



Green House Gases Footprint: **Cruise** vers **Car**

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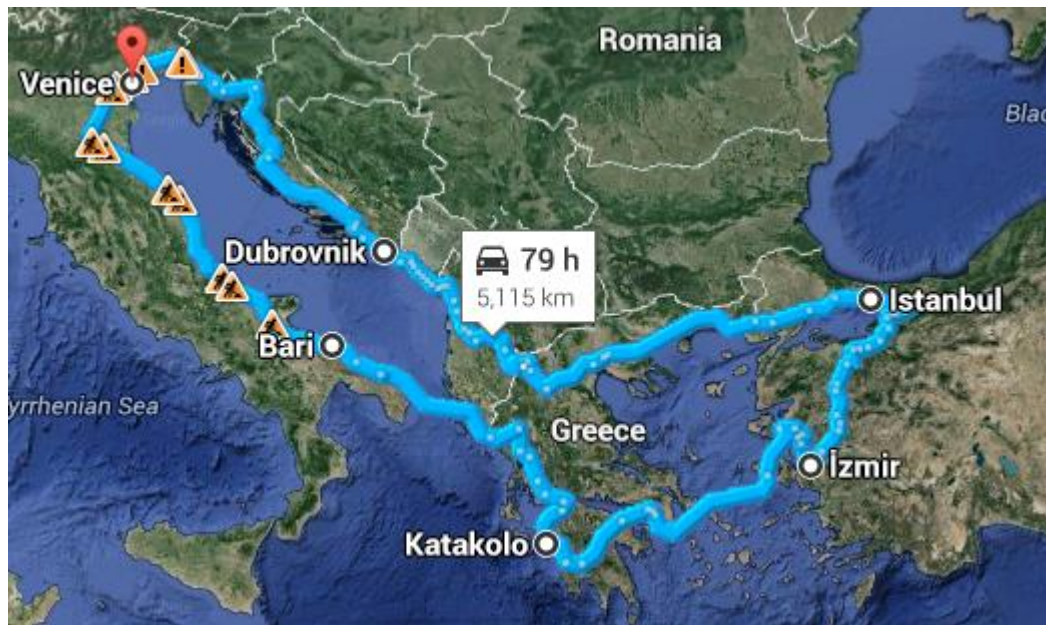
Cruise



Source: MSC Cruises

Journey	Time	Distance (km)
Venice – Bari	17 h 30 min	780
Bari – Katakolon	17 h	500
Katakolon – Izmir	19 h 30 min	450
Izmir – Istanbul	16 h 30 min	400
Istanbul – Dubrovnik	42 h 30 min	1,570
Dubrovnik - Venice	15 h	550
TOTAL	128 h	4,250

Car / Ferry



Source: Google Maps

*Obtained from <www.distancesfrom.com>

**Assumed from: speed is 24 knots (44.4 km/h), and from <www.ferries.co.uk/patras_bari.html>

Journey	Time	Distance (km)
Venice – Bari	7 h 35 min	819
Bari – Katakolon	16 h 30 min**	732*
Katakolon – Izmir	19 h**	847*
Izmir – Istanbul	8 h 28 min	568
Istanbul – Dubrovnik	16 h 4 min	1,281
Dubrovnik - Venice	9 h 4 min	834
TOTAL	76 h 47 min	5,081

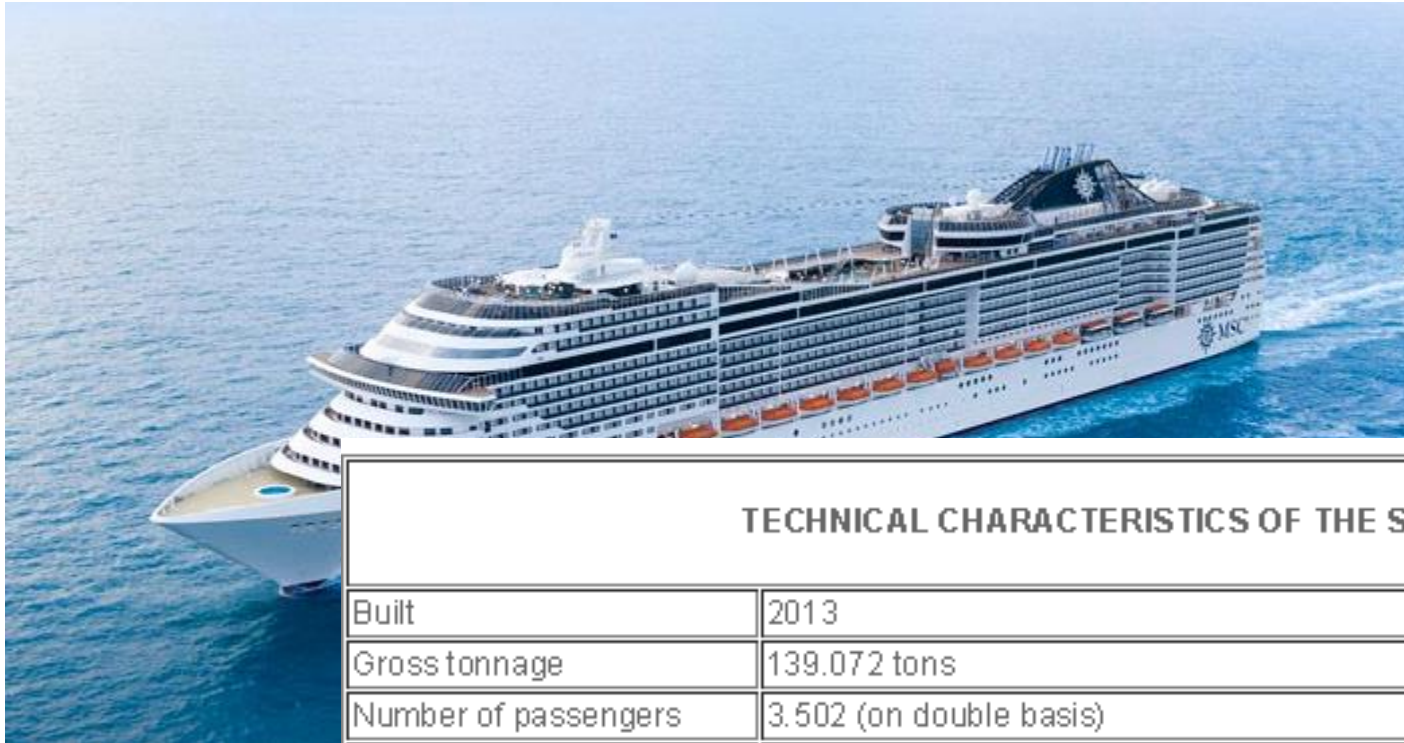
By car (EXTREME!)



Source: Google Maps

Journey	Time	Distance (km)
Venice – Bari	7 h 35 min	819
Bari – Katakolon	28 h	2,745
Katakolon – Izmir	21 h 31 min	1,725
Izmir – Istanbul	8 h 28 min	568
Istanbul – Dubrovnik	16 h 4 min	1,305
Dubrovnik - Venice	9 h 4 min	834
TOTAL	90 h 42 min	7,996

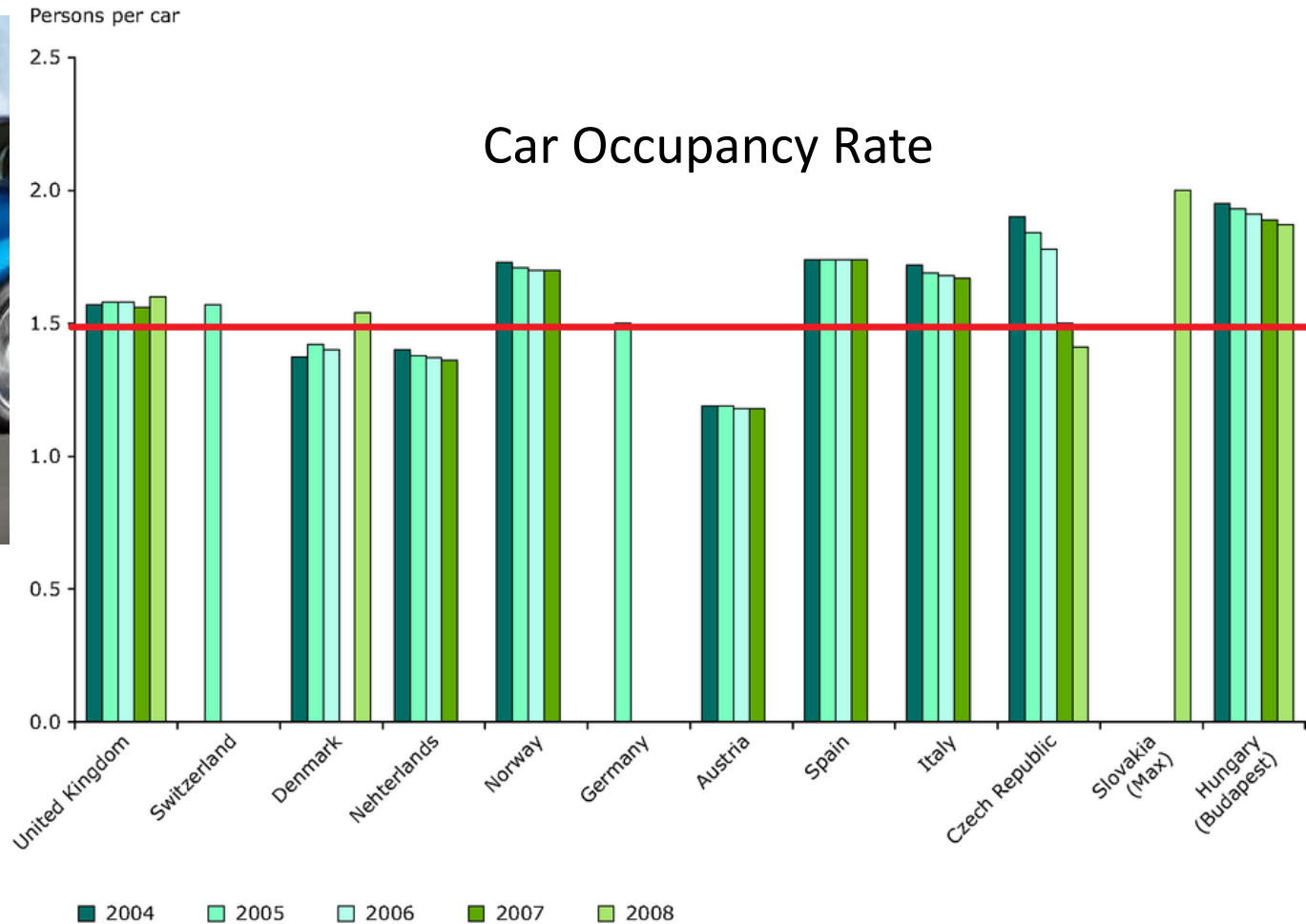
Cruise vs Car



TECHNICAL CHARACTERISTICS OF THE SHIP	
Built	2013
Gross tonnage	139.072 tons
Number of passengers	3.502 (on double basis)
Crew members	About 1.388
Number of cabins	1.751, incl. 45 for guests with disabilities or reduced mobility
Length/Beam/Heigh	333,30 m / 37,92 m post panamax / 67,69 m
Decks	18, incl. 14 for guests
Maximum speed	24.21 knots
Average speed	18 knots
Environmental technology	AWT-Advanced Water Treatment, Energy Saving & Monitoring System

Source: MSC Cruises, MSC Preziosa, <www.msccruises.com.au/au_en/Ships/MSC-Preziosa.aspx> Last accessed: 17/09/2014

Cruise vs Car



Source: Forbes, World's Best-Selling Cars 2013, 1.st Ford Focus, www.forbes.com/pictures/mkk45jikj/1-ford-focus/ Last accessed: 17/09/2014

Source: European Environmental Agency, www.eea.europa.eu/data-and-maps/indicators/occupancy-rates-of-passenger-vehicles/occupancy-rates-of-passenger-vehicles-1 Last accessed: 17/09/2014

Cruise vs Car



Type	MSC Preziosa	Ford Focus	BMW M5
Number of passengers	3,502 + 1,388 crew members	1, 1.5, 2, 4 (3,502 – 876 cars*)	
Fuel consumption - moving	273.6 t/d	6.8 L/100 km**	14.8 L/100 km***
Average speed	18 knots = 33.3 km/h	Depending on the assumption	
Driving time	128 h (4,250 km)	Depending on the assumption	
„Hotel mode“	40 h	18 h (2 hotel nights)	
Fuel consumption - standing	67.2 – 69.6 (68) t/d	/	

*based on the number of passengers

**Source: Cars, Fuel consumption, <www.carsconsumption.com/ford-focus-2-0-petrol-m5-fuel-consumption-efficiency/>, Last accessed: 17/09/2014

***Source: MotorTrend, Used 2013 BMW M5 Performance Specs, <<http://www.motortrend.com/cars/2013/bmw/m5/specifications/>>, Last accessed: 23/09/2014

GHG (Carbon) Footprint



Mode of transport	Cruise and ferry	Car
Fuel	Low sulphur fuel	Petrol
Specific CO ₂ emissions*	3.16 kg/kg	3.17 kg/kg
LCA CO ₂ emissions*,**	3.63 kg/kg	3.65 kg/kg
Specific CO _{2-eq} emissions***	3.41 kg/kg	3.42 kg/kg
LCA CO _{2-eq} emissions****	3.49 – 4.2 (3.93) kg/kg	3.69 – 4.43 (4.0) kg/kg

*CO₂ emissions based only on fuel consumption, source: WELL-TO-WHEELS ANALYSIS OF FUTURE AUTOMOTIVE FUELS AND POWERTRAINS IN THE EUROPEAN CONTEXT

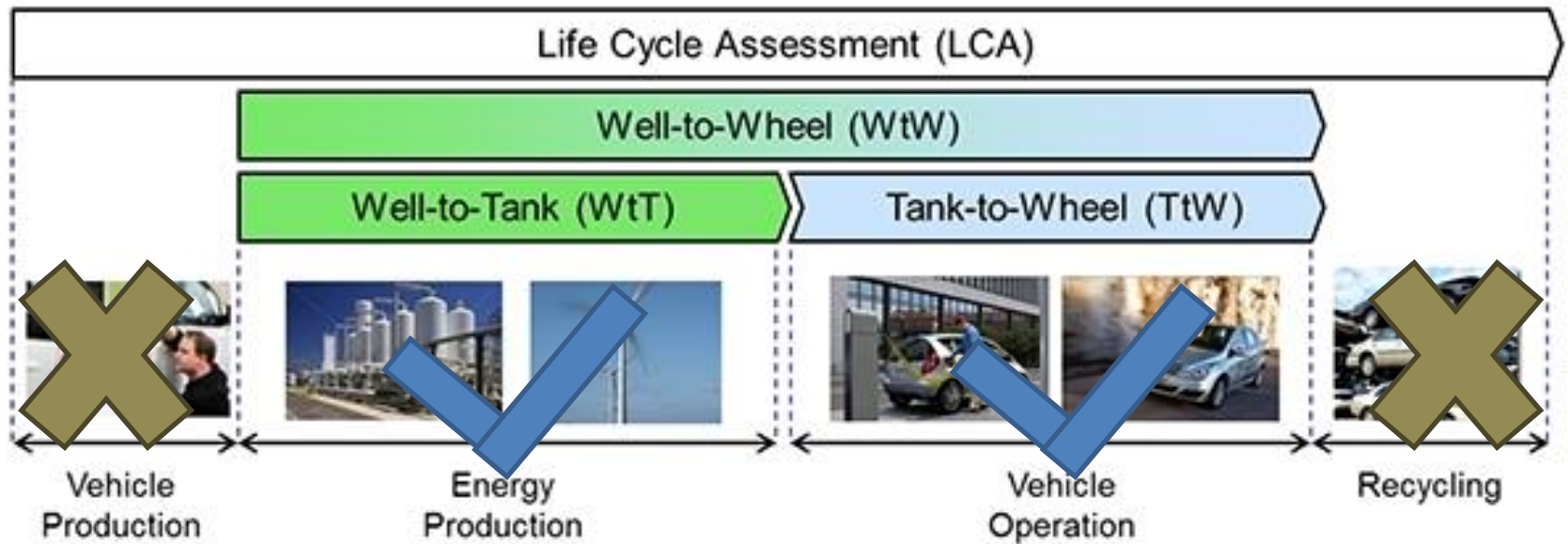
<ies.jrc.ec.europa.eu/uploads/media/TTW_Report_010307.pdf> Last accessed: 17/09/2014

**PE, LBP (2011) GaBi 4, software-system and databases for life cycle engineering, Stuttgart, Echterdingen, Germany, 1992–2008. www.gabi-software.com

***Čuček L., Martín M., Grossmann I.E., Kravanja Z., 2014, Multi-period Synthesis of Optimally-Integrated Biomass and Bioenergy Supply Network. *Comp Chem Eng*, 66, 57-70.

****Eriksson M., Ahlgren S., 2013, LCAs of petrol and diesel, a literature review, Report 2013:058, <pub.epsilon.slu.se/10424/17/ahlgren_s_and_eriksson_m_130529.pdf> Last accessed: 23/09/2014

Assumptions



- GHG (Carbon) footprint calculated only for consumed fuel and hotel accommodation at LCA basis
- Carbon footprint related to car and cruise production and recycling is excluded
- 20 kg CO_{2-eq} per one guest hotel night is emitted (*Source: Filimonau, V., Dickinson, J., Robbins, D., Huijbregts, M.A.J., 2011. Reviewing the carbon footprint analysis of hotels: Life Cycle Energy Analysis (LCEA) as a holistic method for carbon impact appraisal of tourist accommodation. Journal of Cleaner Production 19, 1917-1930*)

Assumptions - ferry



SUPERFAST I, SUPERFAST II

Built in Italy in 2008 & 2009

PASSENGERS	VEHICLES	SPEED (kn)	LENGTH (m)	BREADTH (m)	DECKS	ENGINES	HORSEPOWER
928	700	24	199,1	26,6	8	2 WARTSILA 12V46C	2 X 12.000KW

Source: Superfast Ferries, <www.superfast.com/adriatiki/en/the-fleet.html>, Last accessed: 22/09/2014

- Fuel consumption is assumed to be 0.29 pounds/(h*hp) – 102 t/d (Source: Hydro Lance Corporation, <www.hydrolance.net/page9.htm> Last accessed: 22/09/2014

GHG (Carbon) Footprint - Cruise/Best selling car

Car route: Venice – Istanbul – Venice

Driving time: 37 h (3,480 km)*

Extreme low



Type	MSC Preziosa	Ford Focus			
Number of passengers/ transport mean	3,502 + 1,388 crew members	1 (3,502 cars)	1.5 (2,335 cars)	2 (1,751 cars)	4 (876 car)
Total fuel consumption, „driving mode“	1,459.2 t	621 t	414 t	310 t	155 t
Total fuel consumption, „hotel mode“	113 t	n.a.	n.a.	n.a.	n.a.
Total LCA-based CO ₂ emissions	5,707 t	2,407 t**	1,651 t**	1,272 t**	706 t**
Total LCA-based GHG emissions	6,179 t	2,624 t**	1,796 t**	1,380 t**	760 t**

*Source: Google Maps

**from the total amount 140 t CO_{2-eq} is due to hotel accommodation

GHG (Carbon) Footprint

Car/**ferry** route: Venice – **Bari** – **Katakolon** – **Izmir** -
Istanbul – Dubrovnik - Venice

Driving time: car - 41 h (3,502 km), **ferry** – 35.5 h (1,579 km)



„Nominal“

Type	MSC Preziosa	Ford Focus + Ferry Superfast			
Number of passengers/ transport mean	3,502 + 1,388 crew members	1 (3,502 cars) / 5 ferries	1.5 (2,335 cars) / 4 ferries	2 (1,751 cars) / 4 ferries	4 (876 cars) / 4 ferries
Total fuel consumption, „driving mode“	1,459.2 t	625 t / 754 t	417 t / 604 t	313 t / 604 t	156 t / 604 t
Total fuel consumption, „hotel mode“	113 t	n.a.	n.a.	n.a.	n.a.
Total LCA-based CO ₂ emissions	5,707 t	5,158 t*	3,844 t*	3,464 t*	2,898 t*
Total LCA-based GHG emissions	6,179 t	5,603 t*	4,170 t*	3,754 t*	3,134 t*

*from the total amount 140 t CO_{2-eq} is due to hotel accommodation

GHG (Carbon) Footprint

**Car route: Venice - Bari – Katakolon – Izmir - Istanbul
– Dubrovnik - Venice**

Driving time: 91 h (7,996 km)

Extreme high



Type	MSC Preziosa	Ford Focus			
Number of passengers/ transport mean	3,502 + 1,388 crew members	1 (3,502 cars)	1.5 (2,335 cars)	2 (1,751 cars)	4 (876 cars)
Total fuel consumption, „driving mode“	1,459.2 t	1,428 t	952 t	714 t	357 t
Total fuel consumption, „hotel mode“	113 t	n.a.	n.a.	n.a.	n.a.
Total LCA-based CO ₂ emissions	5,707 t	5,352 t*	3,615 t*	2,746 t*	1,443 t*
Total LCA-based GHG emissions	6,179 t	5,852 t*	3,948 t*	2,996 t*	1,568 t*

*from the total amount 140 t CO_{2-eq} is due to hotel accommodation

GHG (Carbon) Footprint - Cruise/Luxury car

Car route: Venice – Istanbul – Venice

Driving time: 37 h (3,480 km)

Extreme low



Type	MSC Preziosa	BMW M5			
Number of passengers/ transport mean	3,502 + 1,388 crew members	1 (3,502 cars)	1.5 (2,335 cars)	2 (1,751 cars)	4 (876 cars)
Total fuel consumption, „driving mode“	1,459.2 t	1,353 t	902 t	676 t	338 t
Total fuel consumption, „hotel mode“	113 t	n.a.	n.a.	n.a.	n.a.
Total LCA-based CO ₂ emissions	5,707 t	5,078 t*	3,432 t*	2,607 t*	1,374 t*
Total LCA-based GHG emissions	6,179 t	5,552 t*	3,748 t*	2,844 t*	1,492 t*

*from the total amount 140 t CO_{2-eq} is due to hotel accommodation

GHG (Carbon) Footprint

Car/**Ferry** route: Venice – **Bari** – **Katakolon** – **Izmir** -
Istanbul – Dubrovnik - Venice

Driving time: car - 41 h (3,502 km), **ferry** – 35.5 h (1,579 km)



„Nominal“

Type	MSC Preziosa	BMW M5 + Ferry Superfast			
Number of passengers/ transport mean	3,502 + 1,388 crew members	1 (3,502 cars) / 5 ferries	1.5 (2,335 cars) / 4 ferries	2 (1,751 cars) / 4 ferries	4 (876 cars) / 4 ferries
Total fuel consumption, „driving mode“	1,459.2 t	1,361 t / 754 t	908 t / 604 t	681 t / 604 t	341 t / 604 t
Total fuel consumption, „hotel mode“	113 t	n.a.	n.a.	n.a.	n.a.
Total LCA-based CO ₂ emissions	5,707 t	7,845 t*	5,647 t*	4,818 t*	3,577 t*
Total LCA-based GHG emissions	6,179 t	8,547 t*	6,146 t*	5,238 t*	3,878 t*

*from the total amount 140 t CO_{2-eq} is due to hotel accommodation

GHG (Carbon) Footprint

**Car route: Venice - Bari – Katakolon – Izmir - Istanbul
– Dubrovnik - Venice**

Driving time: 91 h (7,996 km)

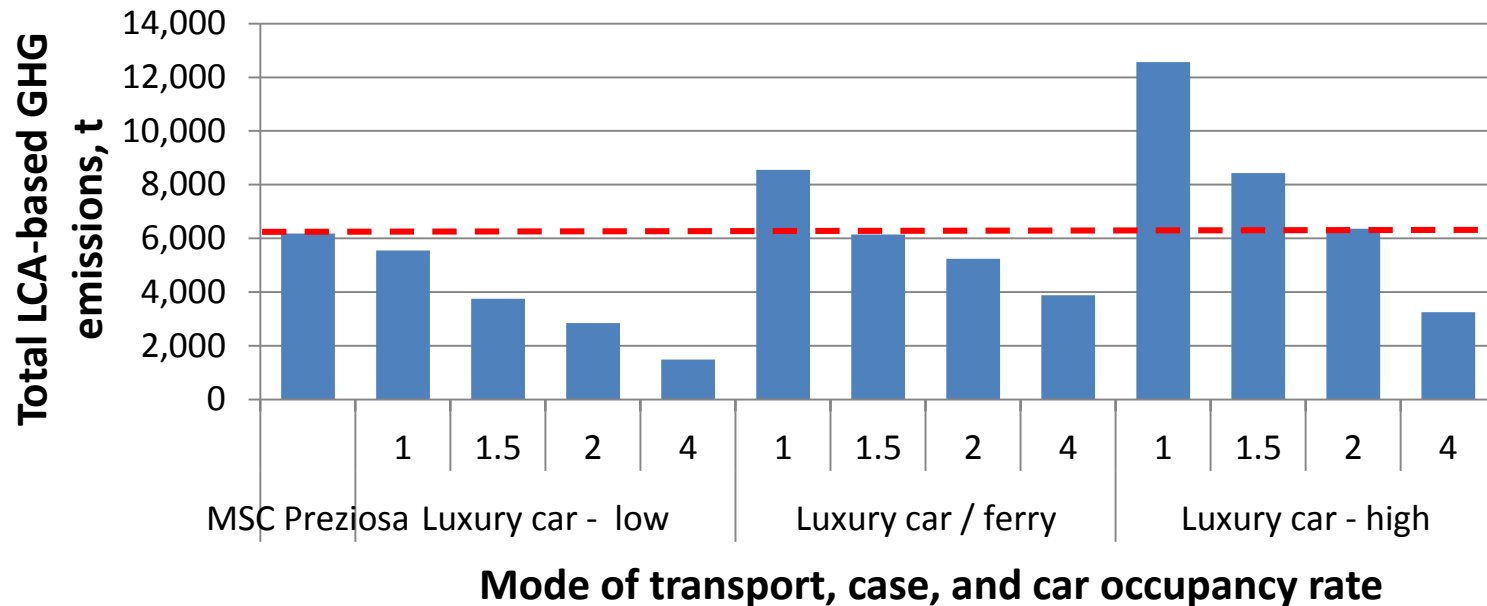
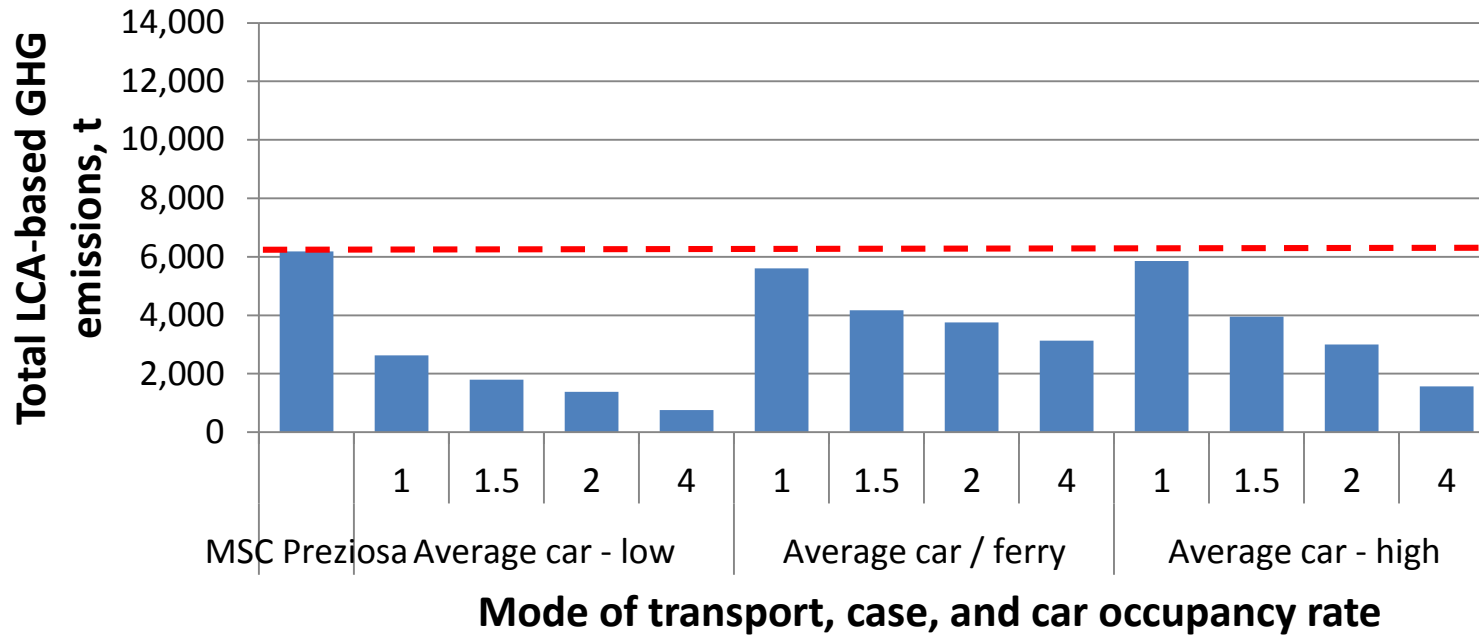
Extreme high



Type	MSC Preziosa	BMW M5			
Number of passengers/ transport mean	3,502 + 1,388 crew members	1 (3,502 cars)	1.5 (2,335 cars)	2 (1,751 cars)	4 (876 cars)
Total fuel consumption, „driving mode“	1,459.2 t	3,108 t	2,072 t	1,554 t	777 t
Total fuel consumption, „hotel mode“	113 t	n.a.	n.a.	n.a.	n.a.
Total LCA-based CO ₂ emissions	5,707 t	11,484 t*	7,703 t*	5,812 t*	2,976 t*
Total LCA-based GHG emissions	6,179 t	12,572 t*	8,428 t*	6,356 t*	3,248 t*

*from the total amount 140 t CO_{2-eq} is due to hotel accommodation

Summary





Conclusions



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- This has been a simplified study, mainly to raise discussion
- It has not been counting for cruise providing luxury and entertainment not possible for the car travel (incl. swimming pools, cinemas etc.)
- Showing that the occupancy matters a lot, especial for cars as the difference 1 and 5 passengers is very considerable
- The driver of the car should not be consider a passenger as the cruiser crew is also not counted as passengers
- If fully included the cruiser is a clear winner
- More detail study would be desirable to consider production and recycling phases as well similar entertainment for the car travel.
- The luxury coach travel should be analysed as well.