



# THE BUSINESS CASE FOR CLIMATE ACTION IN TOURISM

REDUCING GHG EMISSIONS & WATER FOOTPRINT  
THROUGH FOOD CHOICES

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## ABOUT THE SUSTAINABLE TOURISM GLOBAL CENTER (STGC)

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



## HIGHLIGHTS

- Travel & Tourism is one of the world's largest sectors, accounting for over 10% of global GDP and 1 in 10 jobs on the planet in 2019. The sector accounted for 1 in 4 jobs new jobs created globally.
- Travel & Tourism is not only impacting but significantly impacted by climate change and environmental degradation. Without concerted action, Travel & Tourism emissions will rise by 20% by 2030.
- For the sector to achieve a reduction of GHG emissions by 40% from the 2019 baseline, actionable and accessible solutions are needed, combined with additional amounting to US\$ 220-310 billion a year through to 2030.
- Food-related emissions and food waste are a major challenge for the Travel & Tourism sector, and specifically hospitality and food & beverage businesses. In effect, global food systems were responsible for 18 billion tons of carbon dioxide equivalent, or 34% of all human caused GHG emissions in 2015; while food waste effectively accounts for 8-10% of global greenhouse gas emissions.
- Across industries, over 30% of food is lost and wasted each year. If food wasted were halved and people had healthier diets, the GHG emissions from food production could be decreased by 54% by 2050 according to the Johns Hopkins Center for a Livable Future.
- To quantify the impact of menu selection, six different menus for a large event, such as a wedding, are compared in this study. The case clearly showcases how the selection of food has significant impact of the Carbon Emissions of the meal as well as the meal's water footprint, given the vastly different emissions and water usage of the different products utilized in each menu.
- The reduction in GHG emissions related to a meal and the reduction in water footprint, decreased as much as 87.5% and 86.9% respectively between the Baseline menu and other menus.
- Given the cost implications of ingredient selection, the cost of ingredients and menus was assessed, revealing a decrease in cost ranging from 37.6% to 69.2% between the Baseline menu and the other proposed menus.
- Feeding almost eight billion people worldwide comes at a high cost to the planet, requiring the sector and travellers alike to rethinking global eat habits and diets to reduce food-related emissions and the associated water footprint.



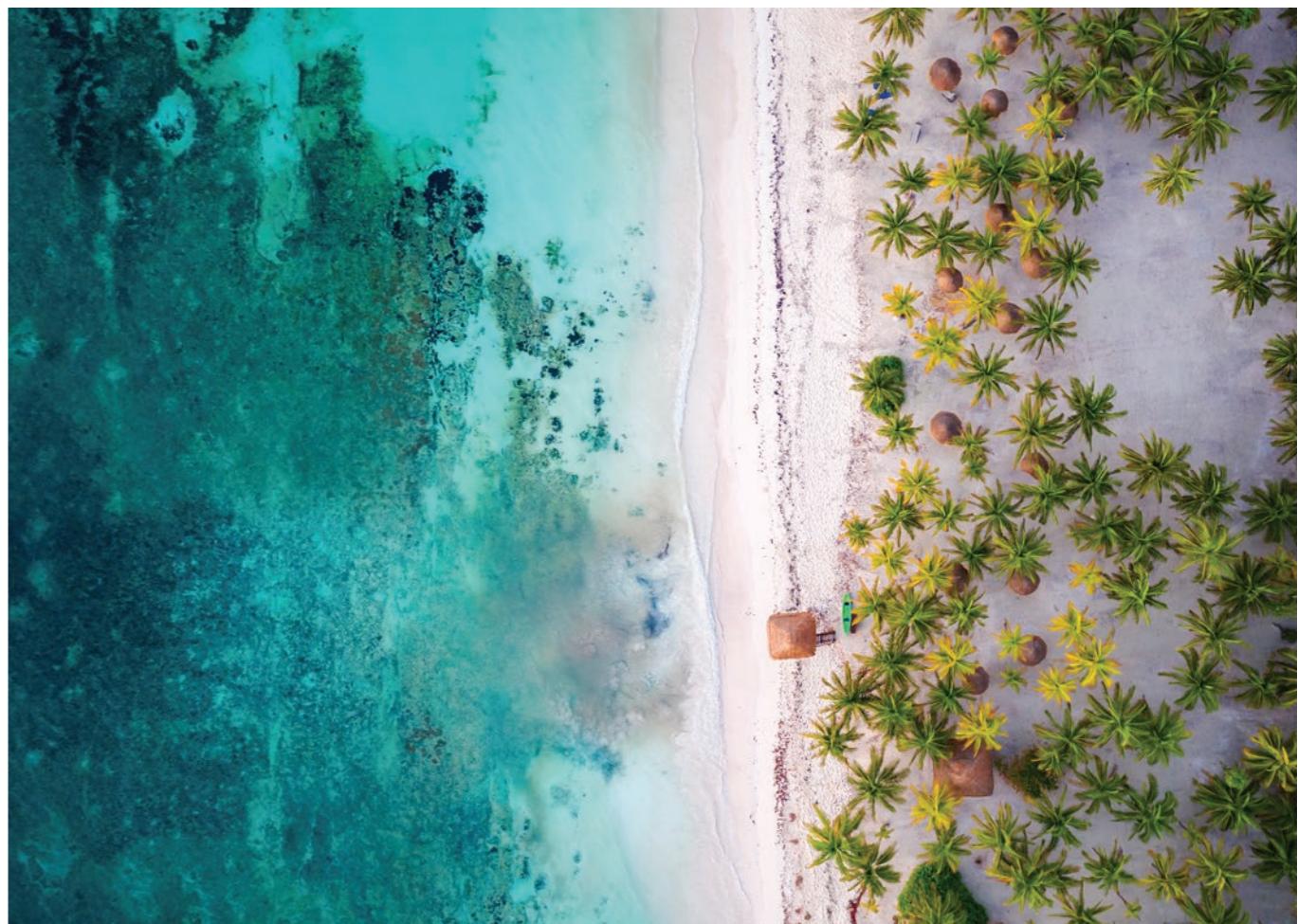
## INTRODUCTION

Travel & Tourism is one of the world's largest sectors, accounting for over 10% of global GDP and 1 in 10 jobs on the planet in 2019. In fact, prior to the pandemic, Travel & Tourism accounted for 1 in 4 jobs new jobs created globally. Whilst the sector was faced its worst crisis in history as a result of the COVID-19 pandemic, it has bounced back with forecasts predicting the continued growth of the sector to 2030 and beyond.

The sector not only drives economic growth, but also poverty reduction, peace and tolerance whilst having a positive impact on local communities and the livelihoods of people touched by Travel & Tourism. Yet, despite Travel & Tourism's tremendous value, the sector is responsible for roughly 8.1% of carbon emissions globally, 12% of all food waste, and total plastic pollution from the sector is estimated to generate annual costs of US\$ 50-170 billion in lost marine ecosystem services. Travel & Tourism is not only impacting but significantly impacted by climate change and environmental degradation, which are a "code red for humanity".

The climate and biodiversity crises are effectively jeopardizing the future of Travel and Tourism. From the growing scepticism of youth to deteriorating ecosystems and increasing destinations at risk to overwhelmed communities. And, without concerted action, Travel & Tourism emissions will rise by 20% by 2030 , further harming our planet. Many destinations, including island states, are especially vulnerable to the risks and impacts of climate change, requiring the Travel & Tourism sector to be part of the solution.

To act on this urgent agenda and achieve a reduction of 40% of Travel & Tourism related GHG emissions from the 2019 baseline by 2030, will require all key stakeholders, small and large, public, and private, to come together to commit and accelerate to change. Yet to do so, will require



coordination and collaboration across stakeholders as well as actionable and accessible solutions, tools as well as best practices to inspire and facilitate the transition.

In this case studies in action series, the Sustainable Tourism Global Center (STGC) explores specific climate and environmental challenges faced by the Travel & Tourism sector. Each edition will delve into a distinctive challenge, and through concrete and quantifiable examples, provides insights and solutions for key stakeholders, which will ultimately benefit people and planet alike.

This edition focuses specifically on the challenge of food-related emissions and food waste. Indeed, global food systems, across industries, are responsible for close to 34% of all human-caused global greenhouse gas emissions, while 30% of food is lost and wasted each year. Given the importance of this challenge for the hospitality and food & beverage industries, this edition aims to provide solutions for these key stakeholders, by examining the influence of food choices in reducing the GHG emissions and water footprint, using the case of a birthday celebration or wedding hosted in a hotel, restaurant, or large catering hall to bring this issue to life.

## THE CHALLENGE: FOOD CHOICES' IMPACT ON EMISSIONS & WATER FOOTPRINT

Although feeding almost eight billion people worldwide is essential, it comes at a high cost to the planet. Indeed, according to a 2021 study, global food systems were responsible for 18 billion tons of carbon dioxide equivalent, or 34% of all human caused GHG emissions in 2015<sup>ii</sup>. What is more, between 1990 and 2015, global food production increased by 40%, with annual emissions from food systems rising from 16 billion tons to CO<sub>2</sub>e to 18 billion tons of CO<sub>2</sub>e. Nevertheless, at the individual level, food related emissions decline from an average of 3 tons to 2.4 tons of CO<sub>2</sub>e between 1990 and 2015.

In addition to the emissions generated by global food systems, globally and across industries, over 30% of food is lost and wasted each year. According to UNEP<sup>iii</sup>, food waste effectively accounts for 8-10% of global greenhouse gas emissions. Whilst in developed nations, 40% of food is lost from market to consumption, in developing countries, 40% of food is lost from production to market. Research suggests that 6-8% of all human-caused greenhouse gas emissions could be reduced if food was not wasted<sup>iv</sup>.

Delving into food production, the use of animals for meat causes twice the pollution of producing plant-based foods<sup>v</sup>. Indeed, meat production and especially beef, has an outsized impact on the environment, amounting to 57% of all food production emissions, one that is far worse for climate than the production of fruits and vegetables. The difference in emissions between meat and plant production is staggering. Whilst the production of 1kg of wheat leads to 2.5kg of GHG being emitted, a single kilo of beef amounts to 70kg in GHG emissions.

According to the Johns Hopkins Center for a Livable Future, if food wasted was halved and people had healthier diets<sup>vi</sup>, the GHG emissions from food production could be decreased by 54% by 2050. According to the 2018 Intergovernmental Panel on Climate Change (IPCC) report, one recommendation is to eat less meat. In addition to causing significant emissions, food has a water footprint; namely, different foods require a certain amount of water, external and internal, to be produced. The water footprint of food is particularly relevant, given the importance of water management and increasing water scarcity in many parts of the world<sup>vii</sup>.



## THE CASE: QUANTIFYING THE IMPACT OF MENU SELECTION

Increasingly, travelers are selecting their next destination based on what they will eat. In effect, according to American Express Travel's 2023 Global Travel Trends Report, 81% of respondents agree that trying local foods and cuisines is the part of travelling they look forward to most. The focus of travelers on gastronomy, combined with a growing prioritization of health-conscious and sustainable travel, provides a unique opportunity for hospitality businesses to proactively address the emissions and water footprint of food selection.

To do so, however, requires an understanding of the specific emissions relating to different foods and their associated water footprint. Using the case of an event, such as a birthday celebration, or a wedding hosted at a hotel or restaurant, this section utilizes the baseline menu from a real wedding of 200 people. The menu used is a typical meal served at a wedding in the United States and compares the emissions and footprint to different menus. The baseline menu is then compared to five different menus to showcase the vast differences in emissions and footprint. Given the cost implications of different ingredients and their potential implications on menu selection, the cost of different ingredients in the United States are included.

### BASELINE MENU

The baseline menu for this study is a menu of a real 200-person wedding in the United States. The menu consisted of fresh bread rolls, butter, beef fillet, potato, green asparagus, wine, cheesecake, and dried figs. Table 1 highlights the portion size of each of the items, their carbon footprint as well as their water footprint.

**Table 1**

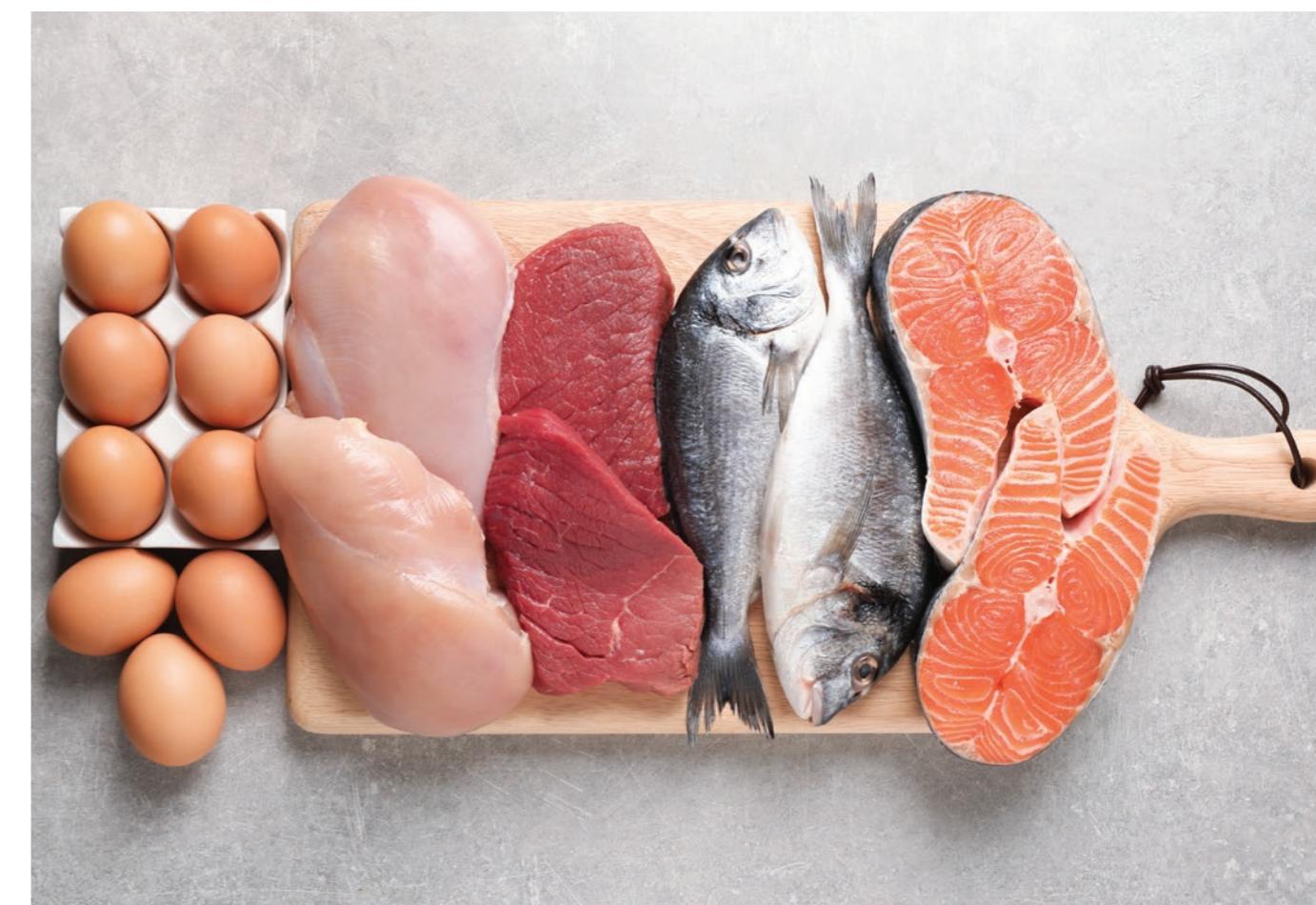
Portion Size (in Grams)	Food Selection	Type of Food	Carbon Footprint (Kg of CO2eq)	Water Footprint (Liters of Freshwater)	Cost of Ingredients (US\$)
125	Wine	Beverage	0.153	109	0.67
170	Baked Potato	Carbohydrate Serving	0.018	49	0.10
200	Beef Fillet	Protein Serving	9.178	6234	5.73
80	Green Asparagus	Vegetable Serving	0.078	172	0.49
60	Fresh Bread Rolls	Bread Serving	0.052	96	0.44
50	Butter	Additional Dairy Products	0.367	278	0.31
120	Cheesecake	Dessert Serving	0.612	346	0.75
100	Dried Figs	Fruit Serving	0.344	344	0.66

The overall carbon and water footprints and the cost per meal for the baseline meal option per individual amounts to:

- **Carbon Footprint: 10.803 KgCO2eq**
- **Water Footprint: 7628 Liters of Freshwater**
- **Cost per Meal: US\$ 8.47**

On this basis, the estimated total carbon and water footprints as well as the cost of the meal for this event with the baseline meal option are:

- **Carbon Footprint: 2160.507 KgCO2eq**
- **Water Footprint: 1,525,529 Liters of Freshwater**
- **Meal Cost: US\$ 1,693.56**



## MENU 2

Unlike the Baseline Menu which includes beef, Menu 2, makes changes, including among others lamb as the main protein. Menu 2 consisted of fresh bread rolls, butter, lamb, cooked rice, sliced potatoes, wine, chocolate cake, and dates. Table 2 highlights the portion size of each of the items, their carbon footprint as well as their water footprint.

**Table 2**

Portion Size (in Grams)	Food Selection	Type of Food	Carbon Footprint (Kg of CO2eq)	Water Footprint (Liters of Freshwater)	Cost of Ingredients (US\$)
125	Wine	Beverage	0.153	109	0.67
170	Cooked Rice	Carbohydrate Serving	0.100	95	0.05
200	Lamb	Protein Serving	8.760	1562	1.34
80	Sliced Potatoes	Vegetable Serving	0.013	23	0.13
60	Fresh Bread Rolls	Bread Serving	0.052	96	0.44
80	Butter	Additional Dairy Products	0.588	444	0.50
120	Chocolate Cake	Dessert Serving	0.284	310	0.60
100	Dates	Fruit Serving	0.167	228	0.19

The overall carbon and water footprints and the cost per meal for Menu 2 option per individual amounts to:

- **Carbon Footprint: 10.117 KgCO2eq**
- **Water Footprint: 2867 Liters of Freshwater**
- **Cost per Meal: US\$ 3.24**

On this basis, the estimated total carbon and water footprints as well as the cost of the meal for this event with the Menu 2 option are:

- **Carbon Footprint: 2023.420 KgCO2eq**
- **Water Footprint: 573,328 Liters of Freshwater**
- **Meal Cost: US\$ 647.15**

Comparing the Baseline Menu to Menu 2, it is clear that the shift in food selection, can lead to a reduction in GHG emissions and water footprint. Specifically, between the Baseline Menu and Menu 2, there is a **6.3% reduction in GHG emissions** relating to food and a **62.4% reduction in water footprint**. From a cost perspective, **Menu 2 is 61.7% less expensive than the Baseline Menu**.

## MENU 3

Menu 3 has further changes, including lobster as the main protein among others. Specifically, Menu 3 consisted of fresh bread rolls, butter, lobster, cooked rice, zucchini, wine, chocolate truffle and peaches. Table 3 highlights the portion size of each of the items, their carbon footprint as well as their water footprint.

**Table 3**

Portion Size (in Grams)	Food Selection	Type of Food	Carbon Footprint (Kg of CO2eq)	Water Footprint (Liters of Freshwater)	Cost of Ingredients (US\$)
125	Wine	Beverage	0.153	109	0.67
170	Cooked Rice	Carbohydrate Serving	0.100	95	0.05
200	Lobster	Protein Serving	4.012	5	3.50
80	Zucchini	Vegetable Serving	0.023	27	0.19
60	Fresh Bread Rolls	Bread Serving	0.052	96	0.44
80	Butter	Additional Dairy Products	0.588	444	0.50
50	Chocolate Truffle	Dessert Serving	0.250	850	0.42
100	Peaches	Fruit Serving	0.049	91	0.18

The overall carbon and water footprints and the cost per meal for the baseline meal option per individual amount to:

- **Carbon Footprint: 5.228 KgCO2eq**
- **Water Footprint: 1717 Liters of Freshwater**
- **Cost per Meal: US\$ 5.28**

On this basis, the estimated total carbon and water footprints as well as the cost of the meal for this event with the Menu 3 option are:

- **Carbon Footprint: 1,045.575 KgCO2eq**
- **Water Footprint: 343,412 Liters of Freshwater**
- **Meal Cost: US\$ 1,056.59**

Comparing the Baseline Menu to Menu 3, it is clear that the shift in food selection leads to significant reductions in GHG emissions and water footprint. Specifically, between the Baseline Menu and Menu 3, there is a **51.6% reduction in GHG emissions** relating to food and a **77.5% reduction in water footprint**. From a cost perspective, **Menu 3 is 37.6% less expensive than the Baseline Menu**.

## MENU 4

Menu 4 has further changes, including wild salmon as the protein. Specifically, Menu 4 consisted of fresh bread rolls, butter, wild salmon, cooked rice, green asparagus, wine, cheesecake, and kiwi. Table 4 highlights the portion size of each of the items, their carbon footprint as well as their water footprint.

**Table 4**

Portion Size (in Grams)	Food Selection	Type of Food	Carbon Footprint (Kg of CO2eq)	Water Footprint (Liters of Freshwater)	Cost of Ingredients (US\$)
125	Wine	Beverage	0.153	109	0.67
170	Cooked Rice	Carbohydrate Serving	0.100	95	0.05
150	Wild Salmon	Protein Serving	0.720	4	4.29
80	Green Asparagus	Vegetable Serving	0.078	172	0.49
60	Fresh Bread Rolls	Bread Serving	0.052	96	0.44
80	Butter	Additional Dairy Products	0.588	444	0.50
120	Cheesecake	Dessert Serving	0.612	346	0.75
100	Kiwi	Fruit Serving	0.051	51	0.27

The overall carbon and water footprints and the cost per meal for Menu 4 option per individual amounts to:

- **Carbon Footprint: 2.354 KgCO2eq**
- **Water Footprint: 1,318 Liters of Freshwater**
- **Cost per Meal: US\$ 6.78**

On this basis, the estimated total carbon and water footprints as well as the cost of the meal for this event with the Menu 4 option are:

- **Carbon Footprint: 470.801 KgCO2eq**
- **Water Footprint: 263,586 Liters of Freshwater**
- **Meal Cost: US\$ 1,355.85**

Once again, comparing the Baseline Menu to Menu 4, the significant difference GHG emissions and water footprint is apparent. Specifically, between the Baseline Menu and Menu 4, there is a **84.4% reduction in GHG emissions** relating to food and a **84.8% reduction in water footprint**. While Menu 4 slightly lower GHG emissions relating to food, its water footprint is significantly lower than that of Menu 3.

## MENU 5

Menu 5 has further changes, including the shift to wheat bread and margarine instead of butter among others. Specifically, Menu 5 consisted of wheat bread, margarine spread, mussels, cooked rice, sliced potatoes, tea, ice cream and strawberries. Table 5 highlights the portion size of each of the items, their carbon footprint as well as their water footprint.

**Table 5**

Portion Size (in Grams)	Food Selection	Type of Food	Carbon Footprint (Kg of CO2eq)	Water Footprint (Liters of Freshwater)	Cost of Ingredients (US\$)
125	Wine	Beverage	0.153	109	0.67
170	Sweet Potato	Carbohydrate Serving	0.034	65	0.24
200	Chicken	Protein Serving	0.620	865	0.53
80	Broccoli	Vegetable Serving	0.038	23	0.14
60	Fresh Bread Rolls	Bread Serving	0.052	96	0.44
80	Butter	Additional Dairy Products	0.588	444	0.50
120	Carrot Cake	Dessert Serving	0.474	204	0.54
100	Mango	Fruit Serving	0.114	180	0.22

The overall carbon and water footprints and the cost per meal for the baseline meal option per individual amount to:

- **Carbon Footprint: 2.072 KgCO2eq**
- **Water Footprint: 1987 Liters of Freshwater**
- **Cost per Meal: US\$ 2.61**

On this basis, the estimated total carbon and water footprints as well as the cost of the meal for this event with the Menu 5 option are:

- **Carbon Footprint: 414.344 KgCO2eq**
- **Water Footprint: 397,326 Liters of Freshwater**
- **Meal Cost: US\$ 522.06**

Comparing the Baseline Menu to Menu 5, it is clear that the shift in food selection, leads to significant reductions in GHG emissions and water footprint. Specifically, between the Baseline Menu and Menu 5, there is a **80.8% reduction in GHG emissions** relating to food and a **74.0% reduction in water footprint**. Interestingly, whilst Menu 5 has slight lower GHG emissions relating to food, its water footprint is slightly higher than that of Menu 4. From a cost perspective, **Menu 5 is 69.2% less expensive than the Baseline Menu**.

## MENU 6

Menu 6 has further changes, including the shift to mussels as the main protein serving, among others. Specifically, Menu 6 consisted of fresh bread rolls, butter, mussels, cooked rice, zucchini, wine, ice cream and strawberries. Table 6 highlights the portion size of each of the items, their carbon footprint as well as their water footprint.

**Table 6**

Portion Size (in Grams)	Food Selection	Type of Food	Carbon Footprint (Kg of CO2eq)	Water Footprint (Liters of Freshwater)	Cost of Ingredients (US\$)
125	Wine	Beverage	0.153	109	0.67
170	Cooked Rice	Carbohydrate Serving	0.100	95	0.05
150	Mussels	Protein Serving	0.013	2	1.27
80	Zucchini	Vegetable Serving	0.023	27	0.19
60	Fresh Bread Rolls	Bread Serving	0.052	96	0.44
80	Butter	Additional Dairy Products	0.588	444	0.50
120	Ice Cream	Dessert Serving	0.398	190	0.60
100	Strawberries	Fruit Serving	0.020	35	0.48

The overall carbon and water footprints and the cost per meal for Menu 6 option per individual amounts to:

- **Carbon Footprint: 1.347 KgCO2eq**
- **Water Footprint: 998 Liters of Freshwater**
- **Cost per Meal: US\$ 3.53**

On this basis, the estimated total carbon and water footprints as well as the cost of the meal for this event with the Menu 6 option are:

- **Carbon Footprint: 269.345 KgCO2eq**
- **Water Footprint: 199,602 Liters of Freshwater**
- **Meal Cost: US\$ 705.21**

Once again, comparing the Baseline Menu to Menu 6, the significant difference in GHG emissions and water footprint is apparent. Specifically, between the Baseline Menu and Menu 6, there is **87.5% reduction in GHG emissions** relating to food and an **86.9% reduction in water footprint**. From a cost perspective, **Menu 6 is 58.4% less expensive than the Baseline Menu**.

## COMPARISON OF THE SIX MENUS

Comparing the six menus below, it is clear that the selection of food has significant impact of the Carbon emissions of the meal as well as the meal's water footprint, given the vastly different emissions and water usage of the different products utilized in each menu. The menu selection also has a significant impact on cost in line with the price of the ingredients.

Menus	Carbon emissions per meal (Kg of CO2eq)	Water footprint per meal (liters of freshwater)	Reduction in GHG emissions	Reduction in the Water Footprint	Cost reduction of ingredients per meal
<b>Baseline Menu:</b> Wine, Baked Potato, Beef Fillet, Green asparagus, Fresh bread rolls, Butter, Cheesecake and Dried figs	10.803	7628	Baseline	Baseline	Baseline
<b>Menu 2:</b> Wine, Cooked Rice, Lamb, Sliced Potatoes, Fresh bread rolls, Butter, Chocolate Cake, Dates	10.117	2867	-6.3%	-62.4%	-61.7%
<b>Menu 3:</b> Wine, Cooked Rice, Lobster, Zucchini, Fresh Bread Rolls Butter, Chocolate Truffle, Peaches	5.228	1717	-51.6%	-77.5%	-37.6%
<b>Menu 4:</b> Wine, Cooked Rice, Wild Salmon, Green Asparagus, Fresh Bread Rolls, Butter, Cheesecake, Kiwi	2.354	1318	-78.2%	-82.7%	-20%
<b>Menu 5:</b> Wine, Sweet Potato, Chicken, Broccoli, Fresh bread rolls, Butter, Carrot Cake, Mango	2.072	1987	-80.8%	-74.0%	-69.2%
<b>Menu 6:</b> Wine, Cooked Rice, Mussels, Zucchini, Fresh Bread Rolls, Butter, Ice Cream, Strawberries	1.347	998	-87.5%	-86.9%	-58.4%



## LOOKING AHEAD: SOLUTIONS

Given that the hospitality industry alone is responsible for 12% of all food waste globally , proactively addressing food waste and food-related emissions is essential for businesses in the hospitality and food & beverage industry.

In effect, while the six menus examined are only illustrative, comparing the six menus showcases the significance of food selection in the hospitality and restaurant industry and their widely varying impact on the environment. It also highlights that shifting towards more sustainable menus would not automatically imply an increase in cost. In fact, Menu 2, 3, 4, 5 and 6, actually reveal a decrease in ingredient costs.

As hospitality and food & beverage businesses propose and create menus, they can also consider the possibility of having a combination of proteins for instance to reduce emissions and footprint. For instance, a menu could have a smaller piece of beef and a piece of fish.

Beyond the data outlined in the context of this report, STGC wishes to support hospitality & F&B business leaders, chefs, caterers, and restaurateurs in their transition to net zero. As such, two beta versions of simple and easy to use tools have been created to [quantify the impact of food products as dishes are created](#), as well as an [overall calculator for menus](#) and their respective impact.

In conjunction, innovative solutions could also be used to reduce the carbon footprint of beef. In effect, according to research, by adding 60 grams a day of Taxiformis red algae to the regular animal feedstock, the methane from cow belching could be reduced by 80%. As such, implementing vendor certifications for beef producers could drive the market into producing and using red algae in turn driving down beef's carbon footprint.

Ultimately, we hope that through a better understanding of emissions related to different foods, hospitality and food & beverage businesses will be better equipped to make informed decisions as they select food products in menu creation; and thus support the sector and global community in reducing emissions and tackling the climate crisis



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## ENDNOTES

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