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BASELINE EMISSIONS FROM TOURISM IN MONTENEGRO

December 2015

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- Asier Sopelana
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Acronyms

CH_4	Methane
CO_2e	CO_2-equivalents
CO_2	Carbon dioxide
DEFRA	UK Department for Environment, Food & Rural Affairs
DOC	Degradable organic carbon
FOD	First order decay
HFC	Hydrofluorocarbon
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse effect gas
GWP	Global warming potential
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
MSW	Municipal solid waste
NIR	National Inventory Report
N_2O	Nitrous oxide
NTO	Montenegro's National Tourist Organization
TCNTM	Towards a Carbon Neutral Tourism in Montenegro
TSA	Tourist Satellite Accounts
UNDP	United Nations Development Programme
UNWTO	United Nations World Tourism Organization

EXECUTIVE SUMMARY

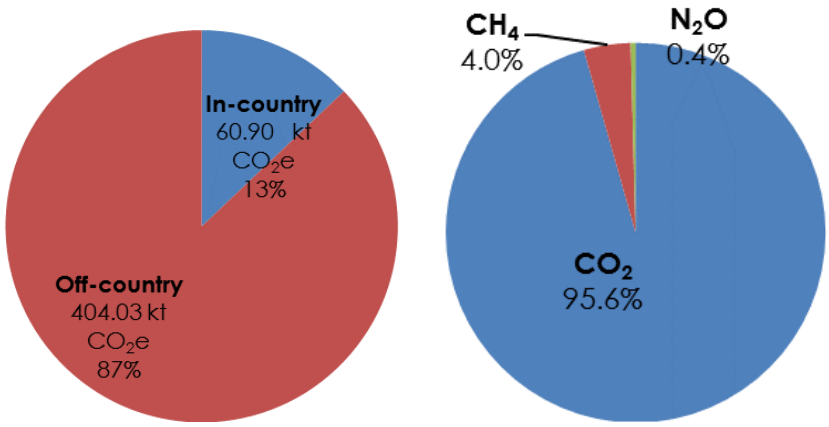
In recent years, Montenegro's tourism sector has experienced a rapid development with an increase in the number of visitors and investments, becoming the main and most dynamic economic sector. As a major contributor to the country's GDP, is one of the strategic drivers of economic growth. However, in the business-as-usual scenario, tourism sector's greenhouse effect gases (GHGs) emissions will rise by 40% in 2020 above 1990 baseline. As a result of this state of affairs, Montenegro's government has decided to curb the sector's emissions and seek its low carbon development.

In this context, Montenegro's Ministry of Sustainable Development and Tourism and the United Nations Development Programme (UNDP) launched the "Towards Carbon Neutral Tourism in Montenegro" (TCNTM) project, with the immediate target of maintaining tourism sector related GHG emissions at the 2013 level. In order to assess the effectiveness of the measures implemented under the project TCNTM's scope of action, the 2013 baseline emissions of GHGs from the tourism sector of Montenegro has been calculated.

The scope of the baseline includes the CO_2, CH_4 and N_2O emissions from the following sectors, differentiating those which take place in and off the country (due the transport of foreign tourists to Montenegro):

IN-COUNTRY EMISSIONS	OFF-COUNTRY EMISSIONS
Accommodation and other services: o Accommodation services. o Food and beverage services. o Travel agencies services. o Cultural services. o Sport and recreational services.	
Road transport	Road transport
Railway transport	Railway transport
Air transport: o Airports	Air transport: o Flights
Ship transport: o Inland navigation o Cruises at berth	Ship transport: o Maritime navigation
Waste o Solid waste o Wastewater	

The baseline emissions from tourism in Montenegro in year 2013 were **464.93 kt CO_2e**. The majority of these emissions (404.03 kt CO_2e; 87% of the total) took place out of the country, in the transportation of foreign tourists from their countries of origin to Montenegro. The rest (60.90 kt CO_2e; 13% of the total) was country-based and had its source in the touristic activities, transportation and waste management within Montenegro.

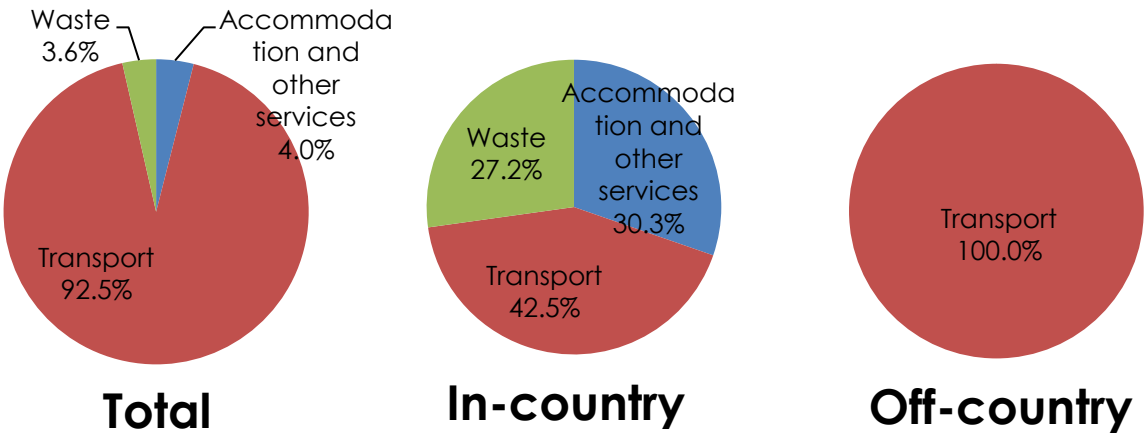


Total GHG emissions' share by geographical origin (left) and by type of GHG.

The total emissions from tourism by sector were as follows:

Sector	t CO_2	t CH_4	t N_2O	kt CO_2e
Accommodation and other services	16,650.3	60.2	1.0	18.5
Transport	427,736.2	39.7	3.9	429.9
Waste	-	641.4	1.8	16.6
Total	**443,486.5**	**741.3**	**6.8**	**464.93**

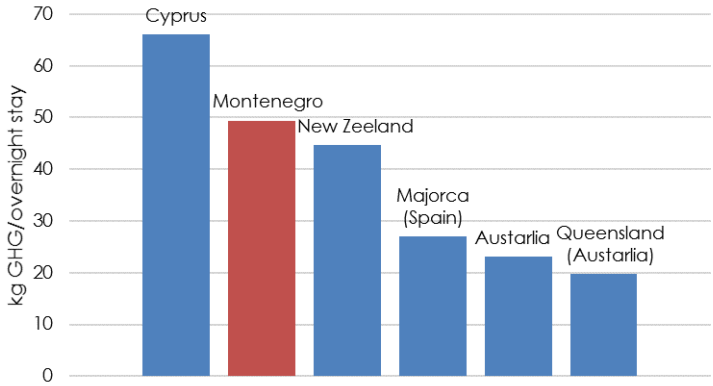
The main source of emissions was the transportation, and the majority of it was generated in the transportation of foreign tourist to reach Montenegro (93%), especially by plane. Regarding this last topic, it must be noted that the national administration has a very limited capacity to put into motion reduction actions and therefore, the public administration efforts should be strongly focused in the mitigation of in-country emissions.



GHG emissions by sector and geographical origin.

Considering only the in-country emissions, it emerges that the most relevant source is transportation (43%), where road transport is the biggest emitter. Then, the second emitter results to be the accommodation and other services, and among them, accommodations services. Therefore, it appears that in these sectors there is a sound potential of mitigation by implementing the use and development of energy efficiency and renewable energies technologies and best practices in accommodation facilities and buildings.

Similar calculations of emissions from the tourist sector in other countries are scarce and not continuous on time. The following figure shows a comparison between the GHG emissions of a tourist overnight stay in a few countries and regions. Comparison between countries should be done with caution, as the methodology used to calculate the indicators vary. However, it is noticeable that there is still room for improvement for Montenegro's tourism sector when comparing with other destinations.



GHG emissions of a tourist overnight stay.

The elaboration of the baseline emissions from tourism in Montenegro has required the participation of several agencies and governmental entities. In order to facilitate future studies as the present, it is recommended to speed up the process centralizing all the information in a single data base hosted by MONSTAT.

The economic data related to tourism is scarce and not detailed. In this sense, it is recommended to continue elaborating Tourist Satellite Accounts (TSA) as pilot elaborated for the year 2009.

It would be recommendable, as well, to actualize waste characterization and the rate of waste generated by tourists every five years or at least every decade.

Although the scope of the Baseline is extensive, the lack of data did not allow the calculation of other GHGs emissions, beside CO_2, CH_4 and N_2O. It is recommended for future works to improve the data in order to determine the emission of these other GHGs, such as HFCs, not only for tourism emissions but also on national level.

All the calculations have been performed using official data. It is required to take into account the existence of informal tourist activity that is not reflected on these official data. Therefore, the GHG emissions from informal tourism sector are not been taking into account in the Baseline.

1. PRESENTATION

The main goal of this Report is to present the methodology used to recalculate the baseline emissions of greenhouse effect gases (GHGs) from tourism in Montenegro and the results of this calculation. The year of the baseline is 2013, date to which all data are referred (except in the case that no specific data for 2013 was available).

First, a brief analysis of the previous GHG emission baseline from Montenegro's tourist sector calculation is presented.

Next, the methodology used for the calculation is described, including the scope of the calculation, the methodological approach to the emitting sectors, the equations used and the data available for the calculations.

Finally, the conclusions on the results of the Baseline are presented, as well as recommendations to facilitate future calculations.

2. PREVIOUS GHG BASELINE CALCULATION:

Towards a Carbon Neutral Tourism in Montenegro

A previous GHG emission baseline of the tourism sector in Montenegro was calculated for the year 2013 within the UNDP-GEF Project *Towards a Carbon Neutral Tourism in Montenegro*, resulting in 83.38 kt CO_2e. The baseline included the emissions from energy used in tourist accommodation, in-country road transport, by cruise ships staying at harbours and other tourism-related infrastructure (in particular from airports).

Table 1. Summary of Baseline GHG emissions from Montenegro's in-country tourism activities.
Source: *Towards a Carbon Neutral Tourism in Montenegro*.

Estimated in-country baseline emissions in 2013	kt CO_2e
Accommodation	45.24
In-country travel by car	20.30
Cruise ships at harbour	16.62
Others (airports)	1.21
Total	**83.38**

The calculation was performed using a bottom-up approach, in which data gaps were filled through estimations and assumptions of the authors. The use for each of the categories is shown in the next table:

Table 2. Summary of data used to calculate the GHG emissions baseline from Montenegro's in-country tourism activities.
Source: Own elaboration based on *Towards a Carbon Neutral Tourism in Montenegro*.

Subsector	Data used
Accommodation	• Number of overnight stays (real). • Average energy consumption per overnight stay: electricity, fuel oil, LPG, coal (estimations). • Emission factors (real).
In-country travel by car	• Annual number of visiting tourists (real). • Average in-country travel (estimation). • Emissions per kilometre (estimation).
Cruise ships at berth	• Average power demand (electricity) of cruise ships when staying at berth (estimation). • Average duration of stay (estimation). • Emission factor of electricity generation by using ships' own engines (estimation). • Number of visiting ships in 2012 (real).
Others (airports)	• Annual energy consumption (electricity, motor fuels) of Podgorica and Tivat airports (real). • Emission factors (real).

3. CALCULATION METHODOLOGY

3.1. Scope

The scope of the baseline is the emissions generated by the tourism sector of Montenegro. The accounted emissions are those generated by tourist, either foreign or domestic, within Montenegro and those originated by means of transport to reach the country, in the year 2013.

The definition of tourism considered for the calculation of the Baseline is the one provided by the United Nations World Tourism Organization: "Tourism is defined by the activities of persons identified as visitors. A visitor is someone who is making a visit to a main destination outside his/her usual environment for less than a year for any main purpose [including] holidays, leisure and recreation, business, health, education or other purposes" (UNWTO, 2010).

The detailed sources of GHG emissions considered are the following:

Table 3. Sources of GHG within scope.
Source: Own elaboration.

Geographical distribution	Sector	Source
IN-COUNTRY EMISSIONS	Accommodation and other services	Fuel consumption by tourists in: • Accommodation services. • Food and beverage services. • Travel agencies services. • Cultural services. • Sport and recreational services.
	Road transport	Fuel consumption of vehicles used for tourists transportation within Montenegro: • Car • Coach • Motorcycle • Caravan/RV
	Railway transport	Fuel and electricity consumption due to tourists using the railway system within the Montenegro.
	Air transport	Fuel and electricity consumption in land activities and airport facilities due to tourists visiting Montenegro.
	Ship transport	Fuel and electricity consumption due to: • Inland navigation for tourists transportation. • Cruises at berth.
	Waste	Degradation of waste generated by tourists during their stay in Montenegro: • Solid waste • Wastewater
OFF-COUNTRY EMISSIONS	Road transport	Fuel consumption of vehicles used for foreign tourists transportation from origin country to Montenegro and back: • Car • Coach • Motorcycle • Caravan/RV
	Railway transport	Fuel and electricity consumption due to foreign tourists using the railway system from origin country to Montenegro and back.
	Air transport	Fuel consumption of planes due to foreign tourists transportation from city of origin to Montenegro and back.
	Ship transport	Fuel consumption of ships used for foreign tourists transportation from origin country to Montenegro and back.

The GHGs within the scope are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O). The three of them are converted into CO_2 equivalents (CO_2e) using the global warming potential (GWP) established by the IPCC for a time horizon of 100 years: 1 for CO_2, 25 for CH_4 and 298 for N_2O.

3.2. Methodological approach

According to the Global Environment Facility's (GEF) Manual for Calculating GHG Benefits of GEF Projects, in order to properly assess the mitigation of GHGs by projects, it is a prior requirement to define a baseline of emissions. The GEF methodology will be used to calculate GHG reduction from projects in tourism in the next phase and, to keep the methodological coherence; the guidelines of GEF have been used to calculate the baseline GHG emissions. The methodological approach used to calculate the baseline GHG emissions is a hybrid approach, combining both top-down and bottom-up approaches. The first one correlates economic data with emissions, through energy consumption of the economic sectors. The bottom-up utilizes activity data[1] related to the sector in study and translates them into GHG emissions through emission factors.

Table 4. Baseline recalculation methodological approach.
Source: Own elaboration.

Sector	Subsector	Methodological approach
Accommodation and other services	Accommodation services.	Hybrid
	Food and beverage services	Top-down
	Travel agencies services.	
	Cultural services.	
	Sport and recreational services.	
Road transport	In-country	Top-down
	Off-country	Bottom-up
Railway transport	In-country	Top-down
	Off-country	Bottom-up
Air transport	Flights	Bottom-up
	Airports	
Ship transport	Inland navigation	Top-down
	Maritime navigation	Bottom-up
	Cruises at berth	
Waste	Solid waste	Bottom-up
	Wastewater	

[1] For more detail regarding the activity data used, see Annex I.

The GHG emission baseline general equation is:

$$Total\ emissions_{CO_2e} = \sum [(Accom\&other_{GHG} + Road_{GHG} + Rail_{GHG} + Air_{GHG} + Ship_{GHG} + Waste_{GHG}) \cdot GWP_{GHG}]$$

Where:

Total emissions$_{CO2e}$ = total CO_2e emissions from Montenegro's tourism sector (t CO_2e)

Accom&other$_{GHG}$= total emission of given GHG from tourist accommodation and other services (t GHG).

Road$_{GHG}$= total emission of given GHG from tourists road transportation (t GHG).

Rail$_{GHG}$= total emission of given GHG from tourists railway transportation (t GHG).

Air$_{GHG}$ = total emission of given GHG from tourists air transportation (t GHG).

Ship$_{GHG}$ = total emission of given GHG from tourists ship transportation (t GHG).

Waste$_{GHG}$ = total emission of given GHG from tourists' waste treatment (t GHG).

GWP = global warming potential of given GHG.

The emission factors used for the calculations are those derived from the National Inventory Report (NIR) of Montenegro. In case of lack of specific emission factors, default emission factors from other sources have been used (e.g. 2006 IPCC Guidelines or the UK Department for Environment, Food & Rural Affairs, DEFRA)[2].

Regarding the methodology proposal presented in the first Inception Report, the calculations presented in this document have been performed to the extent to which the data available and gathered during the mission to Montenegro have allowed to use the proposed methodology. However, as was expected, data gaps render some of the proposed equations unviable. In these cases, new equations adjusted to the available data have been used. Below, a comprehensive explanation of the calculation steps is shown.

3.2.1. Accommodation and other services

The calculation of the emissions from collective accommodation (hotels, resorts, etc.) and other services (beverage and food, travel agencies, cultural, sport and recreational) for tourists was performed through a top-down approach in which the energy consumption of services and other sectors was correlated with the gross output of all the services activities in Montenegro, obtaining the energy intensity of services. These data

[2]For more detail regarding emission factors, see Annex II.

were used with a calculation of the mean expenditure of tourists in each service to obtain the final energy consumption of each of them.

The calculation of the mean expenditure of tourists was performed by approximation, using the 2009 Pilot Tourist Satellite Accounts (TSA). With these data, an expenditure per tourist and day in 2009 was estimated, using 2009 MONSTAT statistics of tourist and overnight stays. This expenditure per tourist and day (which was disaggregated in the different TSA categories) was used to estimate the expenditure in 2013, using 2013 tourist arrivals and overnight stays. The final figure of expenditure obtained was actualized from 2009's current prices to 2013's, using the inflation rate provided by MONSTAT.

In the case of the emissions from private accommodation (apartments, private rooms, etc.), a bottom-up approach was used. Through the energy consumption of households, an activity factor of average energy consumption per overnight stay was calculated and crossed with the total tourist overnight stays in private accommodation in 2013.

Then, in both cases, the following equations were used:

GHG emissions from fuel combustion in accommodation and other services:

$$Emissions_{GHG,fuel} = \sum Fuel\ consumption_{fuel\ i} \cdot Emission\ factor_{GHG,fuel\ i}$$

Where:

Emissions$_{GHG,fuel}$ = emission of given GHG from fuel combustion in accommodation and other services (t GHG).

Fuel consumption$_{fuel\ i}$ = amount of fuel type i consumed in accommodation and other services (TJ).

Emission factor$_{GHG,fuel i}$ = emission factor of a given GHG for fuel type I (t GHG/TJ).

GHG emissions from electricity consumption in accommodation and other services:

$$Emissions_{GHG,electricity} = Electricity\ consumption \cdot Emission\ factor_{GHG,electricity}$$

Emissions$_{GHG,electricity}$ = emission of given GHG from electricity consumption in accommodation and other services (t GHG).

Electricity consumption = electricity consumed in accommodation and other services (GWh).

Emission factor$_{GHG,electricity}$ = emission factor of a given GHG for the electricity generation mix (t GHG/GWh).

Table 5. Data used for the calculation GHG emissions from Accommodation and other services.
Source: Own elaboration.

Data used	Source
Energy balances 2013	MONSTAT
Gross output 2013	
Pilot TSA 2009	
Tourist overnight stays	
Emission factors	NIR/IPCC

3.2.2. Road transport

- **In-country**

The in-country emissions of road transport were calculated in a similar way of touristic services. The same top-down approach was used, but in this case, the energy intensity calculated and the expenditure used were those of road transport. The equation utilized was the following:

$$Emissions_{GHG,fuel} = \sum Fuel\ consumption_{fuel\ i} \cdot Emission\ factor_{GHG,fuel\ i}$$

Where:

$Emissions_{GHG,fuel}$ = emission of given GHG from fuel combustion in in-country road transport (t GHG).

$Fuel\ consumption_{fuel\ i}$ = amount of fuel type i consumed in in-country road transport (TJ).

$Emission\ factor_{GHG,fuel\ i}$ = emission factor of a given GHG for fuel type I (t GHG/TJ).

Table 6. Data used for the calculation GHG emissions from In-country road transport.
Source: Own elaboration.

Data used	Source
Energy balances 2013	MONSTAT
Gross output 2013	
Pilot TSA 2009	
Tourist overnight stays	
Emission factors	NIR/IPCC

- **Off-country**

The off-country road transport emissions were calculated using a bottom-up approach. The proportion of foreign tourist reaching Montenegro by road was obtained through surveys performed by Montenegro Tourist Organization (MTO) in the year 2014, as well as the type of vehicle and its occupation. The travelled distance was calculated taking into account the nationality of foreign tourists in year 2013 and the distance from their home-countries to Montenegro.

GHG emissions from tourist private road transportation (cars, motorcycles, RVs):

$$Emissions_{GHG,road,vehicle\ i} = Distance\ travelled_{road,vehicle\ i} \cdot Emission\ factor_{GHG,road,vehicle\ i}$$

Where:

Emissions$_{GHG,road,vehicle\ i}$ = emission of given GHG from the use of private vehicle type i (t GHG).

Distance travelled$_{road,vehicle\ i}$= distance travelled off-country by tourist with private vehicle type i (km).

Emission factor$_{GHG,road,vehicle\ i}$ = emission factor of a given GHG per kilometre travelled with private vehicle type i (kg GHG/km).

GHG emissions from tourist collective road transportation (coaches):

$$Emissions_{GHG,road,collective} = Distance\ travelled_{road,collective} \cdot Passengers_{road,collective} \cdot Emission\ factor_{GHG,road,collective}$$

Where:

Emissions$_{GHG,road,collective}$ = emission of given GHG from the use of coaches(t GHG).

Distance traveled$_{road,collective}$= distance travelled off-country by tourist with coaches (km).

Passengers$_{road,collective}$ = number of tourist travelling by coach (passengers).

Emission factor$_{GHG,road,collective}$ = emission factor of a given GHG per passenger-kilometer travelled with coaches (kg GHG/pass-km).

Total emissions from tourist off-country road transport:

$$Road_{GHG} = \sum_{i} Emissions_{GHG,road,vehicle\ i} + Emissions_{GHG,road,collective}$$

Table 7. Data used for the calculation GHG emissions from Off-country road transport.
Source: Own elaboration.

Data used	Source
Tourists' countries of origin	MONSTAT
Tourists' off-country modes of transport	NTO Guest Survey 2014
Tourists' usage of vehicles	
Vehicles occupancy	
Emission factors	DEFRA

3.2.3. Railway transport

- **In-country**

In-country emissions of tourist railway transportation were calculated through a top-down approach, in the same way as in-country road transportation.

GHG emissions from fuel consumption inin-country touristrailway transportation:

$$Emissions_{GHG,fuel} = \sum Fuel\ consumption_{fuel\ i} \cdot Emission\ factor_{GHG,fuel\ i}$$

Where:

Emissions$_{GHG,fuel}$ = emission of given GHG from fuel combustion in in-country railway transport (t GHG).

Fuel consumption$_{fuel\ i}$ = amount of fuel type i consumed in in-country railway transport (TJ).

Emission factor$_{GHG,fuel\ i}$ = emission factor of a given GHG for fuel type I (t GHG/TJ).

GHG emissions from electricity consumption in in-country railway transportation:

$$Emissions_{GHG,electricity} = Electricity\ consumption \cdot Emission\ factor_{GHG,electricity}$$

Emissions$_{GHG,electricity}$ = emission of given GHG from electricity consumption in in-country railway transportation(t GHG).

Electricity consumption = electricity consumed in in-country railway transportation (GWh).

Emission factor$_{GHG,electricity}$ = emission factor of a given GHG for the electricity generation mix (t GHG/GWh).

Table 8. Data used for the calculation GHG emissions from In-country railway transport. Source: Own elaboration.

Data used	Source
Energy balances 2013	MONSTAT
Gross output 2013	
Pilot TSA 2009	
Tourist overnight stays	
Emission factors	NIR/IPCC

- **Off-country**

Off-country emissions from railways usage by tourists were calculated as the off-country road transportation, using a bottom-up approach. The calculation of the distances and number of passengers was performed similarly. The equations used were the followings:

GHG emissions from off-country railway transportation

$$Rail_{GHG} = Distance\ travelled_{rail,tourist} \cdot Passengers_{rail} \cdot Emission\ factor_{GHG,rail}$$

Where:

$Rail_{GHG}$ = emission of given GHG from tourist off-country railway transportation (t GHG).

$Distance\ travelled_{rail,tourist}$ = distance travelled by tourists by train (km).

$Passengers_{rai}$ = number of tourist travelling by train (passengers).

$Emission\ factor_{GHG,rail}$ = emission factor of a given GHG for tourist rail transportation (t GHG/passenger-km).

Table 9. Data used for the calculation GHG emissions from Off-country railway transport. Source: Own elaboration.

Data used	Source
Tourists' countries of origin	MONSTAT
Tourists' off-country modes of transport	NTO Guest Survey 2014
Tourists' usage of vehicles	
Vehicles occupancy	
Emission factors	DEFRA

3.2.4. Air transport

- **In-country**

The in-country air transport emissions were calculated using a bottom-up approach. The equation used was the following:

GHG emissions from land activities and facilities (Podgorica and Tivat airports):

$$Emissions_{GHG,airport} = (Electricity\ consumption_{airport} \cdot EF_{GHG,electricity} + \sum Fuel\ consumption_{airport,fuel\ i} \cdot EF_{GHG,fuel\ i}) \cdot \frac{Incoming\ tourists}{Incoming\ passengers}$$

Where:

Emissions$_{GHG,airport}$ = emission of given GHG from airport facilities (ground activities, t GHG).

Electricity consumption$_{airport}$ = total electricity consumed by Podgorica and Tivat airports (GWh).

EF$_{GHG,electricity}$ = emission factor of a given GHG for the electricity generation mix (t GHG/GWh).

Fuel consumption$_{airport,fuel\ i}$ = total amount of fuel type i consumed by Podgorica and Tivat airports (ground activities; TJ).

EF$_{GHG,fuel\ i}$ = emission factor of a given GHG for fuel type I (t GHG/TJ).

Incoming tourists = total number of foreign passengers (passengers).

Incoming passengers = total number of passengers (passengers).

Table 10. Data used for the calculation GHG emissions from In-country air transport. Source: Own elaboration.

Data used	Source
Airports energy consumption	Podgorica and Tivat airports
Foreign passengers	Police authority
Total passengers	
Emission factors	DEFRA

- **Off-country**

The off-country air transport emissions were calculated using a bottom-up approach. The activity data used were the passenger-kilometers to reach Podgorica and Tivat airports. As no other data were available, it was preferred to considered the whole flight emissions as off-country. Specially, taking into account that DEFRA emission factors (used in this case) already include emissions from taking-off and landing.

The equation used was the following:

GHG emissions from flights:

$$Emissions_{GHG,flight} = Distance\ travelled_{flight,tourist} \cdot Passenger_{flight} \cdot Emission\ factor_{GHG,flight}$$

Where:

Emissions$_{GHG,flight}$ = emission of given GHG from tourist air transportation(t GHG).

Distance travelled$_{flight,tourist}$ = distance travelled by tourists by plane (km).

Passengers$_{flights}$ = number of tourists travelling by plane (passengers).

Emission factor$_{GHG,flight}$ = emission factor of a given GHG for tourist air transportation (t GHG/passenger-km).

Table 11. Data used for the calculation GHG emissions from Off-country air transport. Source: Own elaboration.

Data used	Source
Flights' cities of origin	Podgorica and Tivat airports
Foreign passengers	Police authority
Total passengers	
Emission factors	DEFRA

3.2.5. Ship transport

- **Inland navigation**

Inland navigation emissions from tourist were calculated through a top-down approach, in the same way as in-country road and rail transportation. The equations used were:

GHG emissions from fuel consumption in tourist inland navigation:

$$Emissions_{GHG,fuel} = \sum Fuel\ consumption_{fuel\ i} \cdot Emission\ factor_{GHG,fuel\ i}$$

Where:

Emissions$_{GHG,fuel}$ = emission of given GHG from fuel combustion in inland navigation (t GHG).

Fuel consumption$_{fuel\ i}$ = amount of fuel type i consumed in inland navigation(TJ).

Emission factor$_{GHG,fuel\ i}$ = emission factor of a given GHG for fuel type i (t GHG/TJ).

GHG emissions from electricity consumption in tourist inland navigation:

$$Emissions_{GHG,electricity} = Electricity\ consumption \cdot Emission\ factor_{GHG,electricity}$$

Emissions$_{GHG,electricity}$ = emission of given GHG from electricity consumption in inland navigation(t GHG).

Electricity consumption = electricity consumed in inland navigation (GWh).

Emission factor$_{GHG,electricity}$ = emission factor of a given GHG for the electricity generation mix (t GHG/GWh).

Table 12. Data used for the calculation GHG emissions from Inland navigation.
Source: Own elaboration.

Data used	Source
Energy balances 2013	MONSTAT
Gross output 2013	
Pilot TSA 2009	
Tourist overnight stays	
Emission factors	NIR/IPCC

- **Maritime navigation**

The emissions from maritime navigation were calculated using a bottom-up approach. The distance travelled by tourist was calculated taking into account the distance to neighbouring ports. The equations used were:

GHG emissions from tourist maritime navigation:

$$Maritime_{GHG} = Distance\ travelled_{maritime,tourist} \cdot Passengers_{maritime,tourist} \cdot Emission\ factor_{GHG,maritime}$$

Where:

Maritime$_{GHG}$ = total emission of given GHG from tourist maritime navigation (t GHG).

Distance travelled$_{maritime,tourist}$ = distance travelled by tourists by maritime passenger ships (passenger).

Passenger$_{maritime,tourist}$ = number of tourists travelling by ship (passengers).

Emission factor$_{GHG,maritime}$ = emission factor of a given GHG for tourist maritime navigation (t GHG/passenger-km).

Table 13. Data used for the calculation GHG emissions from Maritime navigation.
Source: Own elaboration.

Data used	Source
Number of arrivals by vessel	MONSTAT
Number of arrivals by cruise	
Emission factors	DEFRA

- **Cruises at berth**

The emissions caused by cruises staying at port were calculated through a bottom-up approach. The number of cruises arriving at port, along with specific information provided by Kotor's Port Authority was used in the following equitation:

GHG emissions from cruises at berth:

$$Cruise_{sGHG} = (\sum Cruise_i tonnage \cdot Time\ at\ berth_i) \cdot Fuel\ consumption_{h,t} \cdot Emission\ factor_{GHG,fuel\ oil}$$

Where:

Cruise$_{GHG}$ = total emission of given GHG from cruises at berth (t GHG).

Cruise$_i$ *tonnage* = cruise i gross tonnage (t).

Time at berth$_i$ = time expended at berth by cruise i (hr).

Fuel consumption$_{h,t}$ = Hourly fuel consumption of cruise at berth (kg of fuel oil/hr/tonnage)

Emission factor$_{GHG,fuel}$ oil = emission factor of a given GHG for fuel oil (kg GHG/kg fuel oil).

Table 14. Data used for the calculation GHG emissions from Cruises at berth.
Source: Own elaboration.

Data used	Source
Number of cruises arrivals	MONSTAT
Number of cruises per gross tonnage	Kotor's Port Authority
Average time of stay	
Hourly fuel consumption of cruises at berth	Ecofys
Emission factors	NIR/IPCC

3.2.6. Waste

- **Solid waste**

The calculation of emissions from solid waste generated by tourists was performed through a bottom-up approach method based on the First Order Decay (FOD) method contained in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Waste. The equation used was:

GHG emissions from solid waste disposal:

$$CH_4\ Emissions_{SWDS,tourists} = \left[\sum CH_4 generated_{x,T} - R_T\right] \cdot (1 - OX_T)$$

Where:

$CH_4 Emissions_{SWDS,tourists}$ = CH_4 emissions from tourist's solid waste managed in landfills in year T (kg CH_4).

T = year of inventory.

x = waste category or type/material.

R_T = recovered CH_4 in year T (kg CH_4).

OX_T= oxidation factor in year T (fraction).

Table 15. Data used for the calculation GHG emissions from Solid Waste.
Source: Own elaboration.

Data used	Source
Tourist waste generation rate	National Waste Management Plan
Waste characterization	
CH_4 recovered	EPA
Default values	IPCC

- **Waste water**

In a similar way to emissions from solid waste, GHG emission from tourists' wastewater was calculated using a bottom-up approach based on the 2006 IPCC Guidelines. The equations used were:

CH_4 emissions from tourists' wastewater treatment:

$$CH_4\ Emissions_{WW,tourists} = \left[\sum_{i,j} (T_j \cdot EF_{CH_4,j})\right] \cdot TOW_{tourists} \cdot (1 - S) \cdot (1 - R)$$

Where:

$CH_4\ Emissions_{WW,tourists}$ = CH_4 emissions from tourists' wastewater treatment (kg CH_4).

$T_{,j}$= degree of utilisation of treatment/discharge pathway or system j by tourists (fraction).

$EF_{CH4,j}$ = emission factor of treatment/discharge pathway or system j (kg CH4 / kg BOD).

$TOW_{torusits}$ = total organics from tourists in wastewater (kg BOD).

S = organic component fraction removed as sludge (fraction).

R = fraction of CH_4 recovered (fraction).

$$EF_{CH_4,j} = B_0 \cdot MCF_j$$

Where:

$EF_{CH4,j}$ = emission factor of treatment/discharge pathway or system j (kg CH4 / kg BOD).

B_0 = maximum CH_4 producing capacity (kg CH4/kg BOD).

MCF_j = methane correction factor of treatment/discharge pathway or system j (fraction).

$$TOW_{tourists} = Overnight\ stays \cdot BOD \cdot 0.001 \cdot I$$

Where:

$TOW_{torusits}$ = total organics from tourists in wastewater (kg BOD).

Overnight stays = total overnight stays of tourists (day·tourist).

BOD = per capita BOD (g/person/day).

0.001 = conversion from grams BOD to kg BOD.

I = correction factor for additional industrial BOD discharged into sewers (for collected the default is 1.25, for uncollected the default is 1.00.)

N_2O emissions from tourists' wastewater treatment:

$$N_2O\ Emissions_{WW,tourists} = N_{effluent} \cdot EF_{effluent} \cdot 44/28$$

Where:

$N_2O\ Emissions_{WW,tourists}$= N_2O emissions from the wastewater generated by tourists (kg N_2O).

$EF_{effluent}$= emission factor for N_2O from nitrogen discharged to wastewater, (kg N_2O-N/kg N).

44/28 = conversion factor from kg N_2O-N to N_2O.

$$N_{effluent} = (Overnight\ stays \cdot Protein \cdot F_{NPR} \cdot F_{NON-CON} \cdot F_{IND-COM}) - N_{sludge}$$

Where:

$N_{effluent}$ = total amount of nitrogen from tourists in the wastewater effluent (kg N).

Overnight stays = total number of tourists' overnight stays (person-day).

Protein = daily per capita protein consumption (kg/person-day).

F_{NPR} = fraction of nitrogen in protein (kg N/kg protein).

$F_{NON-CON}$ = factor for non-consumed protein added to the wastewater.

$F_{IND-COM}$ = factor for industrial and commercial co-discharged protein into the sewer system.

N_{SLUDGE} = nitrogen removed with sludge (kg N).

Table 16. Data used for the calculation GHG emissions from Wastewater.
Source: Own elaboration.

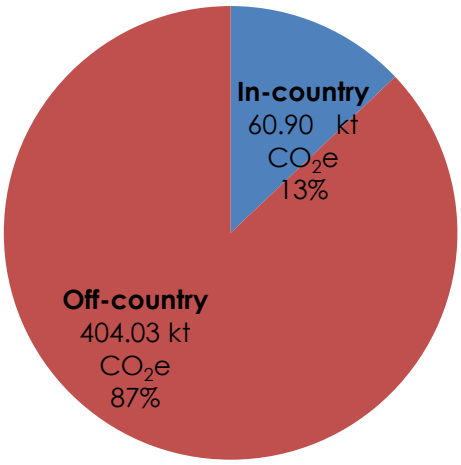
Data used	Source
CH_4 producing capacity	EPA
Wastewater management systems' degrees of utilisation	
BOD	
Per capita protein consumption	FAO
Default values	IPCC
Tourists' overnight stays	MONSTAT

4. RESULTS

4.1. Global results

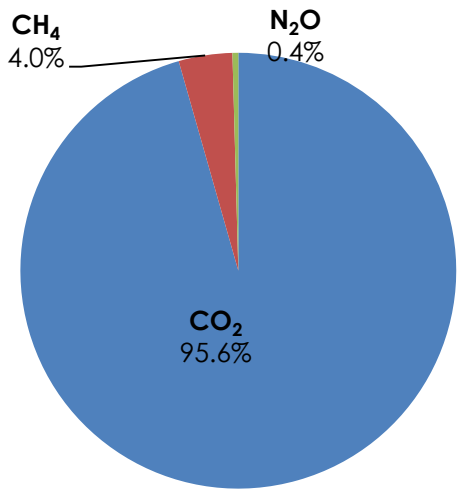
The baseline emissions from tourism in Montenegro in year 2013 were **464.93 kt CO_2e**. The majority of these emissions (404.03 kt CO_2e; 87% of the total) took place out of the country, in the transportation of foreign tourists from their countries of origin to Montenegro. The rest (60.90 kt CO_2e; 13% of the total) was country-based and had its source in the touristic activities, transportation and waste management within Montenegro.

Figure 1: Total emissions by geographical distribution.
Source: Own elaboration.



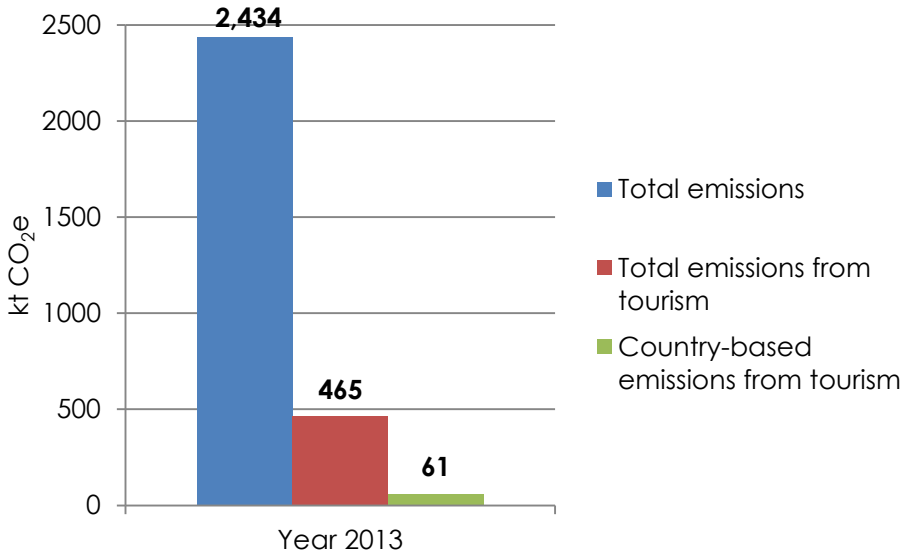
In terms of type of GHG, the baseline emissions were 444.37 kt CO_2, 741 t CH_4 (18.53 kt CO_2e) and 7 t N_2O (2.01 kt CO_2e). Considering each GHG global warming potential (GWP), CO_2 emissions were 95.6% of the total emissions, while CH_4 and N_2O had a 4.0% and 0.4% share of the total, respectively.

Figure 2: Total emissions by type of GHG.
Source: Own elaboration.



Comparing the baseline emissions with the total emissions of Montenegro, as reported in the NIR for year 2013, the country-based emissions from tourism contributed to 2.5% of the total emissions.

Figure 3: Tourism emissions compared to total national emissions.
Source: Own elaboration.



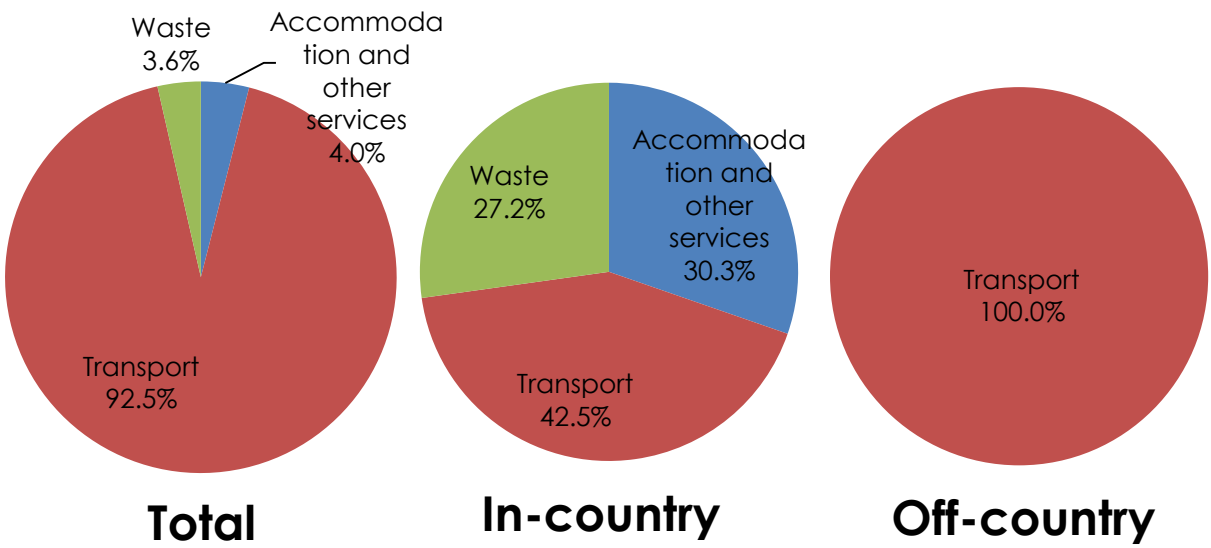
The tourist emissions by sector were as follows:

Table 17. Baseline emissions by sector.
Source: Own elaboration.

Sector	t CO_2	t CH_4	t N_2O	kt CO_2e
Accommodation and other services	16,650.3	60.2	1.0	18.5
Transport	427,736.2	39.7	3.9	429.9
Waste	-	641.4	1.8	16.6
Total	**443,486.5**	**741.3**	**6.8**	**464.93**

Of the total emissions, emissions from transport contributed to 92.5% of the total, while accommodation and other services to 4.0% and waste to 3.6% respectively.

Figure 4: Emissions by sector.
Source: Own elaboration.



In the case of in-country emissions, in-country transport contributed to 42.5%, accommodation and other services to 30.3% and waste to 27.2% of the total. All off-country emissions were sourced from transport.

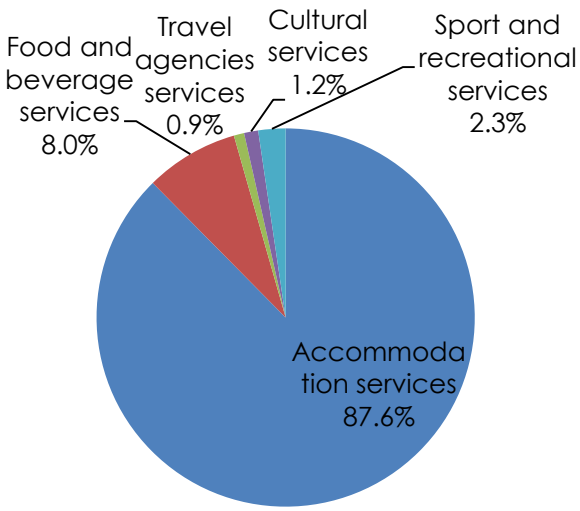
4.2. Accommodation and other services

The emissions from accommodation and other services for tourists in the year 2013 were as shown in following table:

Table 18. Emissions from Accommodation and other services.
Source: Own elaboration.

Emissions summary (t)	CO_2	CH_4	N_2O	CO_2e
Accommodation services	14,524.9	54.8	0.9	**16,171.8**
Food and beverage services	1,368.7	3.5	0.1	**1,474.3**
Travel agencies services	151.4	0.4	0.0	**163.1**
Cultural services	206.7	0.5	0.0	**222.7**
Sport and recreational services	398.5	1.0	0.0	**429.3**
Total	**16,650.3**	**60.2**	**1.0**	**18,461.2**

Figure 5: Source of emissions from accommodation and other services.
Source: Own elaboration.



All emissions from accommodation and other services took place in-country and were originated directly by the consumption of fuels or indirectly by the consumption of electricity.

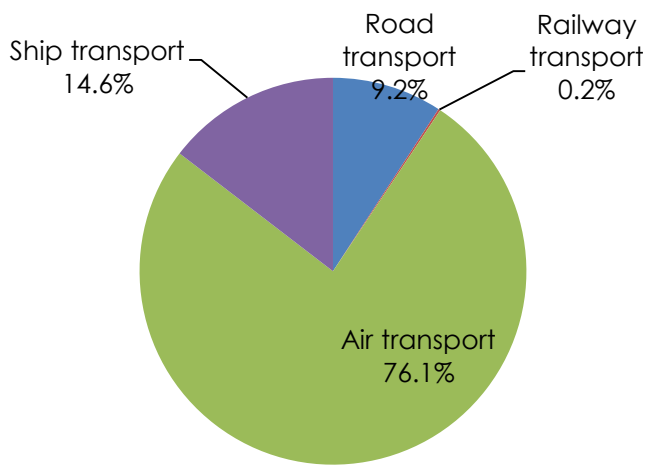
4.3. Transport

Emissions from transport of tourists were as follows:

Table 19. Emissions from Transport.
Source: Own elaboration.

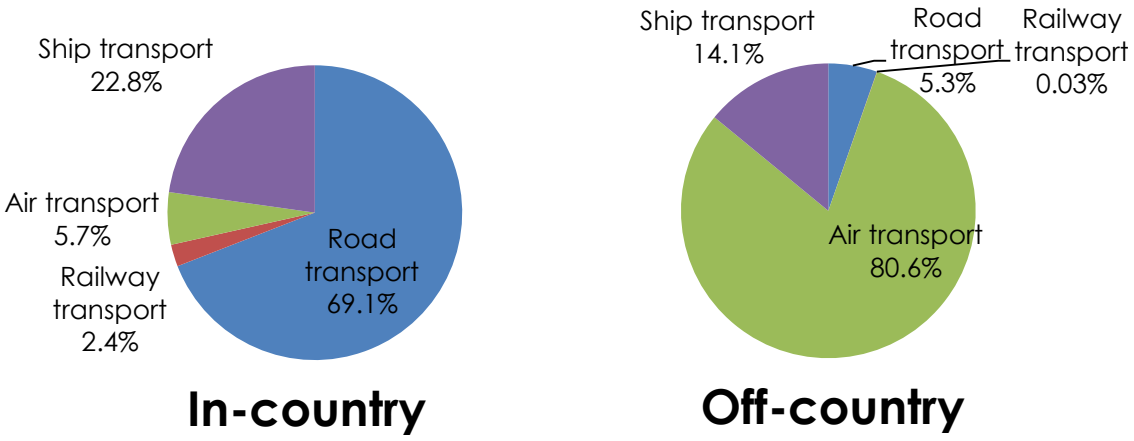
Emissions summary (t)	CO_2	CH_4	N_2O	CO_2e
Road transport	***39,241.7***	***5.7***	***0.3***	**39,486.8**
Off-country road transport	21,479.5	3.1	0.2	21,613.7
In-country road transport	17,762.2	2.6	0.2	17,873.2
Railway transport	***659.7***	***0.1***	***0.3***	**740.6**
Off-country rail transport	39.1	0.0	0.3	116.0
In-country rail transport	620.6	0.1	0.0	624.6
Air transport	***325,587.5***	***23.5***	***2.8***	**326,999.9**
Flights	324,113.3	23.3	2.7	325,515.5
Airports	1,474.2	0.2	0.0	1,484.4
Ship transport	***62,247.3***	***10.4***	***0.6***	**62,673.2**
Maritime navigation	56,431.0	8.2	0.5	56,783.7
Cruises at berth	5,000.8	0.7	0.0	5,032.1
Inland navigation	815.4	1.4	0.0	857.4
Total	**427,736.2**	**39.7**	**3.9**	**429,900.6**

Figure 6: Source of emissions from transport.
Source: Own elaboration.



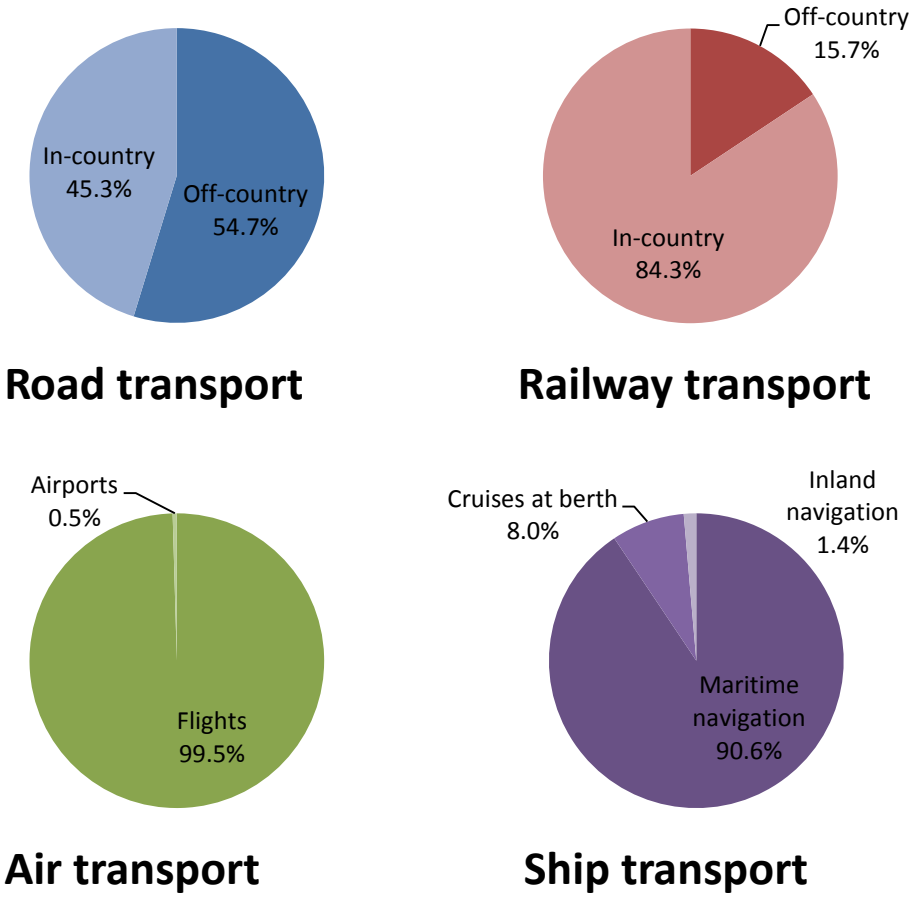
The majority of transport emissions were originated by air transport, followed by ship, road and railway transport. If in- and off-country emissions are analysed separately, the contribution of each type of transport was as follows:

Figure 7: Source of emissions from transport by geographical distribution.
Source: Own elaboration.



The emissions analysed by type of transport were:

Figure 8: Emissions by transport type.
Source: Own elaboration.



These emissions were originated by the consumption of fuels by vehicles, planes and ships, as well as electricity in the case of trains. Additionally, emissions originated by other

activities related to transport are taken into account: fuel and electricity consumed by land activities and airports facilities and fuel consumed by cruises at berth in ports.

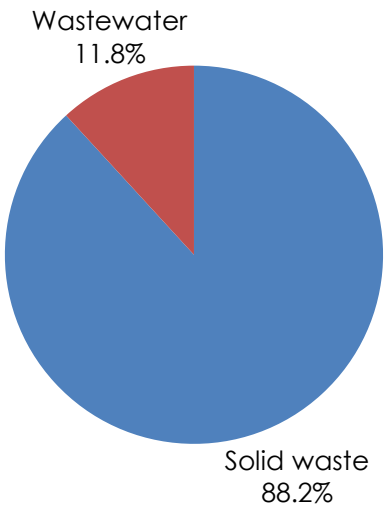
4.1. Waste

The emissions from the management of waste generated by tourists in the year 2013 were as shown in following table:

Table 20. Emissions from Waste.
Source: Own elaboration.

Emissions summary (t)	CO_2	CH_4	N_2O	CO_2e
Solid waste	-	585.5	-	**14,612.6**
Wastewater	-	56.9	1.8	**1,958.9**
Total	**-**	**739.0**	**6.7**	**16,571.5**

Figure 9: Source of emissions from waste.
Source: Own elaboration.



All emissions from waste took place in-country and were originated by the decomposition of the waste (solid or liquid) generated by tourists.

4.2. Main indicators and international comparison

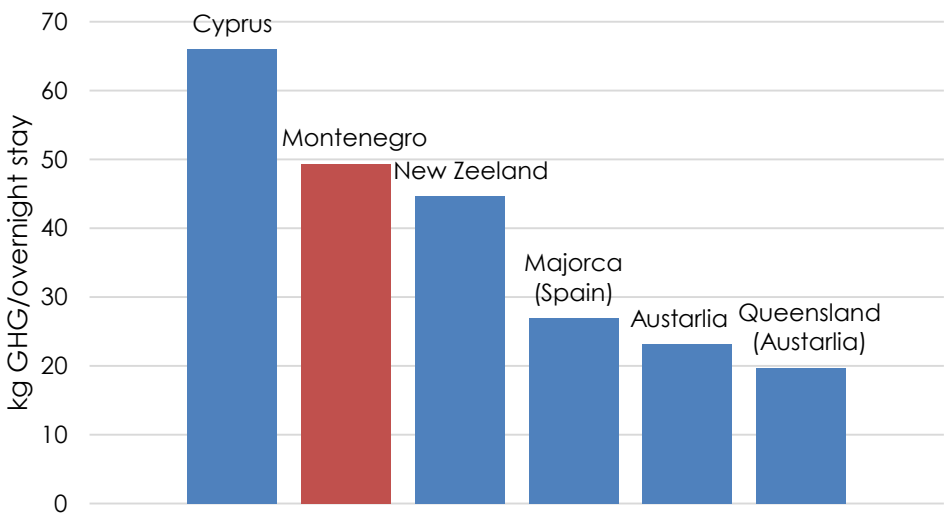
In the following table, the most relevant indicators of 2013 emissions from tourism in Montenegro are shown:

Table 21. Main indicators of tourism GHG emissions.
Source: Own elaboration.

Indicator	Unit	Value
Average emission per tourist arrival	kg CO_2e/tourist	311.6
Average emission per overnight stay	kg CO_2e/overnight stay	49.4
Accommodation emissions per overnight stay	kg CO_2e/overnight stay	1.7
Accommodation and other services emissions per tourist arrival	kg CO_2e/tourist	12.4
Off-country transport emissions per foreign tourist	kg CO_2e/foreign tourist	305.1
In-country transport emissions per tourist	kg CO_2e/tourist	17.3
Waste emissions per tourist	kg CO_2e/tourist	11.1

Similar calculations of emissions from the tourist sector in other countries are scarce and not continuous on time. The GHG emissions of a tourist overnight stay is highly dependent on the destination, reflecting climate, culture, energy sources, available technology and activities undertaken (Sisman, 2007) in the country of study, as well as the origin country of the foreign visitors.

Figure 10: GHG emissions of a tourist overnight stay.
Source: Own elaboration based on various sources[3].



[3] (Becken, 2009); (Sisman, 2007); (STCRC Centre for Economics and Policy, 2010).

The previous figure shows a comparison between the GHG emissions of a tourist overnight stays in a few countries and regions. Comparison between countries should be done with caution, as the methodology used to calculate the indicators vary. In the case of Cyprus and Major, only CO_2 emissions were taken into account, while for the other indicators, more GHG were considered. In the case of New Zeeland, only domestic tourist and their emissions were considered. Thus, the GHG emission per overnight stay in New Zeeland including foreign tourists would be greater, considering the emissions associated with roundtrips to the country.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

There is a considerable difference in the result of GHG emissions between the Baseline here presented and the one included in the project *Towards a Carbon Neutral Tourism in Montenegro*. This difference is based on the methodological approach used: where the previous baseline was calculated through a bottom-up approach limited to the activity within Montenegro, this new baseline is calculated using a hybrid approach with a more comprehensive scope of the emission generated by tourist. In this new approach, not only the emissions generated within country were taken into account, but those generated by foreign tourists to reach the country as well.

Thus, the main source of emissions was the transportation, and the majority of it was generated in the transportation of foreign tourist to reach Montenegro (93%), especially by plane. Regarding this last topic, it must be noted that the national administration has a very limited capacity to put into motion reduction actions and therefore, the public administration efforts should be strongly focused in the mitigation of in-country emissions.

Considering only the in-country emissions, it emerges that the most relevant source is transportation (43%), where road transport is the biggest emitter. Then, the second emitter results to be the accommodation and other services, and among them, accommodations services. Therefore, it appears that in these sectors there is a sound potential of mitigation by implementing the use and development of energy efficiency and renewable energies technologies and best practices in accommodation facilities and buildings.

5.2. Recommendations for future calculations

5.2.1. Data availability

The elaboration of the baseline emissions from tourism in Montenegro has required the participation of several agencies and governmental entities due the wide range of data required to perform the calculations. In order to facilitate future studies as the present, it is recommended to speed up the process centralizing all the information in a single data base hosted by MONSTAT.

The economic data related to tourism is scarce and not detailed. The document from the WTTC *Travel & Tourism. Economic Impact 2013,* provided the direct and total contribution of tourism to the national GDP for 2013. However, the figures included in the document are not disaggregated in categories, as is the case for Pilot TSA 2009. The disaggregation is key for the calculation of emissions from accommodation and other services, as well as for in-country transport. The approximation used with 2009 data was to estimate an expenditure per tourist and day, using 2009 MONSTAT statistics of tourist arrivals and overnight stays. This expenditure per tourist and day (which was disaggregated in the different TSA categories) was used to estimate the expenditure in 2013, using 2013 tourist arrivals and overnight stays. The final figure of expenditure obtained was actualized from 2009 current prices to 2013 current prices, using the inflation rate provided by MONSTAT. This figure is similar to the one provided by the document from the WTTC ("TSA 2013"), but with the advantage of being disaggregated in categories.

In this sense, it is recommended to continue elaborating Tourist Satellite Accounts (TSA) as pilot elaborated for the year 2009 and in case of need train local people trough capacity building programs and learning by doing process. If that it is not possible, the following approximation for future years' calculation is recommended: use "Total contribution to GDP" provided by WTTC for the year of inventory and disaggregate it using the expenditure share in each category of the Pilot TSA 2009. The result would have considerable uncertainty, but would be better than rough assumption.

An even better option be the use of fuel and electricity consumption provided by the UG11E formulary, once MONSTAT has processed and published the data. These data would allow to do a bottom-up approach, which would be much more precise than the current top-down.

The National Waste Management Plan was used to obtain the waste characterization and the rate of waste generated by tourists. Currently, this information is not publicly available from MONSTAT/EPA. It would be recommendable to actualize these data every five years or at least every decade. In case it is not possible, this characterization is still more accurate than the tier 1 default values provided by the 2006 IPCC Guidelines.

Although the scope of the Baseline is extensive, the lack of data did not allow the calculation of other GHGs emissions, beside CO_2, CH_4 and N_2O. Thus, there is no direct account of hydrofluorocarbons (HFCs) from tourism. These gases are used mostly as substitute of ozone-depleting substances, as they don't affect the ozone layer. However, HFCs have very high GWP (up to 14,800 times more than CO_2) and are especially relevant in activities related to refrigeration and air conditioning, as is the case for accommodation and other touristic services. It is recommended for future works to improve the data in order to determine the emission of these gases, not only for tourism emissions but also on national level.

All the calculations have been performed using official data gathered by governmental institutions and other organizations. It is required to take into account the existence of informal tourist activity that is not reflected on these official data. The latest estimations point to a level of informal employment of around 22.6% of the overall employment in Montenegro (ILO, 2011). There are no specific statistics regarding the tourism sector, but it is foreseeable that the existence of unregistered accommodations and other services would make the official data regarding tourists' overnight stays (especially domestic)

lower than the real data. Thus, GHG emissions of domestic tourists are not been taking into account in the Baseline.

5.2.2. Data quality

One of the main barriers identified during the elaboration of the Baseline was the quality of the data. The provided energy balances present values of final energy consumption for the category *Other sectors* that are remarkably low in comparison to the consumption of *Households*. This might be caused by an incorrect classification of energy consumption, allocating consumption from *Other sector* in *Households*.

The Police Authority data sets were used for air transport because all the foreigners that arrive to Montenegro by plane are considered as tourists (according to the definition of tourist from UNWTO) That is the case because Montenegro is not a transit country in terms of air transport. However, this doesn't apply to foreigners that enter the country by road or train, as in the data sets provided there is no distinction between foreigners that stays at least for one night from those that only pass through Montenegro with other destination. In order to improve the data provided by the Police Authority, it is recommended as well, to include questions related to tourism in the forms to be completed by foreigners upon their entry in the country or, in case that it is already included, to make public statistics with the information gathered. Questions to be recommended are the followings:

- Purpose of travel (tourism/stay in country or transit to other destination).
- City of departure (origin of the trip).
- Means of transport used and year of registration
- Intended means of transport to use within the country.
- Intended time of stay.
- Type of accommodation.

The following table compiles the data available and used for the calculation of the Baseline, as well as the preferable data for future calculations and feasible recommendations for the improvement of the data sets:

Table 22. Available data, used data and improvement recommendations.
Source: Own elaboration.

Data available	Used in sectors	Preferable data	Recommended improvements
National energy balances 2013. Source: MONSTAT.	Accommodation (collective) and other services	Fuel and electricity consumption of accommodation facilities and other facilities that provide services for tourists.	Generalize the requirement for tourism facilities to complete the UG11E form to gather fuel and electricity consumption from tourism sector facilities. Disaggregate the "Other sectors" category in the energy balances (Services, Public Administration, Others).
	Accommodation (private)		Collect the electricity consumption of the 4 municipalities that are the main tourist destination (Budva, Herceg Novi, Bar and Ulcinj, in the case of year 2013).
	In-country road transport	In-country road transport tourist-kilometres by type of vehicle	Elaborate similar surveys to the MTO Guest Survey 2014, including not only mode of transport to reach Montenegro, but also modes of transport used within the country.
	In-country railway transport	In-country rail transport tourist-kilometres	
	Inland navigation	Fuel and electricity consumption of inland passenger ships	
Gross output 2013. Source: MONSTAT.	Accommodation and other services; In-country road and railway transport; Inland navigation.	None	None
Pilot TSA 2009 Source: MONSTAT.	Accommodation and other services; In-country road and railway transport; Inland navigation.	TSA 2013	Elaborate Tourist Satellite Accounts yearly or at least every five years, following the model of the Pilot TSA 2009.
Tourist overnight stays. Source: MONSTAT.	Accommodation and other services; In-country road and railway transport; Inland navigation; Wastewater.		
Tourist's countries of origin. Source: MONSTAT	Off-country road and railway transport.	None	None
Tourists' off-country modes of transport.	Off-country road and railway transport.	Guest Survey 2013	Keep elaborating this survey, at least once every five years.

Source: MTO Guest Survey 2014.			
Airport land activity and facilities' energy consumption. Source: Tivat and Podgorica airports.	In-country air transport	None	None
Passengers per flight's city of origin. Source: Tivat and Podgorica airports.	Off-country air transport	None	None
Passenger traffic in 2013. Source: Police authority.	Off-country air transport	None	Police authority should differentiate between foreign passenger in transfer through the country (no overnight stays) and those that stays at least one night. This would allow to use this data for off-country road and railway transport as well.
Number of arrivals by vessel and by cruise. Source: MONSTAT.	Maritime navigation	None	Record the port of origin of vessels before docking in Montenegro.
Total number of cruises arrivals. Source: MONSTAT.	Cruises at berth	None	None
Number of cruises per gross tonnage. Source: Kotor's Port Authority.	Cruises at berth	None	Provide these data from all the ports, not only Kotor.
Average time of stay. Source: Kotor's Port Authority.	Cruises at berth	None	
Tourist waste generation rate and waste characterization. Source: National Waste Management Plan	Solid waste	None	Although the National Waste Management Plan is a one-time document, waste characterization and generation rates studies should be performed at least once every decade.
CH_4 burned in Livade landfill. Source: EPA	Solid waste	Global rate of CH_4 recovered in landfills.	Include the figure CH_4 recovery in Mozura landfill.
CH_4 producing capacity, wastewater management systems' degrees of utilisation and BOD. Source: EPA	Wastewater	None	Review the BOD generation figure provided (21900 g/cap/day) as it seems to be far bigger than the default values provided by IPCC's 2006 Guidelines.
Per capita protein consumption. Source: FAO	Wastewater	None	Verify the value provided by FAO (110.52 g/person/day), as it is for the year 2011 (last one available).

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ANNEX I: ACTIVITY DATA

➢ Economic

Gross Output 2013. Source: MONSTAT

	Nace rev 2	Gross output 2013, current prices, in 000 EUR
A	Agriculture. forestry and fishing	436,828
B	Mining and quarrying	65,012
C	Manufacturing	477,881
D	Electricity. gas. steam and air conditioning supply	251,775
E	Water supply; sewerage. waste management and remediation activities	102,495
H	Transportation and storage	326,614
F	Construction	502,660
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	810,596
I	Accommodation and food service activities	419,865
J	Information and communication	284,792
K	Financial and insurance activities	182,690
L	Real estate activities	311,895
M	Professional. scientific and technical activities	232,242
N	Administrative and support service activities	128,380
O	Public administration and defence; compulsory social security	360,570
P	Education	153,869
Q	Human health and social work activities	201,395
R	Arts. entertainment and recreation	93,451
S+T	Other service activities; Activities of households as employers; undifferentiated goods-and services-producing activities of households for own use	48,169
U	Activities of extraterritorial organisations and bodies	-

Tourist Satellite Accounts 2009. Source: MONSTAT

Tourist Satellite Accounts 2009 (Euros). Source: MONSTAT	Inbound tourism expenditure	Domestic tourism expenditures	Other components	Internal tourism consumption
PRODUCTS	**1.3**	**2.9**	**4.2**	**4.3=**1.3+2.9+4.2
A.Consumption products				
A.1.Tourism characteristic products				
1-Accommodation services	204,860,800	16,101,727	28,015,856	248,978,383
1a-Accommodation services	204,860,800	16,101,727		220,962,527
1b-Accommodation services of all types of vacation home ownership			28,015,856	28,015,856
2- Food and beverage services	105,109,165	5,379,101		110,488,266
3-Local passenger transport services	35,126,700	4,013,159		39,139,859
6- Air passenger transport services	29,724,000	2,784,049		32,508,049
8-Travel agencies services	9,889,369	2,334,820		12,224,189
9-Cultural services	16,018,812	668,594		16,687,406
10-Sport and recreational services	30,882,831	1,286,359		32,169,190
A.2. Other consumption products	67,084,073	9,708,922		76,792,995
TOTAL	498,695,750	42,276,731	28,015,856	568,988,337

➢ Tourism

Arrivals and overnight stays 2013. Source: MONSTAT

Type of accommodation 2013. Source: MONSTAT	Arrivals		Overnight stays		
	Foreign	Domestic	Foreign	Domestic	**Total**
Collective accommodation (Hotels, resorts,etc.)	611,675	82,426	3,011,813	385,495	**3,397,308**
Individual accommodation (Private houses)	712,728	85,177	5,402,402	612,233	**6,014,635**

Tourist by country of origin. Source: MONSTAT.

Country of origin	No. of tourist arrivals
Albania	25,971
Australia	3,921
Austria	16,889
Belarus	20,734
Belgium	8,169
Bosnia and Herzegovina	91,453
Bulgaria	7,117
Canada	3,020
Croatia	23,358
Czech Republic	27,286
Denmark	2,820
Estonia	1,046
Finland	2,107
France	36,602
Germany	34,722
Great Britain	23,885
Greece	4,881
Hungary	17,677
Ireland	3,363
Island	580
Israel	10,077
Italy	31,066
Japan	2,231
Kosovo	35,327
Latvia	1,337
Lithuania	4,911
Luxembourg	1,335
Macedonia	22,497
Netherlands	5,501
New Zeeland	718
Norway	8,069
Other European countries	12,570
Poland	44,764
Portugal	2,715
Romania	18,867
Russia	300,177
Serbia	303,135
Slovakia	8,113
Slovenia	16,651
Spain	3,349
Sweden	9,566
Switzerland	8,927
Turkey	18,428
Ukraine	65,649
USA	10,414
Other non-European countries	22,408

➢ Energy

Energy balances 2013. Source: MONSTAT

	Energy balance of Montenegro, 2013. Source: MONSTAT													
	Electricity	LPG	Motor gasoline	Kerosene aviation fuel	Transport diesel and residual fuel oil	Waste oil (Mazut)	Other oil products	Lignite	Fuelwood and long-meter roundwood	Wood residue	Wood chips	Wood briquettes	Wood pellets	Charcoal
	GWh	kt							m3		t			
Final energy consumption	2,706	14	32	13	170	12	31	24	701,564	70,489	241	377	1,087	693
Industry	1,326	13			29	9	23	13		28,242	2			
Transport	34		31	13	134	3	5							
Railways	20				1		2							
Road transport			31		129		2							
Air transport	4			13	1									
Inland navigation	10				3	3								
Other transport							1							
Households, commerce, pub. auth. etc.	1,346	1	1		7		3	11	701,564	42,247	239	377	1,087	693
Households	1,277				1			11	673,006	41,723	239	59	764	633
Agriculture	12		1		5		1							
Other sectors	57	1			1		2		28,558	524		318	323	60

➢ Transport

Transport mode of foreign tourist. Source: MTO Guest Survey 2014.

Mode of transport used by foreign tourist to travel to Montenegro Source: MTO Guest Survey 2014	%
Car	33.4%
Coach	17.0%
Motorcycle	0.5%
Caravan/RV	0.4%
Bicycle	0.2%
Train	0.5%
Boat/ferry	0.3%
Plane	47.5%
Other	0.2%

Air

Arrivals and departures from Podgorica Airport 2013. Source: Podgorica's Airport Authority.

Podgorica	No. of Passengers	
Origin/Destination	Arrivals	Departures
Baku	1,267	1,193
Bari	1,819	5,058
Belgrade	111,511	109,638
Brno	850	2,612
Brussels	5,672	5,828
Budapest	149	120
Copenhagen	2,464	2,505
Frankfurt	15,788	16,925
Istanbul	27,966	29,055
Kharkov	479	539
Kiev	945	955
Ljubljana	11,788	12,869
London	1,405	1,587
Minsk	6,198	6,360
Moscow	33,186	31,930
Naples	1,158	2,032
Nis	9,060	8,925
Nizhny Novgorod	1,763	1,766
Odessa	129	142
Ostrava	3,456	3,616
Pardubice	2,863	993
Paris	19,696	19,903
Perm	1,400	1,390
Prague	3,914	3,970
Rome	13,885	14,423
St.Petersburg	1,553	1,605
Tyumen	1,873	1,867
Ufa	1,760	1,742
Vienna	31,603	32,229
Warsaw	2,237	2,055
Yerevan	622	582

Zagreb	316	268
Zurich	14,817	15,547
Other	3,738	3,468
Total	**337,330**	**343,697**

Arrivals and departures from Tivat Airport 2013. Source: Tivat's Airport Authority.

Tivat	**No. of Passengers**	
Origin/Destination	Arrivals	Departures
Bari	4,002	1,132
Belgrade	101,492	107,622
Brussels	4,302	4,296
Chelyabinsk	738	684
Dnepropetrovsk	1,485	1,479
Donetsk	6,352	5,950
Ekaterinburg	3,236	3,299
Frankfurt	1,720	1,779
Friedrichshafen	444	295
Graz	-	78
Innsbruck	860	995
Istanbul	7,457	7,395
Kharkov	32,074	31,907
Linz	144	289
Ljubljana	3,778	4,110
London	9,174	9,106
Madrid	68	-
Minsk	4,353	4,320
Moscow	195,440	195,579
Munich	2,513	2,284
Naples	1,899	758
Odessa	6,120	6,108
Oslo	2,185	2,113
Paris	3,250	3,394
Salzburg	412	269
Samara	2,051	1,989
Stockholm	1,627	1,579
St.Petersburg	27,102	27,536
Thessaloniki	107	106
Warsaw	2,109	2,099
Zaporozhye	4,023	4,440
Other	2,469	2,274
Total	**432,986**	**435,264**

Energy consumption in airport facilities and land activities. Source: Podgorica and Tivat airports.

Energy consumption in airport facilities and land activities. Source: Podgorica and Tivat airports	Electricity (GWh)	Gasoline (t)	Diesel (t)
Podgorica	2.2	2.6	36
Tivat	1.7	0.6	35
Total	4	3.2	71

Maritime

Number of people arrived by vessels 2013. Source: MONSTAT.

Number of people arrived by vessels, 2013. Source: MONSTAT	
Total	15,778
By citizenship	
Albania	9
Austria	800
France	474
Greece	117
Croatia	516
Netherlands	202
Italy	1,163
Germany	586
Scandinavian countries	196
Slovenia	160
Switzerland	181
Great Britain	2,112
USA	329
Other countries	8,933

Cruises of foreign vessels in Montenegro 2013. Source: MONSTAT

Cruises of foreign vessels in Montenegro, 2013. Source: MONSTAT	
Cruises	409
Passengers	314.961

Tonnage of passenger ships arriving at Port of Kotor. Source: Port Authority

Tonnage (t, average). Source: Port of Kotor	250	750	3.000	7.500	15.000	25.000	35.000	45.000	75.000	125.000
Passenger ships arriving at Kotor	8	12	130	12	32	2	32	45	90	25

Average stay at berth at Port of Kotor. Source: Port Authority

Cruises at berth	
Average stay in port (hours). Source: Port of Kotor	12 hr 30 min

➢ Waste

Solid waste characterization. Source: National Waste Management Plan.

MSW component	Composition of waste (%)
Organic	32.1%
Paper and paperboard	13.0%
Glass	8.5%
Heavy metals	1.1%
Non-ferrous metals (Al, etc.).	1.6%
Wood	2.6%
Composite packaging	3.7%
PET	5.6%
Plastic	11.9%
Textile	2.8%
Inert waste (rubble, etc.)	2.3%
Hazardous waste	0.6%
Green waste	5.1%
Other	9,0%

EPA data regarding waste. Source: EPA

- In 2013, the landfill, "Livade " burned 228,698.4 kg of CH_4.
- In 2013, of the total population, the household of 260,907 of them were connected to the septic tank (septic Tank- anaerobic lagoons deep).
- BOD 21900 g / cap / day as recommended in the 2006 IPCC value.
- kg CH_4 / kg BOD (2013) - 0,48- recommended IPCC 2006 value.

ANNEX II: EMISSION FACTORS

Fuels emission factors (stationary)

	LPG	Motor gasoline	Kerosene aviation fuel	Transport diesel and residual fuel oil	Waste oil (Mazut)	Other oil products	Lignite	Fuelwood and long-meter roundwood	Wood residue	Wood chips	Wood briquettes	Wood pellets	Charcoal
CO_2 Emission factor (t CO_2/TJ). Source: NIR	63.1	68.6	70.8	68.6	76.6	73.3	99.2	-	-	-	-	-	-
CH_4 Emission factor (t CH_4/TJ). Source: IPCC	0.010	0.010	0.010	0.010	0.300	0.010	0.010	0.300	0.300	0.300	0.300	0.300	0.200
N_2O Emission factor (t N_2O /TJ). Source: IPCC	0.001	0.001	0.001	0.001	0.004	0.001	0.002	0.004	0.004	0.004	0.004	0.004	0.001

Electricity emission factor

	Electricity
CO_2 Emission factor (t CO_2/GWh)	395.2
CH_4 Emission factor (t CH_4/GWh)	0.040
N_2O Emission factor (t N_2O /GWh)	0.006

Road transport (IPCC adjusted)

Emission factors Source: DEFRA 2013	kg CO_2/unit	kg CH_4/unit	kg N_2O/unit
Car (car-km)	0.19	0.00003	0.000
Coach (pass-km)	0.03	0.00000	0.000
Motorcycle (mc-km)	0.12	0.00002	0.000
RV (RV-km)	0.27	0.00004	0.000

Railway transport (IPCC adjusted)

Emission factors Source: DEFRA 2013	kg CO_2/pass-km	kg CH_4/pass-km	kg N_2O/pass-km
Rail	0.01	0.00001	0.00008

Air transport (IPCC adjusted)

Emission factor Source: DEFRA 2013	kg CO_2/pass-km	kg CH_4/pass-km	kg N_2O/pass-km
Domestic (average passenger)	0.324811	0.000046	0.000003
Short-haul (average passenger)	0.191452	0.000011	0.000002
Long-haul (average passenger)	0.225351	0.000011	0.000002

Ship transport (IPCC adjusted)

Emission factors Source: DEFRA 2013	kg CO_2/pass-km	kg CH_4/pass-km	kg N_2O/pass-km
Boat	0.12	0.00002	0.000001