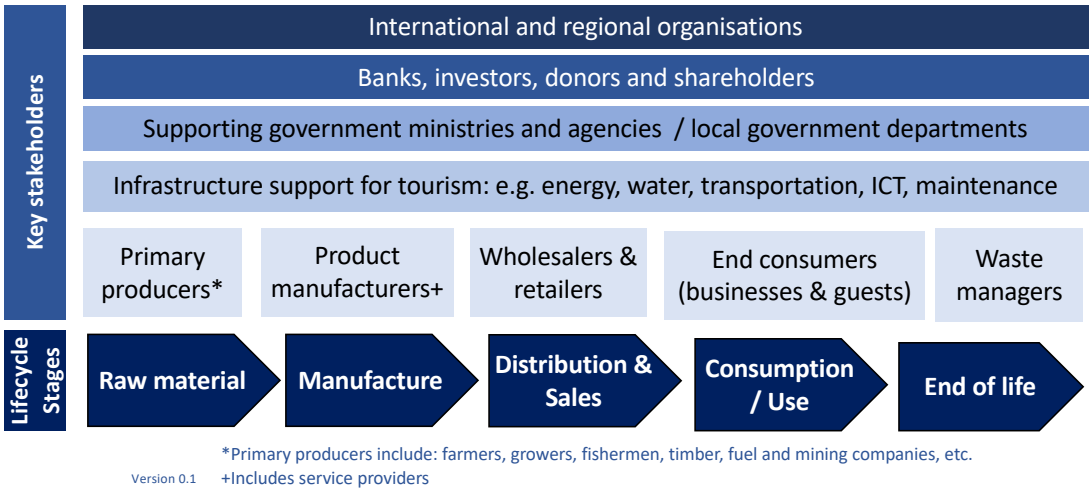
Figures 2.1 and 2.2 also reveal that consumers can only be influenced within limited parts of the tourism value chain, and that many decisions regarding climate change are made before or after consumption, and by non-tourism actors. This is illustrated in Figure 2.2, showing that "end consumers" (businesses or guests) are only one element in the chain. However, as consumers make decisions regarding the type of product/service they wish to purchase, which also has consequences regarding the waste generated, they can indirectly influence the entire value chain on the basis of their choices. There is thus a two-way relationship, i.e. where customers are empowered and willing to make pro-environmental decisions, this can potentially have consequences for raw material production, manufacture and service provisions, as well as waste management. This also means that consumption could turn into a self-reinforcing virtuous cycle of low carbon consumption, provided that information on product/service characteristics is actually provided and presented to customers in a way that increases the appeal to purchase environmentally "better" products/services.

2.2 BUILDINGS

The buildings and construction sector is fundamentally different from the tourism and food sectors. There is a need to distinguish climate change impacts related to new constructions, where decisions regarding building materials and architecture determine the amount of energy needed for constructions as well as these buildings' lifetime energy requirements (Bionova 2018). This is captured in the concept of embodied carbon[1] (IEA and UN Environment

1 "The extraction, processing, manufacture, transportation and use of a product utilises energy and produces many environmental impacts, including emissions of CO_2. With the exception of the generally more evident energy in use, these impacts are regarded as the hidden, or embodied, burdens. Embodied energy and carbon are not, in general practice, a consideration when a building is designed, specified and constructed." (Monahan and Powell 2011: 179).

FIGURE 2.2: COMPLEXITY OF TOURISM SUPPLY AND VALUE CHAIN

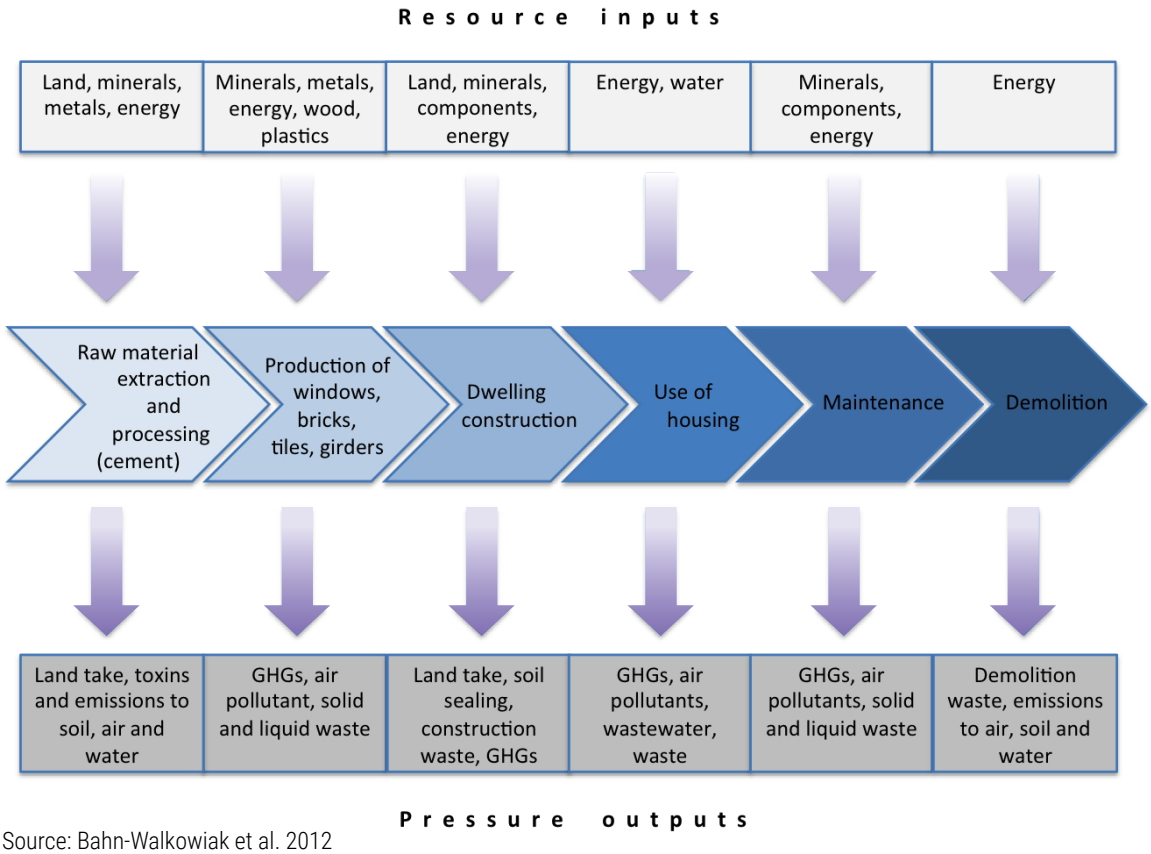


Source: UN Environment 2019

2018). Once a building is finished, a given amount of operational energy is needed to heat, cool or lighten the structure, representing a form of energy lock-in: throughout its lifetime, a residential home or commercial space will vary significantly in its operational energy requirements, depending on its design, construction and level of insulation (Lucon et al. 2014). Among the most effective ways to reduce operational energy demand are passive buildings and community design measures (IEA and UN Environment 2018). For older structures, there exist many options to reduce energy use through retrofitting, including additional insulation as well as technology change regarding heating/cooling/lightning. Depending on building type, which may be commercial or residential, there also exist many options to reduce emissions through management decisions. For instance, reducing average temperatures by one degree for either heating or cooling will lead to a significant decline in energy use (Lucon et al. 2014). Last but not least, homeowners or companies in many countries can opt to purchase green electricity from renewable sources.

The analysis of supply and value chains for buildings is consequently different from tourism or food systems. A simplified analysis of the supply chain for buildings is provided in Figure 2.3, showing that each stage of a dwelling's lifecycle involves the use of different resources. These require energy for their production, such as the machinery involved to extract raw materials, or the energy required to produce cement. Even when a construction is completed, the use of the structure will continue to demand a constant input of energy, such as for heating or cooling. At the end of the lifecycle the demolition of the building will again require energy. All stages consequently produce emissions, and it would be essential for builders as well as consumers to consider raw materials and house designs that involve low energy consumption for their production and later for the use of the building. While policy measures such as performance-based building codes or financial incentives such as tax credits exist to improve building standards or to retrofit existing buildings so they are less energy demanding, the low cost of energy in many countries can act as a disincentive. A lifecycle perspective can help with

FIGURE 2.3: RESOURCE INPUTS AND WASTE OUTPUTS DURING BUILDING LIFECYCLE STAGES



Source: Bahn-Walkowiak et al. 2012

setting the right incentives. As outlined in IEA and UN environment 2018: 46-47:

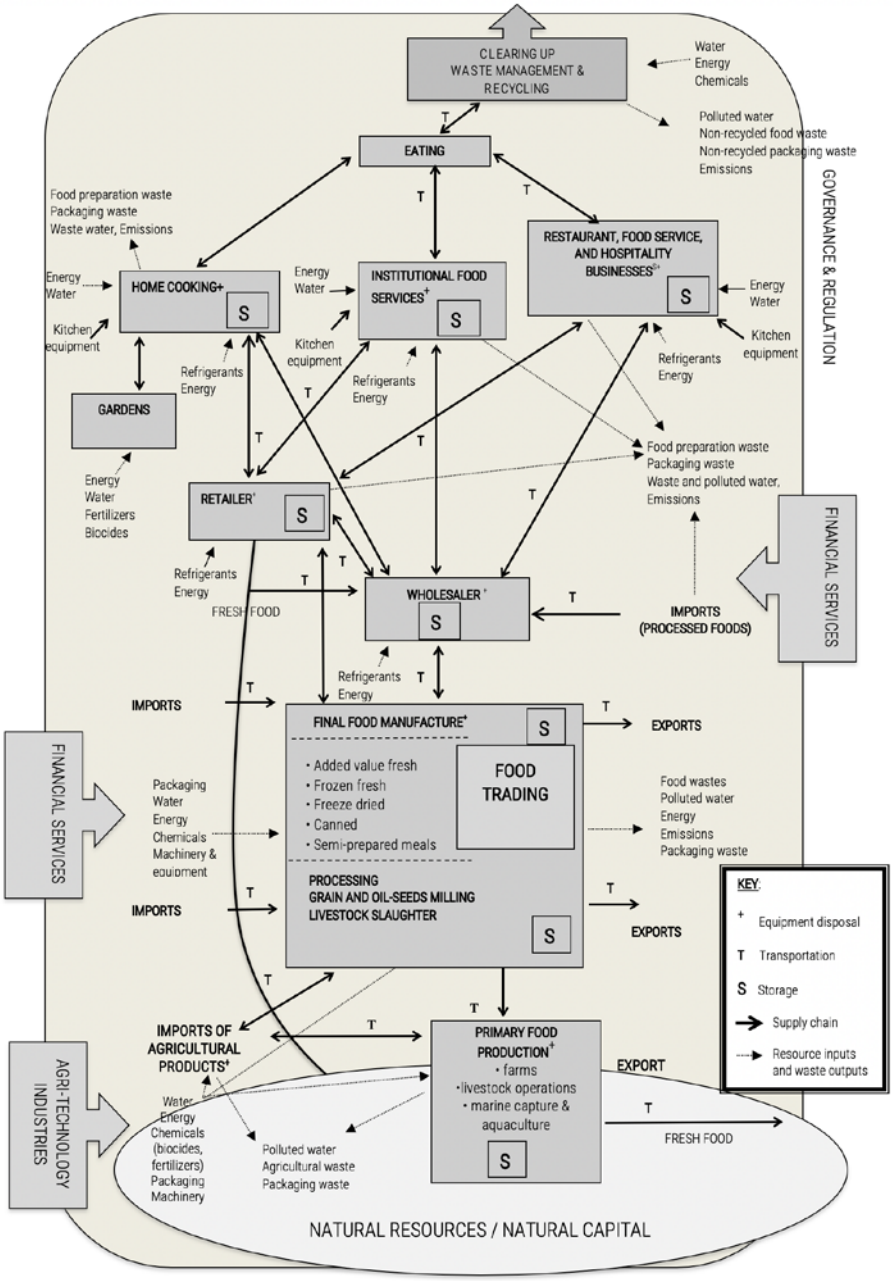
Life-cycle analysis (LCA) can promote the development of sustainable construction because it provides a better understanding of construction impacts on embodied and operational energy (Lehne and Preston, 2018). Globally, LCA is not commonly used today, although it is putting focus on carbon abatement measures in buildings. Efforts are emerging to collect data and implement policy frameworks based on LCA, but broadly speaking they fall short on promoting life-cycle assessments globally.

2.3 FOOD SYSTEMS

Expanding demand is a major driver in the development of the global food system[2], specifically for animal protein and highly processed foods. Of equal importance are large corporations supporting market concentration processes while forcing producers to reduce production cost (Declaration of Bern 2014). As

2 Food systems gather all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation, and consumption of food and the outputs of these activities, including socioeconomic and environmental outcomes (HLPE 2017).

FIGURE 2.4: FOOD SYSTEMS SUPPLY AND VALUE CHAIN COMPLEXITY



Source: Hall and Gössling 2013

various studies have shown, "cost" is however also the most important factor when considering food purchases (Emberger-Klein and Menrad 2018; Hartikainen et al. 2014). This has increased pressure on food producers and continues to encourage the industrialization and globalization of food production and consumption.

Figure 2.4 illustrates the complexity of the flow of materials as well as inputs and outputs of the food system, also indicating where resources are wasted or where the system generates different types of waste. Emissions occur at every stage of food production and consumption. The figure also shows that the food and agricultural sector is embedded in a complex food system, which includes financial services, governance and regulation, wholesalers, waste management and recycling, restaurants, as well as a global agro-food industry (Hall and Gössling 2013).

Greenhouse gas emissions are but one of the global food system's aspects of environmental concern, but a highly relevant one (Hall and Gössling 2013). Reductions in greenhouse gas emissions are theoretically possible throughout the food system, with its main components being production, trade, food processing, retail and consumption. This enables very different stakeholders to support decarbonization, though in a system largely managed on principles of cost-effectiveness, this is unlikely to be a priority for consumers and other stakeholders such as restaurants.

On a global scale, urbanisation and industrialization, market liberalisation, growing incomes, and changes in consumer attitudes have all contributed

to changes in food consumption patterns (Kearny 2010). These have resulted in a Westernization of food cultures, i.e. an increased intake of meat, fat, processed foods, sugar and salt. These systemic changes have in turn been facilitated by the global rise in supermarkets, year-around availability of foods, long shelf lives, and the growth of the global food agroindustry (Kearny 2010). Carbon information tools can contribute to a greater interest in food production processes.

Compounding this, the carbon-intensity of food systems is increasing, as a result of global trends to consume a higher share of animal protein (Kearny 2010; McMichael et al. 2007). Animal protein production increases impacts on climate change, land use, and has negative associated impacts such as acidification, eutrophication, and water use (Poore and Nemecek 2018). Evidence suggests that the system is developing in a direction that makes it more carbon intense.

2.4 CONCLUSIONS

- Value chains in tourism, food and buildings are characterized by different degrees of complexity;
- In tourism, transportation is generally the major aspect determining the climate outcome of tourism activities, followed by accommodation. In buildings, each stage of a dwelling's lifecycle produces emissions, and it is essential to consider materials and designs that involve low energy consumption for both production and use of the building. In food, reductions in greenhouse gas emissions are possible throughout the food system, with its main components being production, trade, food processing, retail and consumption.
- Due to this complexity, consumers and corporate stakeholders have difficulties in considering the effects of their choices down the supply chain;
- Information tools, to be comprehensive and comparable, would have to be based on identical system boundaries/life cycle analyses, ideally considering the entire life cycle of the products/services assessed.

3. CONSUMER BEHAVIOUR

3.1 GOALS OF CHANGING BEHAVIOUR

Tools designed to change consumer behaviour can be considered voluntary soft policy instruments (Cohen et al. 2014). Policy makers often favor these over market-based measures (e.g. carbon taxes) or command-and-control approaches (e.g. fuel efficiency standards) in that voluntary mechanisms place responsibility for outcomes of consumption with the consumer. Information tools that can guide consumer decisions include carbon certifications, business climate performance rankings, as well as more specifically designed educational tools such as dedicated applications and websites. Apart from supporting behavioural change, informational tools should ideally increase carbon literacy, i.e. awareness of the consequences of climate change; knowledge regarding the causes of climate change; the implications of various consumer choices in terms as their contribution to global warming; and opportunities for low-carbon cultures and lifestyles (Howell 2018). Desirable change in consumer behaviour would comprise five dimensions:

- **Avoidance** – to not consume specific items at all;
- **Shift** – to use products that are comparably less carbon-intense;
- **Saving** – to use products over longer time-frames before replacing them;
- **Consideration** – to induce spill-over effects, i.e. one behaviour influencing others;
- **Vote** – empower political parties that advocate policies to reduce consumption, or that increase pressure on businesses to decarbonize production.

To be effective, information tools would have to induce significant changes in consumer behaviour. In the context of the sectors studied in this report, this may for instance include low-carbon transport or accommodation, voluntary carbon offsets, the choice of closer destinations, less frequent travel, or longer stays (tourism); homes or offices that are smaller, built with low-carbon construction materials, and in an energy efficient manner, better insulated, and using low-carbon sources of heat and electricity (buildings); vegetarian or vegan foods, regional or organic food, as well as the avoidance of climatically harmful foods.

An important difference between carbon information tools in the context of tourism, foods, and buildings is the frequency of consumption. For example, tourism is a form of consumption that is more rare (often bi-annual), extending over shorter periods of times, in more indulgent contexts. In comparison, food choices are everyday choices more strongly characterized by food preferences, cultural aspects, income levels, or food accessibility. Choices related to appliances and their use in a home or office will vary in frequency, while decisions made in the context of rented homes, renovations, or house purchases are occasional or rare, and often more context-dependent (e.g. market situation; personal preferences).

Information tools should consider these differences, and work towards three interrelated goals, i.e. to:

- **Inform** about product carbon characteristics, and hence to empower consumers to consider their actions. This should include the relevance of different time-horizons, such as for food and tourism (short- to medium term) and buildings (shorter to longer-term);
- **Inspire** lower-carbon choices, i.e. to convince consumers that low-carbon products or services are qualitatively "better", in both personal and societal terms;
- **Increase** carbon literacy, i.e. to contribute to an understanding of the emissions problem underlying all consumption, as well as the linkage between greenhouses gases and climate change.

3.2 PSYCHOLOGY OF CONSUMER BEHAVIOUR

Consumer choices are complex, and interventions to stimulate behavioural change have been investigated out of various theories of behaviour, such as norm-activation theory (Schwartz 1977), theory of planned behaviour (Ajzen 1985), or value-belief-norm theory (Stern 1999). It is now generally acknowledged that behaviour is influenced by contextual factors (knowledge, cost, alternatives, social norms) as well as personal factors (early cognitions, perceptions, moral motivations, personal norms, and habits) (Steg and Vlek 2009). Any intervention to change behaviour through information tools will thus be embedded in complex frameworks of wider social conditions and norms suggested by an individual's social environment, as well as the characteristics of personal identities, gender (UNEP 2016) and values.

These principal factors need to be considered in any campaign to change behaviour. To date, climate change interventions have relied on three approaches (van der Linden 2014): Early campaigns were based on cognitive-analytical approaches, assuming that knowledge changes attitudes and attitudes change behaviour. Subsequent campaigns then used affective-experiential approaches, often based on negative emotional appeals and guilt messaging. The most recent campaigns have relied on social-normative approaches, promoting social and moral norms to trigger behavioural change.

For the best chance at persuading individuals to overcome psychological barriers to low-carbon choices, evidence to date indicates that information tools should consider the following (Deutsch and Gerard 1955; van der Linden 2014).

- Factual, procedural and effectiveness knowledge, i.e. "what is the problem, how can you address it, and which differences will this make";
- Appeals to cognitive, experiential and normative dimensions of behaviour, i.e. indications of a positive expectation of behaviour in line with what the majority does;
- Consideration of injunctive norms, i.e. that behaviour is commonly approved and morally right to do.

There is much evidence that attitudes towards sustainable business practices is positive, and that a growing number of consumers are intent to positively contribute to climate change mitigation (e.g. Eurobarometer 2011; Hall 2013). Public awareness of the role of energy consumption for climate change is also increasing (e.g. Barr et al. 2010; Higham and Cohen 2011), as is the understanding of specific types of consumption as having greater importance for climate change, such as air travel (Cohen and Higham 2011; Higham and Cohen 2011). The consumption of meat is another aspect not associated with its 'true' climate impact, i.e. consumers still believe that meat is less significant for mitigation (Camilleri et al. 2019), in spite of evidence to the contrary (Hedenus et al. 2014). This shows that additional educational efforts are needed to increase carbon literacy of food systems. Awareness and education should use gender responsive and gender sensitive language to maximize impact as evidence shows that gender norms are drivers for meat consumption (UNEP 2016).

The significance of behavioural change as being supported by carbon literacy or triggered by information tools is currently unclear. This can be illustrated for air travel. Within aviation, there is very limited evidence of behavioural change, as in particular frequent air travelers seem reluctant to change behaviour or to buy carbon offsets (Araña et al. 2012; Cohen and Higham 2011). Business travel in particular may be considered mandatory, though research has highlighted secondary motives such as mileage runs to stay within or reach higher frequent flier classes (Gössling and Nilsson 2010). Social obligations such as visiting family, or social status-seeking appear to have greater relevance than environmental concerns (Gössling and Stavrinidi 2016). Research has thus concluded that efforts to reduce air travel based on voluntary soft policies are unlikely to yield any significant result (see, however, Box 3.1).

In other areas, such as food consumption, recent research has also highlighted that consumers may not be aware of the climate change impacts of their choices (Camilleri et al. 2019). Gose et al. (2016) affirm that there is very limited evidence for changes in diets. Overall, much evidence thus suggests that behavioural change as a result of information campaigns or certification is limited in tourism and the food sector (Araña et al. 2012; Cohen and Higham 2011; Fuerst et al. 2015; Hyland et al. 2013; Karlsson and Dolnicar 2016). This again highlights the complexity of behaviour, and the many dimensions weighing into consumer decisions. Asioli et al. (2017) illustrated this for example for organic food (Figure 3.1, next page).

While there is thus much evidence that observed behavioural change is not significant enough to contribute to an absolute decline in emissions in the different sectors discussed in this report, there ***is*** evidence that informational campaigns and certifications do affect choices and that these can be improved in their efficiency. Disparities between expressed consumer values and demonstrated actions may also be expected in situations where personal costs are weighted against more diffuse social benefits (Kollmuss and Agyeman, 2002; Stoll-Kleemann et al., 2001). It has been argued that psychological barriers may be particularly significant in tourism, where holidays are considered short and socially legitimate

BOX 3.1: FLIGHT SHAME AND BEHAVIOURAL CHANGE IN AVIATION

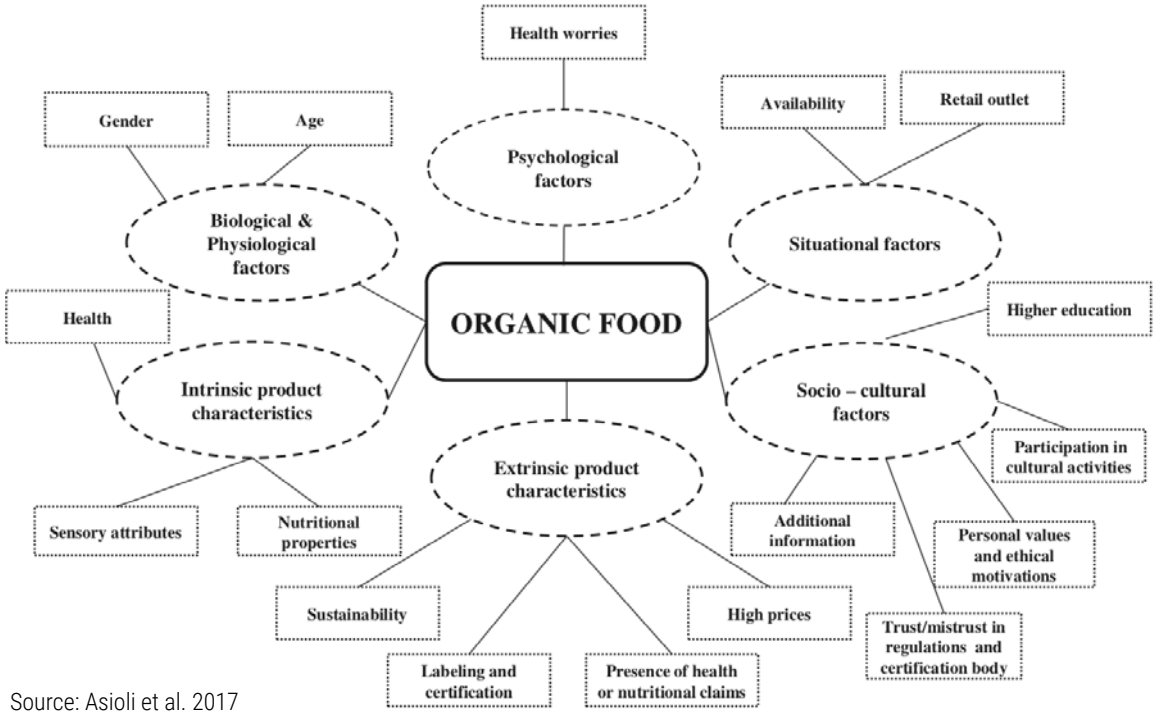
The early months of the year 2019 have seen a growing debate on aviation in a number of countries. Under the newly coined term "flight shame", discussions acknowledge that flying is an environmentally harmful activity, as it contributes disproportionally to climate change. "Flight shame" consequently refers to feelings of engaging in consumption that is climatically destructive, and not aligned with the United Nations' Sustainable Development Goals. Flight shame is an emotion mostly expressed by those concerned about climate change and has had implications for air travel as well as the way flying is perceived by the broader public.

The term flight shame ("flygskam") emerged in Sweden, a country that had seen a public debate on air travel's environmental implications for at least a decade, i.e. since the publication of the 4th Assessment Report of the IPCC in 2007. The energy intensity of flying and its associated high per capita emissions of greenhouse gases were aspects taken up by climate mitigation advocate Greta Thunberg, as well as celebrities such as Swedish biathlete Björn Ferry, who vowed to not fly anymore. A wide range of Swedish politicians has also supported campaigns to use trains rather than to fly, while policymakers continuing to fly faced public scrutiny over their behaviour, as high-speed trains are readily available in Sweden. Bloomberg (2019) reports that 23 percent of Swedes have abstained from traveling by air in the past year to reduce their climate impact, up 6 percentage points comparing to the previous year. Some 18 percent have chosen to travel by train rather than air. Swedavia, which operates 10 airports in Sweden, states that domestic travel has dropped 3 percent last year.

The debate subsequently was taken up in other countries, including Denmark, Germany and France, raising the question of individual responsibility: airlines and other industry associations had so far invested considerable efforts into the depiction of aviation as a "negligible" emissions sector (in terms of its overall contribution to climate change). This omitted the fact that only a very small proportion of humanity flies, with emissions from even single flights exceeding global average emissions per person per year. In other words, flying is one of the most energy intense human activities, which the new debate highlights.

Perhaps even more important is that the public perception of flying is changing. For decades, frequent air travel has been associated with high social status. This is about to change, as in particular frequent fliers are seen as weighing personal benefits over wider societal goals. This view is supported by publications showing that business travellers choose highly mobile lifestyles: Not all flights are necessary for business development and may serve other purposes such as mileage runs to stay within a given frequent flier class (Gössling and Nilsson 2011). Even frequent leisure travel by air may often serve the primary purpose of social capital generation (Gössling and Stavrinidi 2016).

FIGURE 3.1: THE COMPLEXITY OF PURCHASING DECISIONS FOR ORGANIC FOODS



Source: Asioli et al. 2017

opportunities for recovery and relaxation (Cohen et al. 2014; Hibbert et al. 2013). In line with this, Buckley (2012) suggests that while certification schemes continue to increase in number and to become more widespread, they have limited importance for consumer decision-making, because benefits accrue to tourism stakeholders and society, rather than the individual tourist. Compounding this, certifications have low market penetration and low reliability, as their criteria are not transparent to consumers.

Yet, information tools and certifications stimulate behavioural change, with research highlighting the importance of cultural context and location, nationality, place attachment, and socio-demographic characteristics such as age and income (Dolnicar et al. 2017; Gössling et al. 2019; Knezevic Cvelbar et al 2016) (Box 3.2). Often, it is enough to include cues to trigger responses. For example, restaurant studies have shown that introducing nutritional information in menus will increase sales of low-fat menu items (Albright et al. 1990); descriptive food names make such items more attractive (Wansink et al. 2001); and pictures have a positive effect on consumer attitudes (Hou et al. 2017). Even just adding images related to the sea will increase fish choices (Guénguen and Jacob 2012). This underscores the importance of tailoring information tools to specific audiences and purposes. Notably, where personal benefits can be highlighted, as in the case of "local" foodstuffs, this will increase their attractiveness (Feucht and Zander 2018; Röös & Tjärnemo 2011). Such situations represent opportunities to strategically combine more tangible individual benefits with wider social benefits.

As this discussion highlights, information tools must overcome significant psychological barriers, though carbon information appears to be generally perceived positively (Penz et al. 2017). On the side of businesses, this begins with communication strategies, as businesses seem reluctant to discuss their sustainability performance even where progress has been made (Font et al. 2017; Geerts 2014). Furthermore, a major challenge is to mainstream sustainability as an important aspect of brands, and to identify suitable ways of communicating key performance indicators. For example, none of the large tourism platforms have verification systems in place to monitor sustainability indicators to rank the performance of businesses promoted in their platforms.

An important insight is thus that currently, information tools will only reach limited audiences, simply because they have such a limited importance

BOX 3.2: ASPECTS INFLUENCING BEHAVIOURAL CHANGE

In a large-scale experiment seeking to influence towel reuse in hotels, a wide range of aspects were found to influence the effectiveness of interventions (Gössling et al. 2019):

- Analysis showed considerable differences between tourist nationalities. The highest towel reuse rates were observed among visitors from the Nordic countries, which may be explained with stronger beliefs in common values, co-operation and environmental engagement.
- Willingness to participate in towel reuse programmes was found to be age-dependent, increasing from 18-35 years, and declining thereafter. Highest was willingness to participate among middle-aged guests, who appear to be the most concerned with environmental outcomes.
- Guests in four-star hotels are the most likely to support towel reuse. A potential explanation is that in three-star hotels, which attract less affluent guests, customers may feel that they have paid for towels and that they are entitled to changes. Guests in five-star hotels, on the other hand, may be less concerned with resource conservation, generally leading lifestyles that are more resource consumptive.
- Analysis also showed that participation in the towel reuse scheme declined over time. After five days, the effect of re-use messages dissipated, confirming that interventions are rarely long lasting.
- Finally, a notable difference in participation was also found between first time and returning visitors. Returning visitors participated more often in towel reuse, possibly as a result of greater loyalty to the hotel and place attachment.

Source: Gössling et al. (2019)

in communication strategies. A related insight, however, is that it is also useful to direct campaigns at specific groups. For example, Luís et al. (2018) clustered consumers, identifying "Alarmed" and "Concerned activists" as more interested in pro-environmental action, while also identifying groups largely unconcerned by climate change (the "Disengaged" and "Doubtful"). Rather than to direct informational campaigns at the latter, momentum can be more easily built where consumers are already knowledgeable of the problem and have more positive attitudes towards change.

There is evidence that with growing knowledge on climate change and its underlying causes, as well as knowledge helping to make better decisions, there is room to improve and widen the role of consumer information tools. Even where these do not contribute to more climate-friendly choices (i.e. changes in habits), they can increase positive attitudes (Eijgelaar et al. 2016) and carbon literacy, and thus become tools supporting behavioural change on a longer-term basis by redefining social norms.

3.3 CONCLUSIONS

- Consumer behaviour can be influenced on the basis of command-and-control, market-based or voluntary change approaches;
- Consumers are more averse to command-and-control and market-based measures (also because these are often poorly communicated), making policy makers more inclined to rely on voluntary change;
- There is little evidence that voluntary behavioural change contributes to significant changes in overall consumer behaviour;
- Information tools do yield responses, though on modest scales;
- This highlights the need to improve carbon literacy levels in the wider population to change social norms;
- Information tools can be optimized to increase their efficiency by considering the complexity of consumer psychology, including gender norms.

4. CONSUMER INFORMATION TOOLS

4.1 GENERAL CONSIDERATIONS REGARDING INFORMATION TOOLS

There exists a wide range of consumer information tools with relevance for climate change (Gössling and Buckley 2016; Plüss et al. 2016). Yet, most of these tools make a limited contribution to mitigation, as they occupy specific niches in tourism and food consumption, as well as the construction sector, and are often only indirectly relevant for climate change.

Even though this report discusses various information tools, its main focus is on certifications, which should not be confused with eco-management or audit tools, such as the European EMAS, or the international ISO 14001 standards (Duglio and Beltramo 2016, see also Box 4.1).

This section also includes a wide range of best practice examples for carbon certification, rankings and other consumer information tools with potential to affect consumer decisions and to increase carbon literacy. Examples are not necessarily representing a design optimum. Depicted tools are the best as identified for this report in tourism, buildings and food systems.

Certifications are commonly used as tools for policy and marketing, as well as to guide consumer decisions in many industry sectors, including tourism, buildings, and food systems. They can also help companies to benchmark their products or services, and to improve their performance. Carbon labels are specifically designed to focus on energy use and emissions of greenhouse gases. As outlined in the preceding section, all ecolabels, including carbon labels, rely on forms of persuasive communication, i.e. they seek to entice consumers to purchase a product or develop a favorable attitude to a product on the basis of information. This requires that individuals understand that information, appreciate its significance, trust its reliability, and feel empowered to act more sustainably (Gössling and Buckley 2016). Carbon certifications should

BOX 4.1: STANDARDS, LABELS, AND CERTIFICATIONS

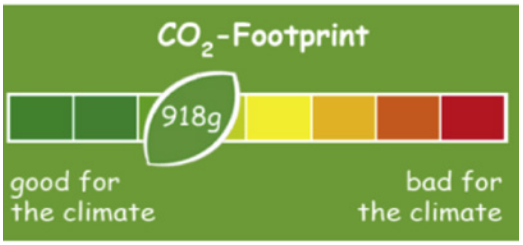
In this report, the following definitions may help to distinguish standards, labels, and certifications.

Standard refers to specific criteria or norms of material goods or services, which may also serve as benchmarks.

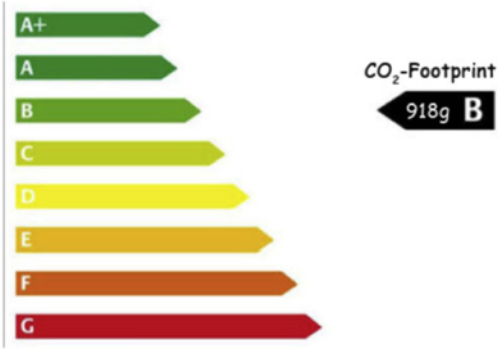
Label describes a logo or stamp highlighting a product or service's specific characteristic(s), which may also be used as a form of trademark.

Certification refers to a formal accreditation process, in which it is confirmed that the certified entity meets a given set of (minimum) standards.

FIGURE 4.1: TWO DIFFERENT CARBON LABELS, SIGNIFICANT DIFFERENCES IN APPEAL



Design A



Design B

thus ideally be designed to address various knowledge dimensions, i.e. factual, procedural and effectiveness knowledge (van der Linden 2014).

As highlighted by Liu et al. (2016), most existing labels depict carbon impacts in terms of weight or color scheme, sometimes also denoting a product as "carbon free". The wide range of existing schemes prompted Liu et al. (2016) to critically observe a number of general weaknesses of existing carbon schemes. This includes the lack of standardization for measurements, the use of different system boundaries, the inclusion of CO_2 (vis-à-vis the full range of greenhouse gases). Even though not mentioned by Liu et al. (2016), this is particularly problematic in the context of air travel, where short-lived non-CO_2 emissions have a considerable impact on global warming (Lee et al. 2009). Further critique by Liu et al. (2016) includes that carbon labels are not used widely, particularly not in developing countries, and that these remain difficult to understand for consumers.

Various studies investigated the effectiveness of certifications, comparing for instance the efficiency of carbon labels, "climate-friendly" claims, organic indications, and "local" claims on the basis of willingness to pay (Feucht and Zander 2018). Findings indicate that "local" classifications are by far the most relevant aspect for consumers, while carbon labels have less relevance. This confirms earlier studies investigating label familiarity, i.e. the degree to which people can associate a specific context with different types of certifications (Sharp and Wheeler 2013). As Feucht and Zander (2018) also compared the design of two different carbon labels, they were able to show that appeal is design-dependent. Design A in Figure 4.1 yielded for instance two to four times higher willingness to pay values than design B when tested in six countries for a liter of milk. Given the wide range of possibilities to design certifications, this opens up for opportunities to optimize designs in order to increase their appeal.

While the terminology "carbon footprint" appears to be understandable to most consumers, it is less clear how Designs A or B (Figure 4.1) compare to other labels, such as the more widely used Carbon Trust certification (Figure 4.2; Sharp and Wheeler

BOX 4.2: COMPARATIVE AND ABSOLUTE MEASURES OF CARBON INTENSITY

A major challenge for consumers is to distinguish comparative and absolute measures of carbon intensity. For example, a product/service may be relatively (comparatively) better than another, as a result of more efficient production processes, or smaller transport distances. Yet, the product/service itself may still be climatically problematic to consume, as the absolute amount of emissions entailed in the product makes a comparably large contribution to climate change. To illustrate this: There are huge differences in the carbon intensity of beef (Gössling et al. 2011). Depending on production site characteristics, one kg of beef may cause emissions of between 13-29 kg CO_2-eq. A carbon label can help distinguishing products, and where a choice of beefs is available, consumers can opt for the product with the lowest amount of CO_2-eq. Given that sustainable per day emissions are in the order of just 10 kg CO_2-eq per day*, consumption of beef is problematic from a climate change point of view, as a 200g steak would already correspond to 25%-60% of daily sustainable emissions.

* Calculation based on the assumption that current emissions of about 5t CO_2-eq per year and person (World Bank 2018) are unsustainable, and need to be reduced by about 20% by 2025. This corresponds to 4 t CO_2-eq per year, which, divided by 365 days, equals about 10 kg CO_2 per person and day.

FIGURE 4.2: CARBON TRUST FOOTPRINT LABEL

Reproduced from Sharp and Wheeler (2013)

2013). Color schemes are likely better in helping to intuitively rank the climate impact of a product. As additional information is available on emissions (in g CO_2), both labels in Figure 4.1 also increase carbon literacy – consumers learn to appreciate how much a kg of CO_2 is, in comparison between product types or identical products. Yet, in a climate change context, it would also be relevant for consumers to be informed about the absolute impact of their choices, i.e. whether specific items should not be consumed at all (Box 4.2).

The Carbon Trust's carbon footprint label (Figure 4.2) may be more suitable in this regard, as it provides additional information, i.e. the label increases procedural knowledge (van der Linden 2014) by advising consumers as to how they can reduce emissions – in this case by adjusting washing temperatures. Further information may be added that highlights sustainable per day emissions (Box 4.2) to move from relative measures of carbon (how emission-intense is consumption of this product?) to absolute comparisons (does consumption of this product add significantly to my personal emissions?). This kind of information would be particularly relevant in the context of holiday emissions, which will often vastly exceed the emissions associated with day-to-day purchases such as groceries.

Certifications could be further improved by adding normative appeals. As outlined in chapter 3, normative appeal designs have influence on decisions, specifically when they highlight social norms (to conform with a positive expectation of the majority) as well as injunctive norms (to make a choice that is morally right) (Deutsch and Gerard 1955). As an example, highlighting that a majority of consumers make low-carbon choices can increase uptake. This has for instance been shown in the context of towel reuse in hotels (Gössling et al. 2019). Where products can be associated with personal benefits, this is likely to have great relevance for their acceptance. As an example, beaches awarded with the Blue Flag have been shown to attract significantly greater domestic tourism flows, as a result of quality perceptions (Cerqua 2017).

Three major challenges emerge from this discussion. The first is to identify common system boundaries that make carbon labels comparative, i.e. to assess products and services on a basis that is based on identical inventory guidelines. The second is to develop certifications that are optimized in terms of their appeal design. Labels should not only be easy to understand, they should also contribute to carbon literacy and increase willingness to prefer low-carbon products/services. Third, standards and certifications have to cover a far greater number of items and become more visible in consumption contexts. In other words, only where certifications cover most products or services, and where these are widely recognized, they will more regularly influence consumption choices. Specifically where labels are harmonized, and more limited in number, the likelihood of recognition by consumers will increase.

A major obstacle to the wider introduction of certifications is the involvement of businesses, for which barriers such as a lack of knowledge, perceived expenses, lack of time, or amount of work involved in compliance have been identified (Jarvis et al. 2010). This raises the question as to whether more products and services should be made comparable on the basis of legislated certification schemes. This is essentially already the case in the building sector, where information on the energy-efficiency of buildings is mandatory in the European Union. Certification has already been shown to have economic implications, as willingness to pay increases for more energy-efficient buildings (Fuerst et al. 2015; Hyland et al. 2013). As a further step, labelling could include information on carbon emissions, highlighting the link between energy efficiency and emissions. Similar approaches could be introduced in tourism and for food systems, though with very different degrees of complexities: Food carbon certification, for example, is far more complex due to the many aspects determining carbon intensities. The assessment of emissions associated with air travel is easy in comparison.

4.2 CONSUMER INFORMATION TOOLS IN TOURISM

Tourism is a complex economic sector including elements of travel and transportation, accommodation, attractions, shopping, events, food, as well as various services

connecting these. Institutionalized attempts to increase the environmental sustainability of tourism date back to the early 1990s, when the Eco-Management and Audit Scheme (EMAS) was introduced in Europe (Weston et al. 2018). Serving more as a tool for businesses to understand and improve their environmental performance, to reduce cost, and to communicate to customers, the scheme developed into a range of tourism information tools. Certifications in particular are now seen as an important tool (Vandenbergh et al. 2011). For example, the Centre for European Policy Studies (Renda et al. 2012) identified 100 labels related to quality, covering a wide range of aspects such as hospitality, culture, recreation, hygiene, and other tourism services. The review for this report led to the identification of 57 tourism-specific labels (see Annex 4.1, based on Ecolabel Index[3] 2018 and Plüss et al. 2016). It is possible that less successful certification schemes are given up. For example, a number of platforms and tour operators presented in Gössling and Buckley (2016) do no longer exist.

3 Ecolabel Index is a website providing an overview of sustainability-related certifications worldwide. The site counts 463 ecolabels and standards, in 199 countries, and 25 industry sectors. A review of labels relevant to this report has been added in the Annex, also identifying certifications including elements of greenhouse gas assessments and mitigation.

4.2.1 CERTIFICATIONS: OUTREACH AND WHAT IS INCLUDED

Tourism certifications can cover several aspects of a trip or be specifically focused on individual elements of a holiday. Certifications for hotels can for example only include lodging-related emissions, while certifications of tour operators will usually embrace wider business practices. Tourism has also great relevance for food production, because restaurants often source foodstuffs from global markets, while tourists have been observed to eat greater quantities of food on holiday than at home, also including a greater share of animal protein (Gössling et al. 2015). On holiday, people generate greater amounts of food waste than at home (Juvan et al. 2018).

Even though tourism certifications have existed for decades, the share of tourism operators affiliated with a certification is still limited. A study on tourism labels in the EU suggests, for example, that close to 17,000 European accommodation

BOX 4.3: TRIPADVISOR AND THE GREENLEADERS PROGRAM

GreenLeaders is a free program helping eco-friendly businesses to better market themselves on the basis of their environmental credentials. Accommodation providers meeting specific standards will be awarded the GreenLeaders badge, which is visible on the listing page. Depending on commitment and achievements, businesses can attain the level of GreenPartner, or qualify for Bronze, Silver, Gold or Platinum badges. Requirements include:

- Having linen and towel re-use plans
- Tracking energy usage on a regular basis
- Recycling
- Using energy efficient light-bulbs
- Educating staff and guests on green practices
- Properly treating waste water (either using an on-site or municipal sewage system)

Notably, most of these measures are economically meaningful or legislated in many countries. The GreenLeader verification process is based on "audits". In order to apply and to receive an "achievement score", businesses need to provide information submitted through an online survey. The claims made are verified by "independent expert sustainability organizations", which may ask businesses to send documentation on their practices. No on-site visits are made. Greater reliance is placed on travelers, who can access information regarding the green practices they can expect. Travelers are then invited to comment on the green practices of the properties, and to report "false information", which may trigger an audit.

Source: TripAdvisor 2018

businesses are certified with a sustainable tourism label (Weston et al. 2018). Yet, the largest share (7,000, or about 42%) fall under TripAdvisor's "GreenLeaders" program, a label scheme that does not appear to have a third party verification process of business performance (see also Box 4.3). Among the remaining certifications, Green Key (1,500 businesses), ECEAT Quality Label (1,300), Green Tourism (1,200), Eco-Lighthouse (1,200), European Ecolabel (789) and Écogite (644) are the largest. Many other certifications list fewer than 100 accredited businesses, and often fewer than 10 (Weston et al. 2018; Plüss et al. 2016).

Measured against the overall number of accommodation establishments in Europe, numbers imply that tourism certification schemes have a very limited outreach. To estimate the share of certified tourism accommodations for this report, their number can be compared to listings in the largest reservation platform, Booking.com. The platform does not provide a comprehensive list of existing accommodation businesses, but it cooperates with some 750,000 partners in Europe (based on a review of nationally registered listings for this report). This would suggest that the share of certified or labelled accommodations in Europe is lower than 2% of all businesses, notably including the 7,000 establishments signed up as TripAdvisor GreenLeaders (cf. Weston et al. 2018). Given Europe's leadership in certification programs (Ecolabel Index 2018; Plüss et al. 2016), the global share of certified businesses is likely to be even lower.

While this indicates a need for tourism certifications to be adopted by a greater number of stakeholders, available data shows considerable differences in national uptake. Norway, for example, counts 1,200 accommodations under the national Eco-Lighthouse certification, corresponding to about a quarter (25%) of Norwegian properties listed by Booking. National studies have also highlighted differences in market penetration depending on touristic entity, with for instance Strasdas et al. (2016) suggesting that some 8% of accommodations, 2% of beaches, 7% of campsites, 21% of golf courses, and 5% of marinas in Germany are certified. Strasdas et al. (2016) also note that certified businesses include a considerably larger number of small and medium enterprises than large businesses. The latter are the more climatically problematic entities in terms of relative (share of total) and absolute (per bed night) resource use and emissions of greenhouse gases (Gössling 2010). In other words, were the market uptake and visibility of certifications measured against bed or guest/client numbers, rather than certified business numbers, the share of certified entities would be considerably lower.

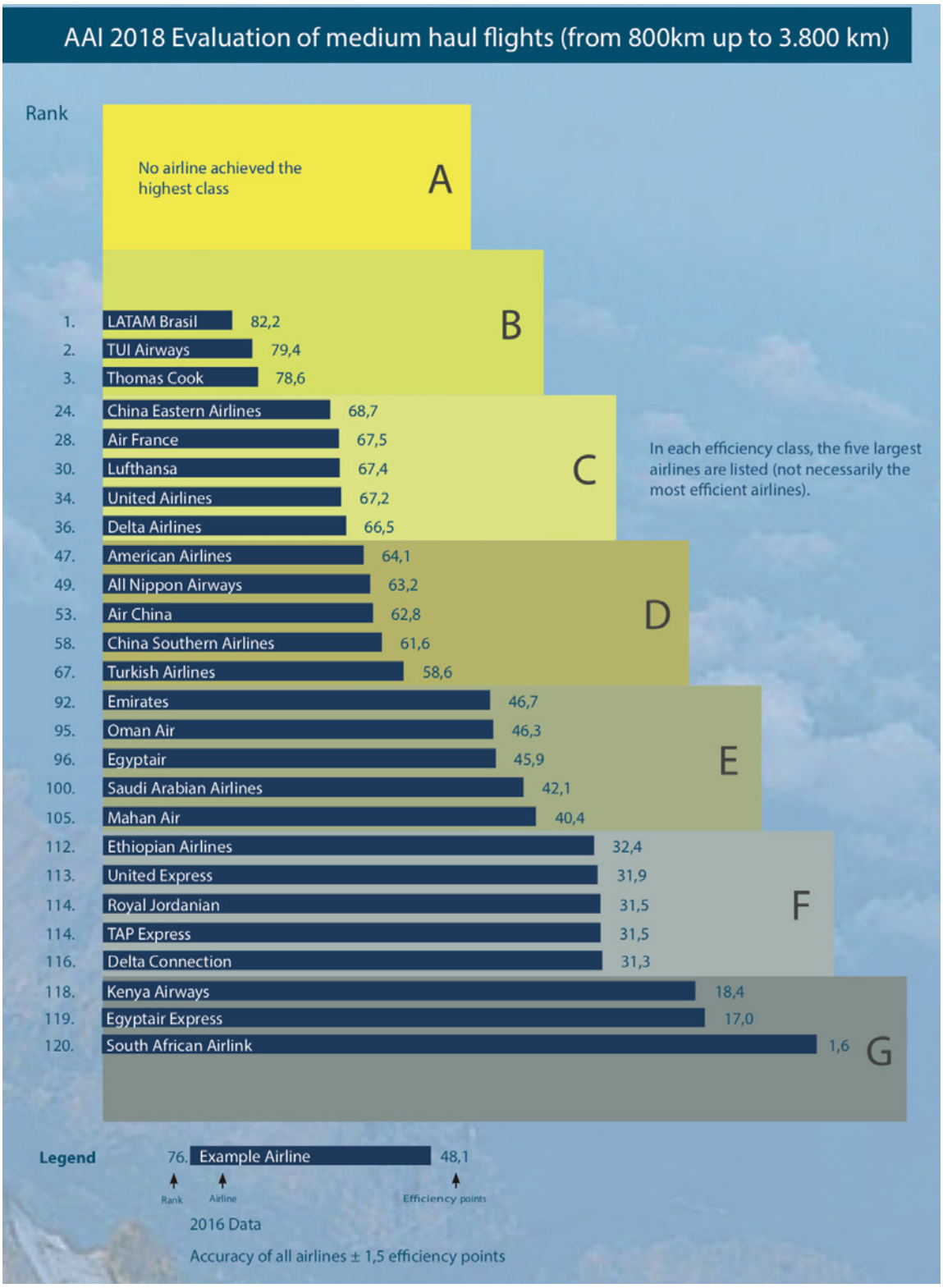
FIGURE 4.3: TRANSPORTATION CHOICES: BEST PRACTICE TRAVEL AGENTS

German travel agency Fairkehr, in a brochure designed to address youth finishing school and looking into a gap year travel experience, underscores that unique experiences can be gained close to home. The brochure addresses readers: "You decide yourself how much your travel affects the climate. The rule of thumb is that the longer you travel, the worse for the climate. Bus and railway are better than aircraft or car. If you want to be non-polluting, you walk or bicycle." The agency also highlights differences in CO_2-intensities for accommodation.

Source: www.katzenprung-deutschland.de

FIGURE 4.4: ATMOSFAIR AIRLINE INDEX

The Airline Index compares and ranks the fuel efficiency of the 200 largest airlines in the world, distinguishing short, medium and long-distance flights. The comparison is based on the consideration of actual fuel use required for specific connections, considering aircraft type, engines, winglets, seating and freight capacity, as well as load factors for both passengers and freight. Its purpose is to make efficiency a factor in the competition of airlines.



Source: www.atmosfair.de/en/

4.2.2 CERTIFICATIONS: CRITERIA AND CREDIBILITY

The wide range of certifications in tourism raises the question of their comparability. Often, certifications address various aspects, such as service quality, the environment, or wider social and economic criteria. To harmonise certifications and standards and to strengthen their sustainability criteria, the Global Sustainable Tourism Council (GSTC) was created in 2010. The GSTC establishes and manages global sustainability standards, known as the GSTC criteria. There are two sets: Destination criteria for public policy-makers and destination managers, and Industry criteria for hotels and tour operators. These are the guiding principles and minimum requirements that any tourism business or destination should consider, to preserve natural resources and to respect cultures. GSTC is part of the European Union's "European Eco-Tourism Labelling Standard", which has a similar goal of providing and fostering sustainability standards. The European standard recognizes sustainable tourism standards that are equivalent to the GSTC's criteria. Certifications can consequently seek to become GSTC recognized or accredited, the former implying that the standards used are aligned, and not contradictory to the GSTC. Accredited means that the certification standard is both aligned and following a process approved by the GSTC accreditation panel, i.e. fulfilling expectations on "transparency, impartiality and competence".

While there is a consensus that certification should seek to "strengthen and coordinate tourism sustainability certification by building on established global standards and processes, such as Global Sustainable Tourism Criteria" (Weston et al. 2018: 11), there are several questions regarding complexity:

1. Is it meaningful for all tourism businesses to be assessed on the basis of identical global standards?
2. Are all aspects of sustainability certifications equally relevant?
3. Should carbon certifications provide information on emissions, or is their contribution to carbon literacy even more important?

To further illustrate these points, what defines sustainability is not always globally generalizable. It is important to understand that sustainability is relative and it varies depending on geography and local conditions (UNEP, 2016). As an example, campaigns around saving water might not be the most relevant in Iceland, where renewable freshwater resources are abundant and where geothermal energy sources make it possible to heat water without the use of fossil fuels. Greenhouse gas emissions, on the other hand, are always equally problematic irrespective of the location where these are released. A related question is the incommensurability of parameters. For example, given the relevance of climate change, should mitigation be considered and valued alongside criteria such as the environmental friendliness of the office materials used by a business? In short: there is a need to discuss whether different SDG goals can be integrated in one certification, and whether climate change should deserve specific attention.

Against this background, it is worth mentioning that the GSTC does not mention climate change in its criteria overview, which highlights "consumption of resources, reducing pollution, and conserving biodiversity and landscapes" (GSTC 2019). However, "pollution" subsumes climate change, with various criteria specifically referring to mitigation for tour operators (10 criteria) and hotels (8 criteria) (Tables 4.1, 4.2). There are no mitigation criteria for GSTC accredited destinations, even though these have a particularly large potential to reduce emissions through their choice of markets, influence on length of stay, and opportunities to charge various forms of air passenger duties (Gössling et al. 2016; 2019).

The apparent reluctance of certification schemes to take onboard more stringent decarbonization criteria and to make these enforceable against minimum standards reflects on wider industry perspectives, i.e. the global tourism sector and its organizations could work more pro-actively towards mitigation. In particular, UNWTO and the World Tourism and Travel Council have opportunities to call for the introduction of any program that would account for the sector's emissions, to suggest timelines for mitigation, to support and implement measures to reduce emissions, to call for legislation making decarbonization of the sector mandatory, or to even engage in voluntary schemes such as carbon certification.

TABLE 4.1: PERFORMANCE INDICATORS GSTC: TOUR OPERATOR CRITERIA

D2.1 Greenhouse gas emissions Significant greenhouse gas emissions from all sources controlled by the organization are identified, calculated where possible and procedures implemented to avoid or to minimize them. Offsetting of the organization's remaining emissions is encouraged.	Total direct and indirect greenhouse gas emissions are monitored and managed. Carbon Footprint per tourist/night is monitored and managed. Actions are taken to avoid and reduce significant annual emissions from all sources controlled by the organization. Actions are taken to encourage suppliers of products and services to avoid and reduce significant annual emissions. Carbon offset mechanisms are used where practical.
D2.2 Transport The organization seeks to reduce transportation requirements and actively encourages the use of cleaner and more resource efficient alternatives by customers, employees, suppliers and in its own operations.	Where practical and feasible, the cleanest and most resource efficient transport options are used in the provision of tour programmes and excursions. Information is provided and promoted to customers on alternative (climate friendly) transport options, where available. Alternative transport options (e.g. bike rental, car sharing, pick-ups) for guests and staff are provided or facilitated. Markets accessible by short and more sustainable transport options are favoured. Local suppliers are favoured and daily operations seek to minimize transport use.

Source: https://www.gstcouncil.org/gstc-criteria/gstc-industry-criteria-for-tour-operators/

TABLE 4.2: PERFORMANCE INDICATORS GSTC: HOTEL CRITERIA

D2.1 Greenhouse gas emissions Significant greenhouse gas emissions from all sources controlled by the organization are identified, calculated where possible and procedures implemented to avoid or to minimize them. Offsetting of the organization's remaining emissions is encouraged.	Total direct and indirect greenhouse gas emissions are monitored and managed. Carbon Footprint per tourist/night is monitored and managed. Actions are taken to avoid and reduce significant annual emissions from all sources controlled by the organization. Carbon offset mechanisms are used where practical.
D2.2 Transport The organization seeks to reduce transportation requirements and actively encourages the use of cleaner and more resource efficient alternatives by customers, employees, suppliers and in its own operations.	Information is provided and promoted to customers on alternative (climate friendly) transport options, for arrival, departure and during their visit. Alternative transport options (e.g. bike rental, car sharing, pick-ups) for guests and staff are provided or facilitated. Markets accessible by short and more sustainable transport options are favoured. Local suppliers are favoured and daily operations seek to minimize transport use.

Source: https://www.gstcouncil.org/gstc-criteria/gstc-industry-criteria-for-hotels/

4.2.3 OTHER INFORMATION AND RESERVATION TOOLS

In recent years, a number of platforms have come into existence, encouraging travelers to make more environmentally friendly choices. Some of these platforms focus on emissions, including:

Bookdifferent, a reservation platform that assigns CO_2 emission values to hotel nights. All listed hotels are depicted with their carbon footprint, expressed in kg CO_2, as well as a clover sign depicting "greener" choices. CO_2 emission values are calculated on the basis of an algorithm, i.e. these need to be seen as indicative, though the platform claims that the methodology is based on emission values of 24,000 hotels that have been assessed through the Hotel Carbon Measurement Initiative (HCMI). The provision of information on carbon emissions contributes to carbon literacy, introducing climate impacts as a key criterion into the decision-making process. Website: www.bookdifferent.com

Sleepgreenhotels is a platform offering low-carbon accommodation in Austria, Germany and Italy. All hotels seek to be specifically sustainable in everything they do, and often rely on new and innovative technologies. Emissions of greenhouse gases are significantly reduced through initiatives to source foodstuffs locally, to use wood for hotel constructions, or to offer well-insulated rooms with very limited energy-requirements. The platform does inform in great detail about the initiatives that have been implemented by each hotel and illustrates relative efforts on the basis of up to five "green pillows", which are displayed in the overview to guide travellers. While hotels are decidedly low-carbon, there is no explicit information on emissions available in the overview of hotels. Website: www.sleepgreenhotels.com

Viabono offers environmentally friendly hotel choices in Germany. In order to join the platform, hotels are asked to join one or several standards, such as Klima-Hotels, KlimaNeutral, CO_2-Fußabdruck, DehogaUmweltcheck, bett+bike, or EU BIO. Several of the labels refer to greenhouse gas emissions: Klima-Hotels and KlimaNeutral imply that emissions caused by the stay have been offset

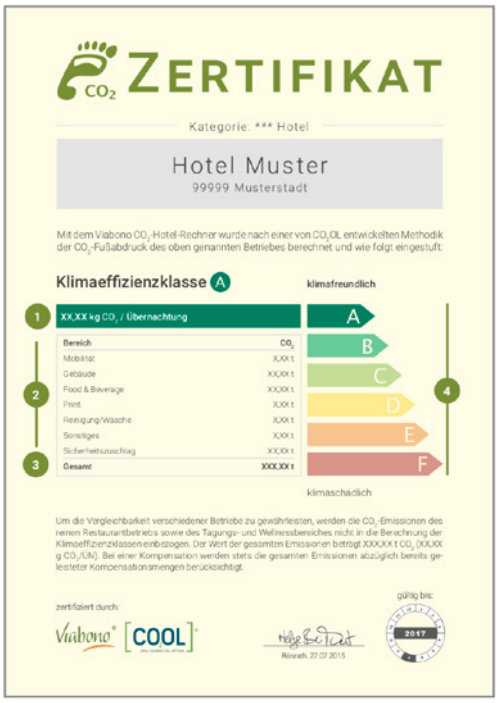
FIGURE 4.5 WINGGY, A MULTIPLE SUSTAINABILITY DIMENSIONS TOOL

Winggy is a software designed for helping tourist accommodations (hotels, spa & campsites) to optimize operating costs and to reduce environmental impacts including CO2, water, and energy resources (it is not an accredited certification). It also considers the amount of organic produce used by an accommodation business. Even though designed to combine a reduction in environmental impacts with financial savings, the software can also be used to translate data into a visualization of an establishment's environmental performance, and hence as a communication tool addressing guests. It is one of the few certifications combining multiple sustainability dimensions, and addressing businesses as much as consumers. The software has already been used to calculate the sustainability performance of more than 300 hotels in France, in Morocco and in the Seychelles.

Source: www.betterfly-tourism.com

FIGURE 4.6: VIABONO CARBON CERTIFICATION FOR ACCOMMODATION ESTABLISHMENTS

Viabono is a German organization developing sustainability certifications, specifically a carbon efficiency label for hotels. The certification depicts information on CO_2-emissions per guest night, detailed for transportation, buildings, food and beverages, print media, cleaning and other aspects of the operation. The label also lists the overall emissions from the business, and ranks it on the basis of its climate impact per bed night in one of six categories. Color schemes allow customers to grasp the hotel's performance at a glance, but detailed CO_2 data also enhances carbon literacy.



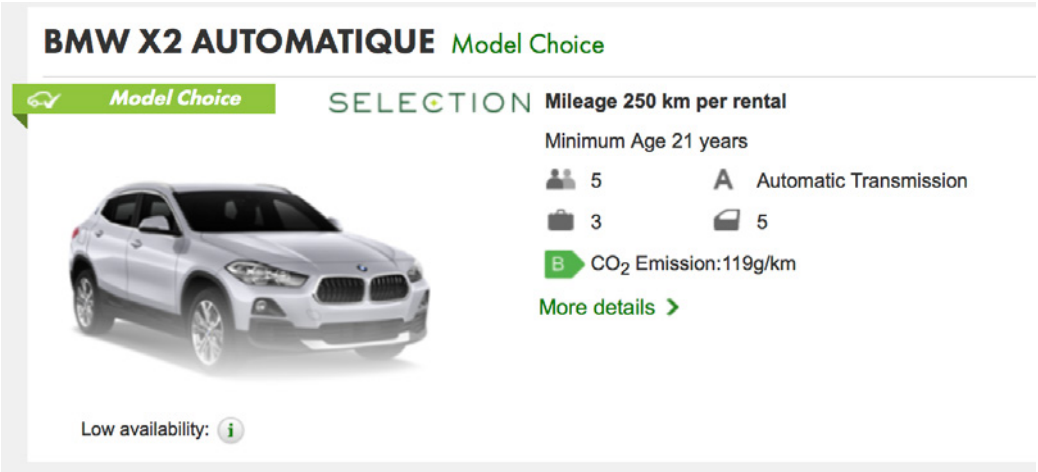
Teilnehmende Beherbergungsbetriebe erhalten durch die Erstellung eines CO_2-Fußabdrucks von Viabono einen genauen Überblick über:

1. Ihre CO_2-Emissionen pro Gast und Übernachtung,
2. Ihre CO_2-Emissionswerte, aufgeschlüsselt in die Bereiche Mobilität, Gebäude, F & B, Print, Reinigung/Wäsche sowie Sonstiges,
3. die gesamten CO_2-Emissionen Ihres Betriebes sowie
4. Ihre Einstufung, die anhand von Vergleichswerten aus einem umfassenden Datenpool in eine von sechs Klimaeffizienzklassen (A-F) durchgeführt wird, die den Energieeffizienzklassen der Europäischen Union nachempfunden sind und einen Vergleich gegenüber Mitbewerbern ermöglichen.

Source: www.viabono.de

FIGURE 4.7: EUROPCAR CAR RENTALS

Europcar is one of the few car rental platforms providing an efficiency label. The platform lists cars in classes depending on emissions per km. It combines the more intuitive approach of a color scheme with emissions in grams of CO_2 per km, contributing to carbon literacy. Car models cannot be filtered by efficiency, however.



Source: www.europcar.com

and that e-mobility is supported. CO_2-Fußabdruck means that the hotel's carbon footprint has been measured. Dehoga Umweltcheck depicts environmentally friendly businesses, while bett+bike addresses cyclists. BIO denotes that at least a share of the food offered is produced organically. Hotels also inform about low-carbon transportation. As a minimum requirement for joining the platform, partners have to perform better than comparable businesses in terms of water and energy consumption, as well as waste generation. Guests can choose their preferred accommodation on the basis of standards used, individual measures established, or the number of green pillows. Website: www.viabono.de

4.3 BUILDINGS

Buildings cause emissions of greenhouse gases during construction, use, and demolition. It is generally useful to also distinguish residential and commercial buildings, which differ in their energy-use characteristics. Information tools related to buildings can consequently aid decision making in various stages: when a new building is to be constructed, this concerns a) the energy-efficiency of measures, and the contractor of choice, b) the characteristics of the materials used for construction, and c) the outcome in terms of the building's future energy requirements. To illustrate this: a new home can be equipped with three-pane windows, to reduce energy losses. This will decrease the lifetime energy use of the building. The three-pane windows may be purchased from a company committed to avoiding emissions (for example by sourcing the glass from a nearby provider to avoid transports). The windows may then be installed by another firm contributing to mitigation through low carbon operations (for example using small, energy efficiency service vehicles). Each choice consequently has implications for the supply chain, as well as outcomes for the lifetime energy use of the house and the wider SDGs.

There exist various certifications and labeling schemes that can help prospective homeowners or businesses to build more sustainable, energy-efficient houses, or to choose low-energy constructions on the basis of certifications. Schemes and indicators will also help increasing pressure on the construction sector (to build passive or plus energy buildings), as well as the residential home sector, where customers are increasingly aware of the cost of energy. Often, the energy-efficiency of new housing, including the procurement of low-carbon construction materials and construction processes, will depend on urban planning, local and national legislation, finance options, as well as architects and their design suggestions (Rodríguez Serrano and Porras Álvarez 2016).

4.3.1 ENVIRONMENTAL AND ECONOMIC ASSESSMENT TOOLS

Sustainability assessments of buildings distinguish environmental impacts and economic costs, based on lifecycle assessments (LCA) or lifecycle cost assessments (LCC). These can be translated into different forms of environmental product declarations (EPD) or energy labels or certifications. Usually such systems are created and implemented

nationally, reflecting on differences in climate, available building materials and building tradition, or energy supply systems (Box 4.4).

Standards compare different characteristics of a building, such as energy, water, material, transport, health, indoor environmental quality. In some cases, they are also used in various countries, such as the Australian Green Star, which was customized to fit the South African property market, and is now also used in Ghana, Namibia and Rwanda. Several other standards such as BREEAM, DGNB or SBToolCZ have even been more widely used: The American LEED approach was applied in over 100 countries. For details of the schemes see UN (2018).

Considerable attention has been paid to the issue of system boundaries, i.e. as to which elements to include in lifecycle analyses of building materials (Wu et al. 2014). In this regard, Wu et al. (2015) argue that calculations should include the extraction and processing of raw materials; manufacturing, transportation and distribution; operation (i.e. use and maintenance); and end-of-life treatments, such as reuse, recycling and final disposal (Wu et al. 2015: 110). As the authors outline, uncertainties in the operational and end-of-life stages make it however necessary for many carbon-labeling schemes to rely on partial life-cycle data (e.g. cradle-to-gate and cradle-to-site). A main concern with regard to standards and labelling in the construction sector is thus that carbon content calculations are not based on identical system boundaries (which may be cradle-to-gate, cradle-to-site, cradle-to-retail and cradle-to-grave). For this reason, standards are difficult to compare.

As a result, the scope of carbon labelling schemes in the building sector currently varies between countries. For example, the UK Inventory of Carbon and Energy includes 34 categories of materials on a cradle-to-gate basis, while the Construction Carbon Index developed in Singapore comprises 10 categories of materials on a cradle-to-site basis. Ecoinvent in Switzerland is based on a cradle-to-grave approach, comprising 11 categories, while the US Life cycle Inventory Database uses different system boundaries for 25 categories of materials. For further discussion of benchmarking issues in carbon labelling schemes see Wu et al. (2015), for certifications for building materials see Pacheco-Torgal et al. (2014), Baldo et al. (2014), as well as Peri and Rizzo (2012).

BOX 4.4: NATIONAL ASSESSMENT TOOLS FOR BUILDINGS

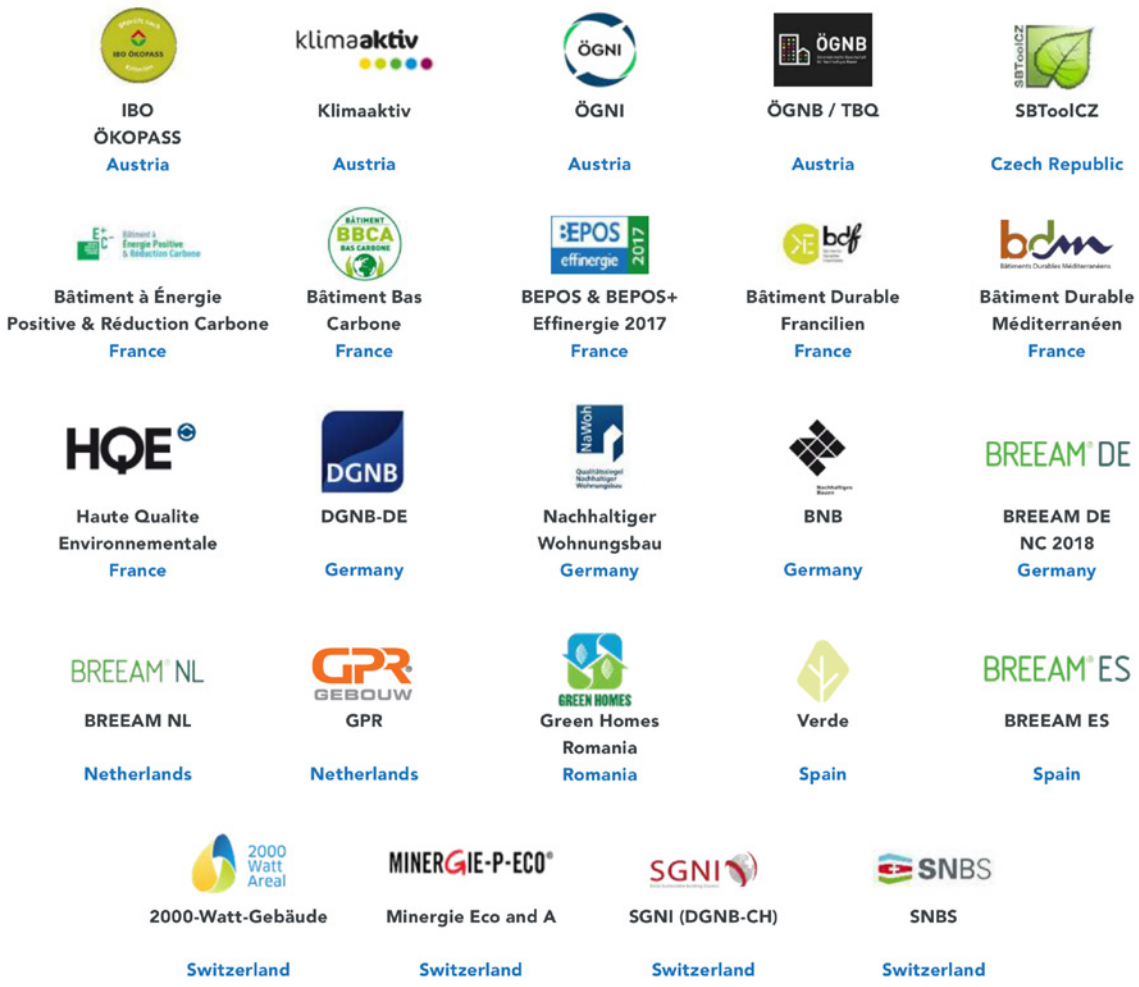
National examples of assessment systems, rating systems or certification programs for buildings include, though the list is not exhaustive:

- BREEAM, UK (Building Research Establishment Environmental Assessment Methodology)
- CASBEE, Japan (Comprehensive Assessment System for Built Environment Efficiency)
- DGNB, Germany (German Society for Sustainable Construction)
- EDGE (Excellence in Design for Greater Efficiencies)
- GRIHA (Green Rating for Integrated Habitat Assessment)
- GSAS, Qatar (Global Sustainability Assessment System)
- Green Star, Australia
- HQE, France (High Quality Environmental standard8)
- LEED, US (Leadership in Energy and Environmental Design)
- Pearl rating system, Abu Dhabi UAE
- SBToolCZ, Czech Republic
- SHERPA (Sustainable Housing Design in the Global South)

Source: UN 2018

Standards and certifications specifically focused on emissions from constructions have also been discussed in Bionova (2018). The organization distinguishes five methodologies to assess and avoid embodied carbon. In order of efficiency, these include i) decarbonization (reducing all emissions to a minimum, then compensate the remainder); ii) carbon caps (calculate a project's embodied carbon and prove it is not exceeding set limits); iii) carbon ratings (evaluate carbon performance and rate against scale); iv) carbon comparison (compare design options against baseline); v) carbon reporting (calculate the carbon of the project). While all approaches will increase knowledge of climate change impacts, decarbonization can make the greatest contribution to reductions, by up to 60%. As highlighted by Bionova (2018), there

FIGURE 4.8: TRADEMARKS OF ASSESSMENT SYSTEMS (CONTINENTAL EUROPE)



Source: Bionova 2018

exist various schemes supporting green building systems, which are recognizable by the trademarks used (Figure 4.8, next page).

Information tools for buildings include those that can aid decision-making when calls for tender for (public) construction works are made. For projects, performance criteria can be defined in tender criteria and contract conditions. The process has been outlined in UN 2018 (see also Porkka and Huovila 2004).

4.3.2 ENERGY PERFORMANCE CERTIFICATES

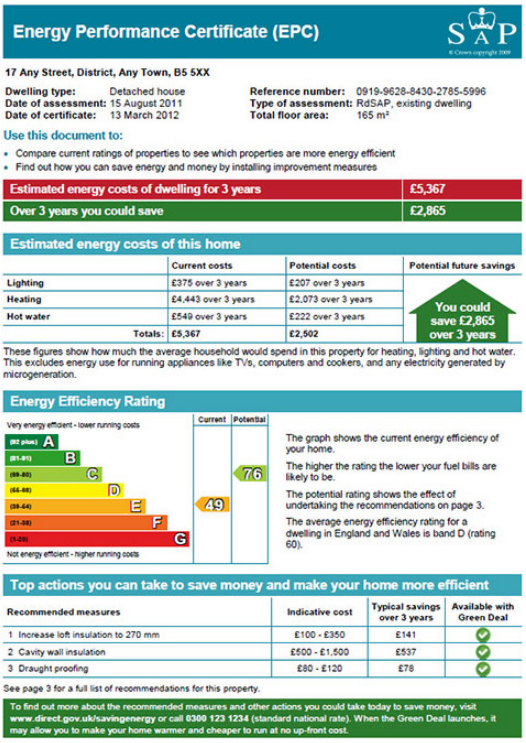
For existing buildings, energy efficiency ratings can have considerable importance for sales, and hence decisions to retrofit constructions to improve energy efficiency. Schemes may be most advanced in the EU, where buildings are responsible for a large share of overall energy use, and where 75% of the building stock is considered energy inefficient (EC 2018). Various EU Directives have contributed to improvements of the energy performance of buildings, with the current Energy Performance of Buildings Directive highlighting that all new buildings must be nearly zero-energy buildings by 31 December 2020, and that energy performance certificates must be issued when a building is sold or rented. The certificate must also be included in all advertisements for the sale or rental of buildings (EC 2018).

Energy performance certificates provide information that is ultimately related to costs, as inefficient buildings will require more energy. When

choosing a home for purchase or rent, consumers will weigh various factors, such as availability of homes (market situation) or the desirability of specific houses in terms of space, garden, and location. However, research presented to the EU (European Commission 2013) suggests that in some cities, energy efficiency certifications already have an impact on markets, with for example a one letter improvement in energy efficiency in Austria's capital Vienna having been estimated to increase prices by 8% in the sales market and by 4.4% in the lettings market (for a UK example of an energy performance certificate see Figure 4.9).

The general effect of energy performance certificates has however been confirmed in other recent studies, showing that higher energy efficiency ratings result in an increase in market values (Fuerst et al. 2015; Hyland et al. 2013). This suggests that efficiency ratings can have a positive effect as consumer information tools, and that energy efficiency considerations begin to have market relevance (Figure 4.4; for a Best Practice example see Figure 6.6). This is of great importance for certifications, as market value changes

FIGURE 4.9: EXAMPLE OF AN ENERGY PERFORMANCE CERTIFICATION



Energy Performance Certificate (EPC)

17 Any Street, District, Any Town, B5 5XX

Dwelling type: Detached house
Date of assessment: 15 August 2011
Date of certificate: 13 March 2012
Reference number: 0919-9628-8430-2785-5996
Type of assessment: RdSAP, existing dwelling
Total floor area: 165 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

Estimated energy costs of dwelling for 3 years	**£5,367**
Over 3 years you could save	**£2,865**

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£375 over 3 years	£207 over 3 years	You could save £2,865 over 3 years
Heating	£4,443 over 3 years	£2,073 over 3 years	
Hot water	£549 over 3 years	£222 over 3 years	
Totals:	£5,367	£2,502	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating

	Current	Potential
Very energy efficient - lower running costs		
(92 plus) A		
(81-91) B		76
(69-80) C		
(55-68) D		
(39-54) E	49	
(21-38) F		
(1-20) G		
Not energy efficient - higher running costs		

The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years	Available with Green Deal
1 Increase loft insulation to 270 mm	£100 - £350	£141	
2 Cavity wall insulation	£500 - £1,500	£537	
3 Draught proofing	£80 - £120	£78	

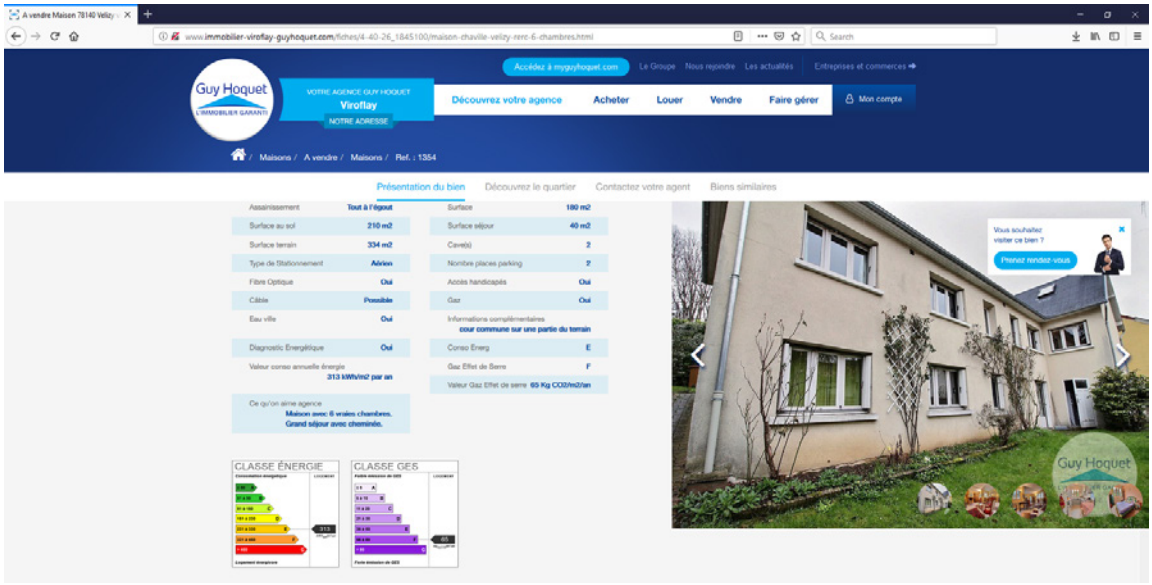
See page 3 for a full list of recommendations for this property.

To find out more about the recommended measures and other actions you could take today to save money, visit www.direct.gov.uk/savingenergy or call 0300 123 1234 (standard national rate). When the Green Deal launches, it may allow you to make your home warmer and cheaper to run at no up-front cost.

Source: http://gogreena.co.uk/wp-content/uploads/2012/10/energy-performance-certificate.jpg

FIGURE 4.10: ENERGY LABEL FOR RESIDENTIAL BUILDINGS AS USED ONLINE BY REAL ESTATE AGENT

The European Union has a unifying energy standard for buildings, visualized in an energy label. As energy represents a cost, it alerts prospective buyers to additional costs depending on the structure and insulation of the building. As research has shown, such information has considerable implications for asking prices, as energy-efficient houses are valued higher.



Source: Example of real estate agent's website

constitute an important personal benefit that is more likely to translate into changes in decision-making. Unlike other voluntary certifications, energy performance labels for buildings thus work on the basis of mechanisms that are market-based, in that the label is associated with a future cost.

BOX 4.5: DATABASES WITH FOOD CARBON CONTENT DATA

- http://www.ecoinvent.org
- http://www.agri-footprint.com
- http://www.lcafood.dk
- http://esu-services.ch/data/fooddata/
- http://www.cleanmetrics.com/html/food_carbon_footprints.htm

BOX 4.6: ZURICH'S LOW CARBON DIET RESTAURANT CONTEST

In order to reduce greenhouse gases in the restaurant sector, the city of Zurich initiated a restaurant contest in six of the city's canteens, challenging chefs to reduce the CO_2-eq amount of all consumed menus. The restaurants serve between 40-250 lunch guests. Food data for all participating restaurants was collected over an eight-week period, and the chefs' strategies to reduce emissions recorded. Notably, chefs needed to consider food purchases, menu designs, as well as guest communication in order to make low-carbon choices attractive.

Emissions amounted to in between 1.7 to 2.3 kg CO_2-eq per guest served. Evaluation showed that restaurants used various strategies to avoid emissions and managed to decarbonise menus by 19% on average. The best restaurant achieved a 42% reduction in emissions, corresponding to about 0.7 kg CO_2-eq per meal. Guests were asked about their contentedness with the menus offered. Results confirm that opinions were entirely positive. As various media outlets covered the initiative, it also generated debate beyond the participating restaurants.

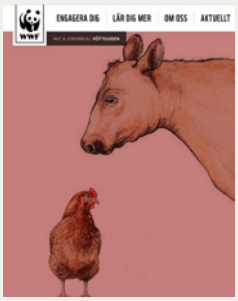
Source: Eaternity 2018

4.4 FOOD SYSTEMS

Food is consumed at home and in different types of restaurants, street or food markets. It is consequently useful to distinguish information tools for grocery purchases as well as those relevant for restaurants. While it is a complex task to calculate emissions for food, there now exist a wide range of databases providing information on carbon content (Box 4.5).

Recent research determined the carbon intensity of different foodstuffs on a comparative basis (Poore and Nemecek 2018). Two dimensions of such comparisons are of relevance for consumption choices. First, identical products can be distinguished in terms of their carbon impact on the basis of comparative assessments. This helps consumers to identify and favour the product entailing lower carbon emissions. For instance, where transport distance is the major distinguishing factor between two otherwise identical foodstuffs, consumers may feel inclined to purchase the local product with the lower carbon footprint. Second, foodstuffs vary greatly in terms of their absolute carbon footprint, with for instance the consumption of beef having far greater implications for climate change than the consumption of chicken (assuming the same amount

BOX 4.7: WWF MEAT GUIDE



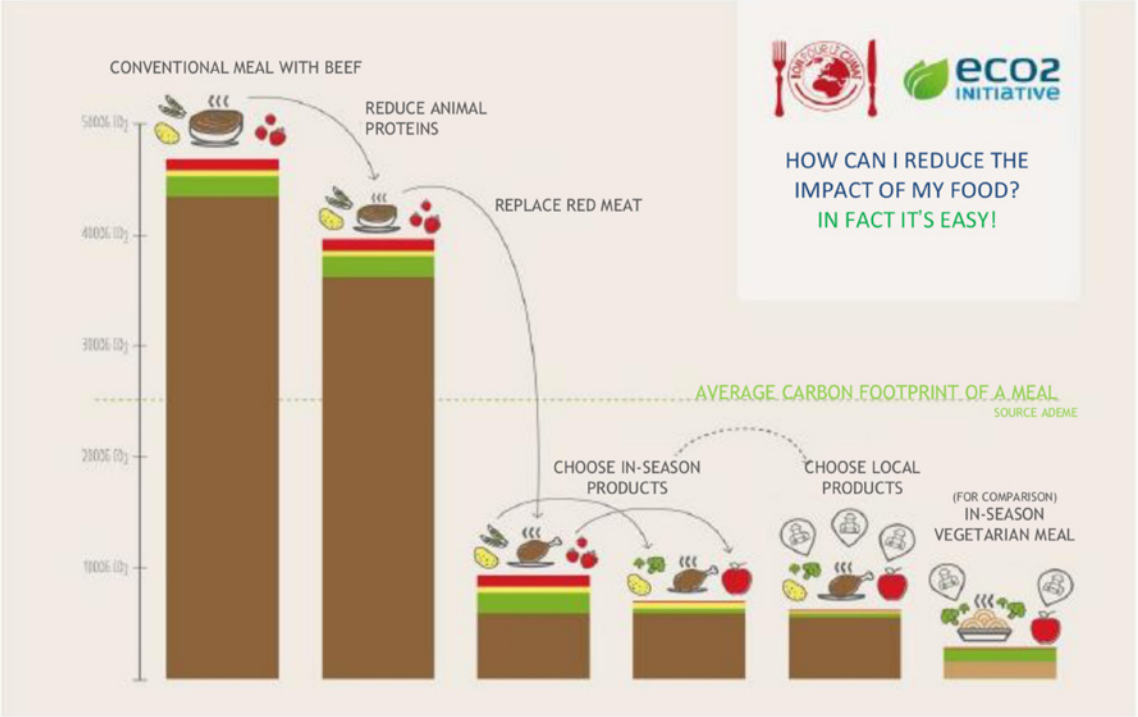
The Meat Guide has the objective to:

- Raise awareness on the environmental impact of food production, in particular high impacts of meat production and consumption;
- Lower meat consumption in the national contexts;
- Promote consumption of meat with lower environmental impact, and meat that contributes to sustainable food systems;
- Create awareness of sustainable consumption of meat among key target groups such as consumers, retailers, restaurants and public procurement officials;
- Promote a varied protein intake by consumers.

Source: WWF 2016

FIGURE 4.11: ECO2INITIATIVE ILLUSTRATING THE IMPACT OF DIFFERENT CHOICES ON OVERALL FOOD CARBON EMISSIONS

The Eco2Initaitive's website highlights differences in CO_2 emissions depending on basic choices. It visualizes that a reduction in meat consumption already makes a considerable contribution to mitigation; replacing red meats will yield a very significant decline in emissions. Adjustments based on in-season products, local produce, or vegetarian choices will help to further decline the carbon footprint of meals.



Source: www.wwf.fr

of calories). Through carbon labels, consumers can consequently learn to compare different foodstuffs in terms of their overall impact.

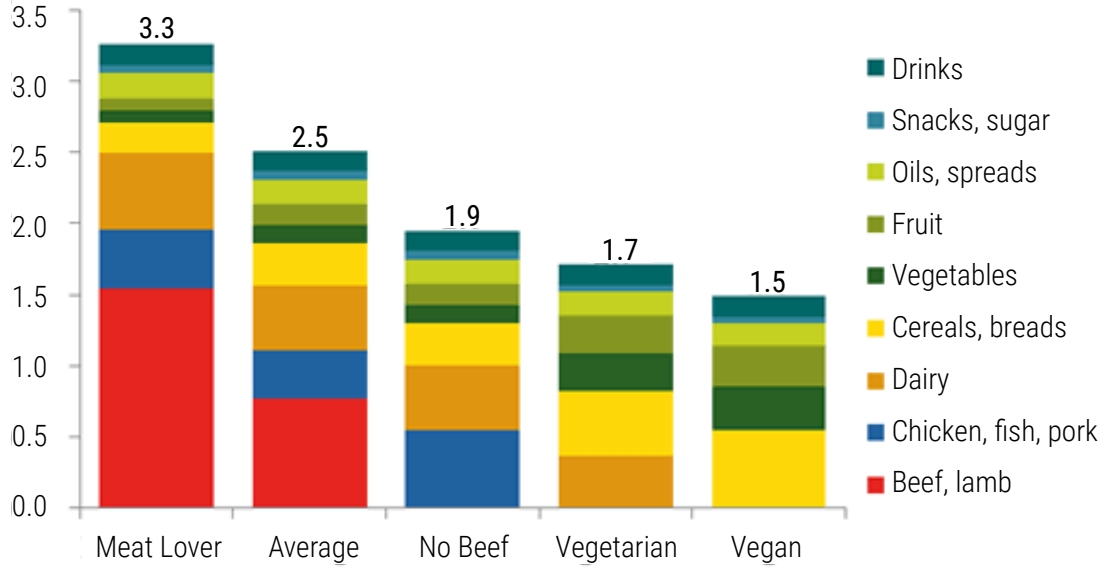
Information also needs to be targeted at chefs, who are responsible for decisions potentially affecting a large number of consumers. Relatively few tools seem available in this regard, as chefs mostly learn by doing; i.e. on the basis of lessons taught by other chefs. Swedish World Wide Fund for Nature (WWF 2016) is one example of an organization seeking to fill this gap, in the form of a Meat Guide. The guide addresses consumers, but it may also have appeal for chefs (Box 4.7).

4.4.1 CERTIFICATIONS: OUTREACH AND IMPACTS

The most prominent information tools in the food sector are certifications (Annex A3). Ecolabel Index (2018) lists 102 ecolabels for products and restaurants, for example, though only 16% of these consider greenhouse gas emissions. Carbon labels were introduced by some supermarket chains such as Tesco in the UK or Walmart in Chile, but were later retracted. Even though the reasons remain unclear, it is possible that the supermarket chains noted that the labels confused consumers, as research suggests (Gadema and Oglethorpe 2011; Hartikainen et al. 2014). Yet, rather than to abandon the idea of carbon labeling food products, Gadema and Oglethorpe (2011) suggest that it was necessary to establish: "…effective linkages between food policy and food market actors to drive a targeted and coherent carbon labeling policy". To date, studies suggest that the effect of carbon labels on food purchasing decisions has remained limited (Gadema and Oglethorpe 2011; Emberger-Klein and Menrad 2018; Hartikainen et al. 2014).

There currently exist various carbon labels for food, of which the best established appears to be the Carbon Trust food label in the UK (Figure 4.2). Carbon labels also exist in Canada, Korea, Japan,

FIGURE 4.12: CARBON FOO(D)PRINTS AS A RESULT OF DIET TYPES



Note: all estimates based on average food production emissions for the US. Footprints include emissions from supply chain losses, consumer waste and consumption. Each of the four example diets is based on 2,600 kcal of food consumed per day, which in the US equates to around 3,900 kcal of supplied food.

Source: http://shrinkthatfootprint.com/food-carbon-footprint-diet

France, the USA, and Taiwan. Apart from certification on packaging, there are also a considerable number of websites informing on climate impacts of food consumption and providing advice on low-carbon diets. Their outreach is unclear, though the information provided is often very illustrative of the effects of food consumption, with evidence that the understanding of labels grows over time (Li et al. 2017). As an example of foo(d)print information to highlight the importance of diet choices, see Figure 4.12. The illustration, available on the website Shrink That Footprint, highlights the need to increase carbon literacy. Columns show that specific diets are relatively better, but they all refer to tons CO_2, i.e. an abstract concept that will be difficult to understand for most people (for alternative illustrations see Best Practice cases 6.8 and 6.9).

While there is less evidence that certifications have an effect on consumer choices in tourism, this is different in the food sector, where information tools have been shown to have a more significant influence on behaviour. For example, Vanclay et al. (2011) tested carbon labeling of groceries in Australia. Using green (low), yellow (medium) and black (high) carbon footprint symbols on food items, they could show that sales of "black" items ("bad" in terms of climate change) declined by 4% during the first month, and 6% during the second month of the study period, while sales of "green" products increased by 2% in the first, and 4% in the second month. The authors concluded that there may be a learning effect involved. Visschers and Siegrist (2015) tested the effect of a "climate-friendly choice" label on menus in a Swiss university canteen, finding that sales of climate friendlier meals increased by 10%. Notably, the authors also found that climate-friendlier choices increased over time, affirming the learning effect. As with carbon labeling in more general food-contexts (Gadema and Oglethorpe 2011; Emberger-Klein and Menrad 2018; Hartikainen et al. 2014), research suggests that restaurant guests do perceive information on food item carbon content positively (Filimonau et al. 2017), even though less positively than "local" labels (Zander and Feucht 2018).

One explanation is that carbon labels are more abstract and difficult to understand, providing less tangible personal benefits than "local" or "organic" certifications (Gadema & Oglethorpe 2011; Hartikainen et al. 2014; Röös & Tjärnemo 2011; Upham et al. 2011). It has also been speculated that "local" is associated with benefits to farmers and the local economy; short transport distances; fewer environmental impacts; quality and health (Campbell et al. 2014; Darby et al. 2008; Feldmann &

BOX 4.8: LABELING UNHEALTHY FOODS: EXAMPLES FROM CHILE AND ECUADOR

Chile

The Chile Ministry of Health implemented a law in 2015 that regulates nutritional information of food products, and their labelling regarding energy (calories), sodium, sugar and saturated fat (USDA Foreign Agricultural Service (2015). The law focuses on food products favoured by children to address obesity resulting out of unhealthy diets.

Limits for the content of energy are, for foods, 275 kcal/100g, and 400 mg/100g for sodium, 10g/100g for total sugar, and 4g/100g for saturated fat. Equivalent values for liquid foods are 70kcal/100 ml for energy, 100mg/100ml for sodium, 5g/100 ml for total sugar, and 3g/100 ml for saturated fat. Foods that exceed the limits are required to use black stop signs, indicating foods high in salt, sugar, energy or saturated fat, with one stop sign for each of the nutrients in excess. The law also states that:

The product shall not be sold, marketed, promoted, or advertised within establishments of preschool, primary or high school education.

The product shall not be advertised on media or means of communication that target children under 14 years old, such as posters, printed materials, point of sale or textbooks, nor in television, radio, internet, magazines, or in advertising space during or close to the latter, when the capture audience is greater than or equal to 20% of children under 14 years of age.

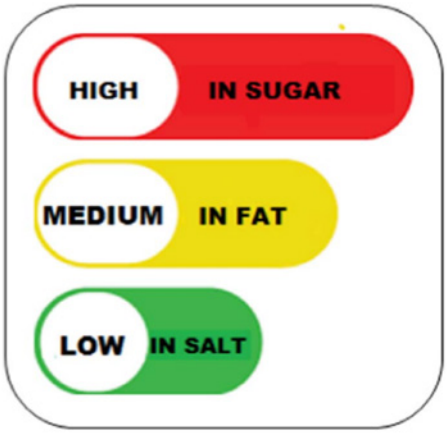
The product shall not be given freely to children under 14 years old nor can they use commercial hooks directed to that public such us toys, accessories, stickers or other similar incentives.

While the black label is not related to climate change, it provides a potential option for the labelling of climatically harmful products.

Ecuador

The Government of Ecuador introduced new legislation in 2014 that requires processed foods to carry a traffic light label indicating sugar, fat and salt levels (Figure 4.13). The label has to be placed on a white or grey background and must be proportional in size to the package. The bars, which can be red, yellow or green, indicate high, medium or low levels of fat, sugar or salt. Research shows that the label is easily understood by consumers, and that it has a modest effect on consumer choices (Freire et al. 2016). The authors also show that companies have started to reduce levels of added fat, sugar or salt, in order to increase their label standard. Again, while the label is not related to climate change, it provides a potential option for the labelling of climatically harmful products.

FIGURE 4.13: ECUADORIAN LABEL FOR PROCESSED FOODS

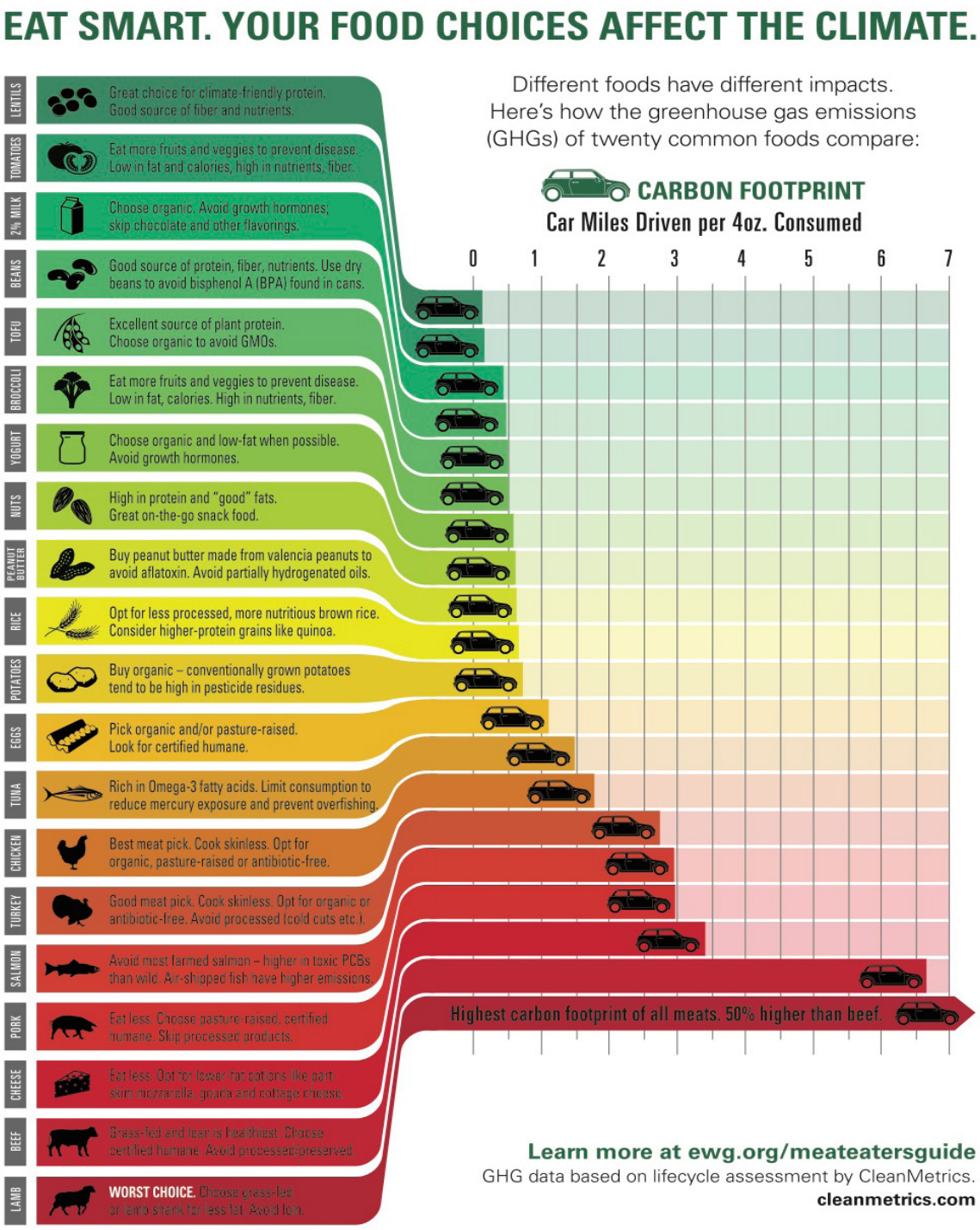


Source: Freire et al. (2016), USDA Foreign Agricultural Service (2015)

Hamm 2015), the latter again representing personal benefits. A key question in the context of food is thus whether "local" claims can be meaningfully combined with more climate-friendly choices. For instance, where transport distances are short, this is likely to also go along with lower emissions. This has been proposed by Onozaka and McFadden (2011) and Onozaka et al. (2015), and could be explored in greater detail for other foods, as well as restaurant menus in order to increase the attractiveness of low-carbon diets. Another potential avenue to increasing carbon literacy and interest in low-carbon foods is to integrate these with health issues. For instance, Chile has introduced black labels for unhealthy

FIGURE 4.14: INFORMATION ON MORE CLIMATE-FRIENDLY FOOD CHOICES

The website of the Environmental Working Group provides a "Meat Eater's Guide" to climate change and health, which informs about animal protein. The organization cooperates with CleanMetrics to calculate the greenhouse gas emissions associated with 20 food types, which, in order to illustrate their climate impact, are compared to emissions from driving a car. This makes the impact comprehendible through comparison with an activity most consumers are familiar with.



Source: www.ewg.org/meateatersguide/eat-smart/

BOX 4.8: INFORMATION AND COMMUNICATION TECHNOLOGIES HELPING TO REDUCE FOOD WASTE

In recent years, a wide range of Internet-based platforms and smartphone applications have been developed to reduce domestic and restaurant food waste. These are aided by smart kitchenware designs, linked to apps.

Website FoodSharing.de is a German pioneer platform to facilitate food sharing between consumers, farmers, and retailers. The platform has shown a considerable potential for sharing approaches (Ganglbauer et al. 2014). Crowdbutching.com offers customers to buy part of a specified animal (cow, pig, chicken, turkey, goat or deer). The animal is sold locally, i.e. interested customers buy a meat box, and the animal is slaughtered when all parts are sold. The platform's motto "Eat less, and better meat" seeks to attract consumers interested in more sustainable and transparent food choices, and exists in The Netherlands, Germany and the UK.

Websites and applications can also assist with overviews of available food supplies at home or facilitate the sharing of excess food (Farr-Wharton et al. 2014). Examples include:

- RescuingLeftoverCuisine.org – Dedicated to food donations to homeless shelters.
- MealConnect.org – Connecting donors (restaurants, supermarkets) with food banks.
- Leket Israel – Donation of leftover foods.
- Fridge Pal – App creating home food inventory and shopping lists.
- Cropmobster.com – Offering excess produce that farmers cannot sell.
- Matsmart.se – Website offering excess production, foods about to expire, seasonal foods, or food in old packaging at 20-90% below retail price.
- Eaternity.org – Helps restaurants and food professionals to assess the carbon content of their menus.

The longer-term success of these websites and applications is not always clear, however, as several apps that have been hailed as breakthroughs in food waste avoidance have already disappeared again, even though these were widely discussed in the media (e.g. LeftoverSwap, EatChaFood).

foods (in terms of calories, sodium, sugar, or saturated fat content), while Ecuador introduced a traffic light system to inform on these aspects (Box 4.8, previous page). Dietary guidelines could include carbon content as another parameter of food impact and display this along nutritional information.

4.4.2 INFORMATION TOOLS TARGETED FOR RESTAURANT OWNERS AND CHEFS

Information tools also need to be directed at restaurant owners and chefs, who would be the ones using carbon or local labels. It stands to reason that only where owners/chefs have acquired a degree of carbon literacy and energy awareness, will they make decisions with positive repercussions for climate change. Any such process could begin with energy use in the restaurant, which is also a major cost factor. Restaurant associations have calculated, for example, that the cost of energy is 6.7% of restaurant turnover in Germany. This is equivalent to an energy requirement of 12.3 kWh per dinner served, or 4.1 kg CO_2 per dinner served (Dehoga 2016).

Yet, there is very limited evidence that owners or chefs are aware of the large amount of energy required for meal preparations. This would also explain why many options to reduce the energy needed for food preparations, or the overall climate impact of restaurants, are not better explored. As an example, offering beer out of kegs rather than bottles will result in an energy requirement of 0.02 kg CO_2-eq per liter of beer, while recycled bottles will increase emissions 15-40 times, to 0.3-0.75 kg CO_2-eq per liter of beer (Poore and Nemecek 2018). Similar is true for food waste, as a study of two restaurants in Switzerland concluded that 7.7% to 10.7% of food purchases were wasted, mostly because of large portions served that remained uneaten (Betz et al.

2015). The authors also calculated that 78-92% of the waste was avoidable, amounting to 10.5 to 16.5 tons of food per year, and a corresponding loss of CHF85,000 per year and restaurant. Insights such as these make climate considerations attractive, as they represent economically sound decisions. New information tools need to be developed, however, to spread such insights and to advice chefs and owners on opportunities to realize economic and climate gains.

4.5 CONCLUSIONS

- The most common information tools in all three sectors are certifications; there is room to use other types of consumer information tools that lead to lifestyle changes.
- The ways in which certifications address consumers are often different in the three sectors, as they may be associated with economic benefits (buildings), personal health benefits (food), or quality aspects (tourism). This is of particular relevance where certifications are not only associated with carbon, rather than energy cost (buildings), local origin (food), or wider sustainability initiatives (tourism).
- Certifications have not achieved market penetration, even though there is evidence that these are perceived positively by consumers. Collaboration between businesses, civil society organizations and governments can improve market penetration and their impacts.
- Inconsistencies in certifications, for instance with regard to system boundaries chosen for life cycle analysis, can be addressed through a concerted effort by stakeholders. The alignment of information tools can make them comparable, which can further advance the uptake and their capacity to drive behaviour change.
- Information tools, including certifications, should be optimized to increase carbon literacy and consumer appeal; Carbon literacy need to target individuals and households as well as communities, businesses, institutions, and governments. Each stakeholder has the ability to shape the context of consumption and lifestyles in a complementary way.
- Information tools may also be used in tandem to improve their consumer appeal (for instance, “local” in combination with “carbon” certification).

5. CONCLUSIONS: BARRIERS AND ENABLING CHANGE

5.1 IDENTIFYING BARRIERS

Any mitigation strategy needs to consider where considerable amounts of emissions are generated. This report looked into tourism, buildings and food systems, which together account for the majority of emissions of greenhouse gases. From an individual's perspective, it is in particular tourism consumption (air travel, cruises), as well as specific food choices (beef and other meats, dairy products, or seafood) that entail high emissions. Building and construction-related decisions also have great importance, as they determine "embodied energy" (the energy contained in construction materials and required to build houses) and "operational energy" (the energy needed in particular for lighting, heating and cooling). However, in buildings, management decisions also have great relevance for climate change outcomes, as for instance temperature preferences, lightning, energy supplier choices, and overall energy management all determine energy requirements. These insights suggest that information tools have greater relevance for some forms of consumption, as specific choices such as air travel will significantly drive up per capita emissions. This is also the main reason why decarbonization strategies need to consider demand-side approaches, complementing national efforts focused on production as underlying Nationally Determined Contributions reported to UNFCCC. The roles of governments and business are also essential in ensuring product and service availability, while citizens should be better incentivized to adopt climate-related life-style options as soon as possible (Institute for Global Environmental Strategies, 2019).

As outlined in this report, climate change is a problematic concept for its high degree of abstractness. Yet, climate change mitigation is standing out among the Sustainable Development Goals for its far-reaching negative consequences in case of failure to limit global warming. A central question is thus whether mitigation should be integrated in broader pro-sustainability strategies, or whether it should be evaluated and advanced as a separate issue. This report argues that due to the complexity of climate change, and the need to increase carbon literacy levels in the general population, specific carbon information tools should be developed for each of the three different subsectors, and even for individual activities within these subsectors, such as air travel. Carbon certifications may be combined with labels covering wider sustainability dimensions, or with labels that support pro-climate choices through quality associations, such as "local" claims. Where certifications can be meaningfully combined to address several sustainability dimensions, this may also help making these more attractive, while simultaneously reducing overall certification numbers.

Another key finding of this report is that information tools such as websites, apps, standards or certifications do not usually include aspects of mitigation, and that they also have very low market penetration. Of all information tools, certifications are the most common. Many have been developed in tourism as well as for more sustainably produced foodstuffs, but few have a main focus on climate change: For example, the review of tourism and food sustainability certifications for this report (Annex A1, A3) revealed that only about half consider mitigation at all. Even more problematic is the fact that information tools are not widely used. The most visible form of information tools, certifications, is usually restricted to a very limited number of businesses, with no evidence of a wider adoption by tourism businesses, restaurants or retailers. Only where the use of certifications is mandated by law, as in the case of buildings in the EU, carbon information tools will see market penetration and become more widely relevant for consumers.

Available research suggests that current consumer information tools have modest effects on behaviour. Certifications for buildings may be the most effective tools, as energy is a cost that is considered by

prospective buyers, with measurable implications for property prices. Certified food items may be associated with better health or taste, representing personal benefits. This could be an important factor for choices, considered by a share of consumers. Carbon certifications in tourism are likely to have the least appeal, because they are associated with limitations in personal choices, encouraging altruistic behaviour, i.e. to not consume a specific item for the benefit of society. This has very limited appeal to most people, including younger people. Only where carbon certifications provide associated benefits can they be expected to influence behaviour at more significant scales.

Research also indicates that carbon information tools are associated with longer-term learning effects, in that their relevance increases over time. This means that short-term outcomes of carbon certification (immediate behavioural change) should be distinguished from longer-term effects (knowledge on climate change and mitigation needs). There is also evidence that existing certifications are not optimized in their appeal designs. Existing carbon certifications are often limited in terms of the information provided and considered misleading or difficult to understand. These issues are the main barriers identified in this report, which are considerably different from those highlighted by other authors, who have more often pointed to low consumer interest as a result of too many certifications, perceptions of low credibility, or incomparable system boundaries underlying assessments. While these issues need to be addressed, they are unlikely to represent the main reasons for the observed lack of consumer behavioural change.

5.2 ENABLING CHANGE

This report identified a number of shortcomings with regard to consumer information tools, which may be strategically overcome through a range of measures:

1 INCREASING THE SCOPE OF CARBON CERTIFICATIONS

Carbon information tools, and in particular certifications, are perceived positively by consumers. They may not influence behaviour in significant ways on the basis of current designs, but there is no reason to delay the introduction of carbon certifications (or the integration of carbon criteria in existing schemes) on a broader basis. This would be particularly desirable for high carbon consumption, such as air travel, where emissions should be displayed on all tickets, also considering non-CO_2 effects. Efforts should also be made to include carbon information in air travel sales platforms, and to make airlines as well as individual flights comparable on the basis of emissions. Notably, the support of organizations such as the WTTC or UNWTO is paramount in this endeavor. Governments may provide incentives for in particular small enterprises struggling with the cost of labeling schemes. Certification should also be more frequently used for other tourism products and food items, as well as in buildings, and on a global scale.

2 MAINSTREAMING CARBON CERTIFICATION

Given the lack of resources of many businesses to adopt certification schemes, as evidenced by very low market penetration, the introduction of certification schemes could be legislated. This implies that governments need to set a helpful regulatory context, facilitating and inspiring better decision-making, creating market demand through sustainable public procurement, and supporting research and innovation (UNEP, 2016). One example is the case on energy certifications for buildings in the European Union, showing that energy efficiency schemes are politically feasible to introduce, and supportive of consumer decision-making. Carbon certification schemes could be introduced for tourism products, foods, as well as in restaurants. As efforts are unlikely to be successful on global scales, these should be introduced nationally, with support for small enterprises struggling with the cost of certification, and within wider initiatives to increase climate change awareness. The support of organizations such as ICAO, IATA, WTTC, or UNWTO (tourism), large retailers (food) or equivalent national organizations should be invited, though governments need to move ahead on carbon certification irrespective of industry opinion. Carbon information tools also need to be made more visible and searchable, so that consumers can easily identify carbon friendly products and services, navigate websites for low-carbon products, and compare the offers made by different companies. Filters for more sustainable and low-carbon travel

products, for example, need to become a standard. This is of particularly great relevance for the large platforms, including Booking, AirBnB, Expedia, or TripAdvisor, whose marketing strategies are not yet in line with decarbonization goals. Insights such as these are also relevant for food products, where large food corporations have so far taken a modest interest in climate change, as well as buildings, where there exist many more options to advance low-carbon construction and operation.

3 INFORMATION TOOLS NEED TO BE HARMONIZED

Much evidence suggests that very different system boundaries are used for carbon assessments in the tourism, buildings, and food systems sectors. There is thus a need to align information tools to make them comparable. Accreditors seeking to standardize sustainability certifications need to pay greater attention to mitigation. For example, the GSTC could give mitigation a more prominent place in its criteria for tourism certification, while also providing benchmarks, and encouraging significant year-on-year reductions in carbon. For national certifications, it is advisable that standards be set by governments, including the calculation of the certified business' energy use and emissions, and year-on-year reductions.

4 INCREASING CARBON LITERACY

There is much evidence that consumers are insufficiently aware of climate change and even confused by carbon certifications. Labels that do not use color schemes or similar intuitive information are unlikely to appeal to consumers. Major efforts should thus be made to increase carbon literacy in the wider population. As sustainability certifications and indicators including mitigation as one of many criteria are not contributing to this goal, mitigation should become a more integral part of sustainability certifications. It may also be meaningful to develop or use carbon certifications separately and as stand-alone information tools, to foster awareness. Carbon literacy is potentially as important as actual changes in behaviour, at least in the short term: many consumers may not be ready to make personal adjustments to their lifestyles, but educated on the problem, they may be willing to support legislation enforcing changes. Educational efforts should be made along supply chains, as well as on more generalized societal levels, for instance by better integrating climate change mitigation in school curricula. However, it is important to take into account that the so-called knowledge-action or intention-behaviour gap suggests that awareness cannot easily be acted upon if there is a lack of sustainable options and access to them (UNEP, 2016).

5 CERTIFICATIONS AND OTHER INFORMATION TOOLS CAN BE OPTIMIZED

This report has highlighted that many information tools are not optimized to appeal to consumers. For example, in the food sector, carbon certifications could be better associated with lower cost, "local" or "regional" claims (shorter transport distances), as well as "better health" information. This is because "health" is a tangible benefit for consumers, while "local" claims have great appeal to consumers due to specific associations (e.g., support for local farms). Vegan and vegetarian diets entail personal benefits though they are also low-carbon choices. Certifications for buildings could seek to put greater emphasis on the cost of energy, making financial considerations more relevant for prospective buyers. In the tourism sector, certifications need to be better aligned with notions of higher quality, i.e. personal benefits, to overcome their otherwise altruistic character. All consumer information tools can be improved in their appeal by providing factual, procedural and effectiveness knowledge, while also relying to a greater extent on normative designs. In addition, a more holistic, structured, and evidence-based understanding of the impacts of daily decisions can facilitate the embracing of more sustainable lifestyles.

6 DEVELOPMENT OF NEW CARBON INFORMATION TOOLS

With most efforts to increase carbon literacy and to change consumer behaviour being focused on certifications, there is scope for the development of new consumer information tools. Such initiatives could for instance include the measurement of carbon footprints, as well as more tangible approaches such as metering for houses in developing and emerging economies. Rankings are a powerful mechanism to complement information tools, commending leaders and exposing laggards in energy efficiency and emissions. Currently, most tools provide information on the relative carbon content of products, but where choices exist between products, these need to be made more explicit. Rankings could highlight best in class companies or products; websites and apps could make low-carbon choices comparable. Contests can also play a significantly greater role as information tools, as they generate media headlines and influence public discourse. The private sector should further integrate climate change into core business strategies to develop innovative ways to reduce the pressure on the world's resources. This includes best communicating about product sustainability performance to enhance informed decision-making (UNEP, 2016).

ANNEX A1: CERTIFICATIONS IN TOURISM

Name of certification	Label[1)]	Type of Organisation[2)]	Global/ Regional/ National	Number of businesses certified	GHG assessment
Audubon International	A	NP	Global	44 (hotels)	
BIO Hotels	A	IA	Global	> 90 (hotels)	
Biosphere Tourism	M	NP	Global	177 (destinations)	YES
Blaue Schwalbe	A	FP	Global	106 (accommodation)	
Blue Flag	TA	NP	Global	4558 (beaches, marinas, boats)	
Carbon Neutral Certification	M	Expert board	Global	149 (clients, not only tourism)	YES
Certified Green Restaurant®	G	NP	USA, Canada	614 (restaurants)	
Certified Wildlife Friendly®	TA	NP	Global	?	
David Bellamy Conservation Award	A	NP	United Kingdom	579 (parks)	YES
Distinción Turismo Sustentable	A, TA, S	NP	Chile	143 (businesses)	YES
EarthCheck ECO	TA	FP	Global	?	YES
Eco Awards Namibia	A	NP	Namibia	80 (accommodation)	YES
ECO certification	A	Public Entity	Malta	29 (hotels & farmhouses)	
Eco Hotels Certified	A	NP	Germany	?	YES
Eco Romania	A, TA	NP	Romania	52 (products)	
Ecocamping	A	IA	Global	219 (camping facilities)	YES
EcoLabel Luxembourg	A	NP	Luxembourg	55 (tourism entities)	YES
Ekologicky setrny vyrobek / Environmentally Friendly Product	S	GO	Czech Republic	about 100 (companies)	
Ecotourism Ireland	TA	NP	Ireland	?	YES
Ecotourism Kenya	A	NP	Republic of Kenya	86 (entities)	YES
Environmentally Friendly Label: Croatia	S	GO	Croatia	?	

Name of certification	Label[1)]	Type of Organisation[2)]	Global/ Regional/ National	Number of businesses certified	GHG assessment
Estonian Ecotourism Quality Label	A, TA	NP	Estonia	?	
EU Ecolabel	A, S	GO	Global	400 (hotels)	
European Ecotourism Labelling Standard	M	NP	Global	?	YES
Fair for Life	P	FP	Virgin Islands, U.S.	?	
Fair Trade Tourism	NP	NP	Southern Africa	69 (members)	YES
Good Shopping Guide Ethical Award	S, P	Social Enterprise	Global	?	
Green Business Bureau	TA, S	FP	USA, Canada	?	
Green Certificate: Latvia	A, TA	NP	Latvia	ca. 80 (tourism businesses)	
Green Destinations Standard	M	NP	Global	81 (destinations)	
Green Globe Certification	M	FP	Global	?	YES
Green Hospitality Award	A, G	FP	Ireland	24 (suppliers)	YES
Green Key	A, TA	NP	Global	ca. 2900 (businesses)	
Green Key Eco-Rating Program	A	IA	USA, Canada	?	YES
Green Seal	A, G	NP	USA	51 (hotels & restaurants)	
Green Sign	A	FP	Germany	84 (hotels)	YES
Green Star Hotel	A	IA	Egypt	76 (hotels)	YES
Green Table	G	O	British Columbia, Canada	87 (restaurants)	
Green Tourism Business Scheme	A, TA	NP	UK, Ireland	1986 (tourism businesses)	YES
Hoteles más Verdes	A	NP	Argentina	99 (hotels)	YES
ibex fairstay	A	NP	Switzerland	62 (accommodations)	
International Eco Certification Program	A, TA, S	NP	Australia	375	YES
KRAV	G	NP	Sweden	about 2000 (businesses)	YES
LEAF	G	NP	Canada	88 (restaurants & suppliers)	

Name of certification	Label[1)]	Type of Organisation[2)]	Global/ Regional/ National	Number of businesses certified	GHG assessment
Legambiente Turismo	A, TA	NP	Italia	?	
Nature's Best Ecotourism	TA	NP	Sweden	64 (companies)	
$NoCO_2$	A, G, S	FP	Global	about 150 (companies)	YES
Nordic Swan	A, G	NP	Scandinavia	about 700 (hotels & restaurants)	YES
Österreichisches Umweltzeichen	M	GO	Austria	507 (tourism entities)	
Rainforest Alliance Certified	A, TA	NP	Global	?	YES
Responsible Tourism Tanzania	A	NP	Tanzania	32 (entities)	YES
Sustainable Tourism Education Program (STEP)	M	NP	Global	?	YES
TripAdvisor's GreenLeader	A	FP	Global	?	YES
TourCert	M	NP	Global	247 (members)	YES
Travellife	M	IA	Global	936 (tour operators & hotels)	YES
Viabono	A, G	FP	Germany	Current number unknown	YES

1) A: Accommodation; TA: Tourist activities (including beaches, marinas and boats in the case of Blue Flag certifications); P: Products; S: Services; G: Gastronomy; M: Multiple.

2) NP: not for profit; FP: for profit; IA: industry association; GO: government

Source: Ecolabel Index 2018

ANNEX A2: CERTIFICATIONS IN BUILDINGS (PROPERTIES, PROJECTS, CONSTRUCTION COMPANIES)

Name of certification	Type of Organisation	Global/Regional/ National	Number of properties/ construction companies certified	GHG assessment
ANAB - Architettura Naturale	NP	Italia	?	
Arge TQ	FP	Germany, Austria, Switzerland	152	
Audubon International	NP	Global	3000	
BOMA Go Green - BOMA BESt	IA	Canada	>7000	
BREEAM	NP	Global	16,707	YES
Built Green	NP	Canada	142	YES
CASBEE	-	Japan	?	YES
Certified Envirodesic	FP	Canada	?	
CHPS - Collaborative for High Performance Schools	NP	USA	300	YES
David Bellamy Conservation Award	NP	United Kingdom	579	YES
DGNB Certificate	NP	Germany	1361	YES
Earth Advantage	NP	Oregon, USA	146	YES
EarthCheck	FP	G	?	YES
EcoVillage	NP	Russia	?	YES
Effinature	Certification body	France	?	
Energy Labelling of Buildings: EU	GO	Global	?	YES
Green Advantage Certification	NP	USA	?	
Green Flag Program	NP	USA	?	
Green Globes	FP	USA	?	YES
Green Key Eco-Rating Program	IA	USA, Canada	?	YES
Green Shield Certified	IA	USA	?	
Green Star NZ	NP	New Zealand	159	YES
HQE	IA	France	?	

Name of certification	Type of Organisation	Global/Regional/ National	Number of properties/ construction companies certified	GHG assessment
IBO	IA	Austria	300	YES
Indoor airPLUS	GO	USA	?	
LEED Green Building Rating Systems	NP	USA	94,000	YES
Minergie	NP	Switzerland	45,966	
Passivhaus	NP	Global	4,547	YES
R-2000 Certificate	GO	Canada	64	YES
Waterwise Marque	NP	United Kingdom	?	

Source: Ecolabel Index 2018

ANNEX A3: CERTIFICATIONS IN FOOD SYSTEMS

Name of certification	Label[1)]	Type of Organisation[2)]	Global/ Regional/ National	Number of producers certified	GHG assessment
4C Association	F	NP	Global	?	
AB (Agriculture Biologique)	F	NP	France	?	
ABIO	F	NP	Brazil	?	
AfOR Compost Certified	F	NP	United Kingdom	?	
Afrisco Certified Organic	F	NP	South Africa	?	
AIAB (Italian Association for Organic Agriculture)	F&O	NP	Italia	?	
AMA Biozeichen	F	GO	Austria	?	
American Grassfed	F	IA	USA	about 170 (producer members)	
Animal Welfare Approved	F&O	NP	USA, Canada	1977 (producers, restaurants)	
Aquaculture Stewardship Council	F	NP	Global	?	
AsureQuality Organic Standard	F	GO	Australia, New Zealand	?	
Australian Certified Organic	F&O	NP	Australia	?	
AvoGreen®	F	IA	New Zealand	?	
B Corporation	F&O	NP	Global	2655 (companies)	YES
Best Aquaculture Practices	F	NP	Global	> 1600 (facilities)	
BIODAR	F	NP	Slovenia	?	
BioForum Biogarantie and Ecogarantie	F&O	NP	Belgium	?	
BioGro New Zealand	F	NP	New Zealand	> 750 (producers)	
BIO Hellas	F	FP	Bulgaria, Greece	> 9000 (customers)	
BIO Hotels	F&O	IA	Global	63 (restaurants)	
Biokreis	F	NP	Germany, Austria, Switzerland	about 1700 (producers & partners)	
Bioland	F	NP	Germany	about 8300 (producers & partner)	
Bio Quebec	F	GO	Quebec, Canada	?	
Bio-Siegel	F	GO	Germany	5197 (companies)	
Bio Suisse	F	NP	Switzerland	923 (companies)	

Name of certification	Label[1)]	Type of Organisation[2)]	Global/ Regional/ National	Number of producers certified	GHG assessment
Bird Friendly Coffee	F	NP	Global	?	
Bonsucro	F	NP	Global	about 160 (facilities)	YES
British Columbia Certified Organic	F	NP	British Columbia, Canada	?	
C.A.F.E. Practices	F	FP (Starbucks)	Global	about 90 (partners)	
California Certified Organic Farmers - CCOF	F	NP	California, USA	> 2000 (producers)	
Canada Organic	F	GO	Canada	?	
CarbonFree® Certified	F&O	NP	Global	178 (partners)	YES
Carbon Neutral Certification	F&O	Expert Board	Global	149 (clients)	YES
Carbon Reduction Label	F&O	FP	Global	?	YES
Certified Australian Southern Rocklobster „CleanGreen" Program	F	IA	Southern Australia	13 (collaborators)	
Certified Green Restaurant®	F	NP	USA, Canada	614 (restaurants)	
Certified Humane Raised and Handled	F	NP	USA	?	
Certified Naturally Grown	F	NP	USA, Canada	> 750 (producers)	
Certified Vegan	F	NP	USA	about 950 (companies)	
Certified Wildlife Friendly®	F&O	NP	Global	?	
Chão Vivo	F	NP	Brazil	?	
China Organic Food Certification	F	NP	China	?	
Climatop	F&O	NP	Switzerland	?	YES
Danish Ø-mark	F	GO	Denmark	?	
Delinat Bio Garantie	F	FP	USA	about 250 (products)	
Demeter Biodynamic®	F&O	NP	USA	?	
Dolphin Safe / Dolphin Friendly	F	NP	Global	?	
Ecocert	F&O	FP	Global	?	YES
Eco-Leaf	F&O	IA	Japan	?	YES

Name of certification	Label[1)]	Type of Organisation[2)]	Global/ Regional/ National	Number of producers certified	GHG assessment
Ecomark: India	F&O	GO	India	?	
Environmental Product Declaration	F&O	GO	Global	about 1000 (products)	YES
Estonian Organic Farming	F	GO	Estonia	?	
EU organic products label	F	GO	Global	?	
Fair for Life	F&O	FP	Virgin Islands, U.S.	?	
Fairtrade	F&O	NP	Global	1.66 million (farmers & workers)	
Fair Trade Certified (USA)	F&O	NP	Global	about 900,000 (farmers & workers)	
FairWild	F&O	NP	Global	26 (companies)	
Food Alliance Certified	F	NP	USA	?	
Friend of the Sea	F	NP	Global	320 (companies)	
Global Good Agricultural Practice (GAP)	F	IA	Global	?	
Green Crane: Ukraine	F&O	NP	Ukraine	?	
Green Good Housekeeping Seal	F&O	FP	USA	1872 (products)	YES
Green Table	F	O	British Columbia, Canada	87 (restaurants)	
Green Tick	F&O	FP	New Zealand	?	YES
HAND IN HAND	F	FP	Global	?	
Japanese Agricultural Organic Standard (JAS)	F	GO	Japan	?	
KRAV	F&O	NP	Sweden	about 2000 (companies)	YES
LEAF	F	NP	Canada	88 (restaurants & suppliers)	
LEAF Marque	F	NP	United Kingdom	1032 (certified businesses)	
LFP Certified	F	NP	Ontario, Canada	79 (farmers)	YES
LIVE (Low Input Viticulture and Enology)	F	NP	USA	382 (vineyards & wineries)	YES
Luomuliitto - The Ladybird label	F	NP	Finland	?	
Luomu Sun Sign	F	GO	Finland	?	
Marine Stewardship Council	F	NP	Global	43,000 (fisheries & suppliers)	
Max Havelaar (FairTrade)	F	NP	Switzerland	?	

Name of certification	Label[1)]	Type of Organisation[2)]	Global/ Regional/ National	Number of producers certified	GHG assessment
Milieukeur: the Dutch environmental quality label	F&O	NP	Netherlands	?	YES
National Green Pages™ Seal of Approval	F&O	NP	USA	about 3000 (businesses)	YES
Nature's Promise	F	FP	USA	?	
Naturland e.V.	F&O	NP	Global	about 54,000 (producers)	YES
Neuland	F	NP	Germany	?	YES
Non-GMO	F	NP	USA, Canada	14,208 (retailers)	
Ocean Wise	F	NP	Canada	ca. 700 (partners)	
ORC-Cert Organic Seal	F	NP	Hongkong	151 (operations)	
Oregon Tilth	F	NP	Global	?	
Organic Farmers & Growers Certification	F	FP	United Kingdom	about 1200 (farmers)	
Organic Food Federation	F	NP	United Kingdom	?	
Processed Chlorine Free	F&O	NP	Global	?	YES
Protected Harvest	F	NP	USA	?	
QCS Organic	F	IA	USA	?	
Rainforest Alliance Certified	F&O	NP	Global	?	YES
RSPO Certified Sustainable Palm Oil	F	NP	Global	> 3000 (members)	
RTRS Certified Soy	F	IA	Brazil	about 200 (members)	
Salmon-Safe	F&O	NP	Westcoast, North America	about 400 (organisations)	
SeaChoice	F	NP	Canada	?	
SIP Certified	F	NP	California, USA	199 (vineyards)	YES
Soil Association Organic Standard	F&O	NP	United Kingdom	?	
SPCA Certified	F	NP	Canada	18 (farms)	
Sustainable Winegrowing New Zealand	F	IA	New Zealand	about 1700 (vineyards & wineries)	
USDA Organic	F	GO	USA	?	
UTZ Certified	F	NP	Global	987,000 (farmers)	YES
Vermont Organic Certified	F	NP	Vermont, USA	687 (farms)	
Wholesome Food Association	F	NP	United Kingdom	75 (producers & suppliers)	

Source: Ecolabel Index 2018

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This report details how the use of **consumer information tools** can support greenhouse gas emission reductions in three industry sectors: tourism, buildings and food. Consumer information covers a range of tools and systems that seek to guide consumers to make more sustainable choices about goods and services (products), including in their use and end of life phase. Tools can take many forms, including certifications, voluntary standards, product declarations, ratings, marketing claims, foot printing, life-cycle assessments, product campaigns in store or on social media, and other ways of communicating with consumers on environmental and social issues connected to products (for instance through product design). They can be single- or multi-issue, and can follow a life cycle approach to provide a holistic perspective considering the impacts of every stage of the product development process, including how a product is used and how it is treated responsibly at end-of-life.

In this context, the report defines the climate change mitigation challenge for the tourism, buildings and food sectors within the framework of the Paris Agreement. It outlines the structure of the three sectors and details their supply chain specifics. The report then summarizes the state of the art on consumer behaviour, before it describes existing consumer information tools in each sector. Barriers to and solutions for their more widespread use are discussed along with recommendations for business and policy makers. The report also contains a number of best practice cases.

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