



Stakeholder Workshop 5th October 2010

UIC Headquarters
Paris



EcoTransIT World: Seaborne Freight Emissions



Stefan Seum, Paris, 5 October 2010



- Introduction to Seaborne Freight Emission Calculations
- Methodology of Seaborne Freight Emission Calculations
- Introduction to Airborne Freight Emissions Calculations
- Questions and Answers

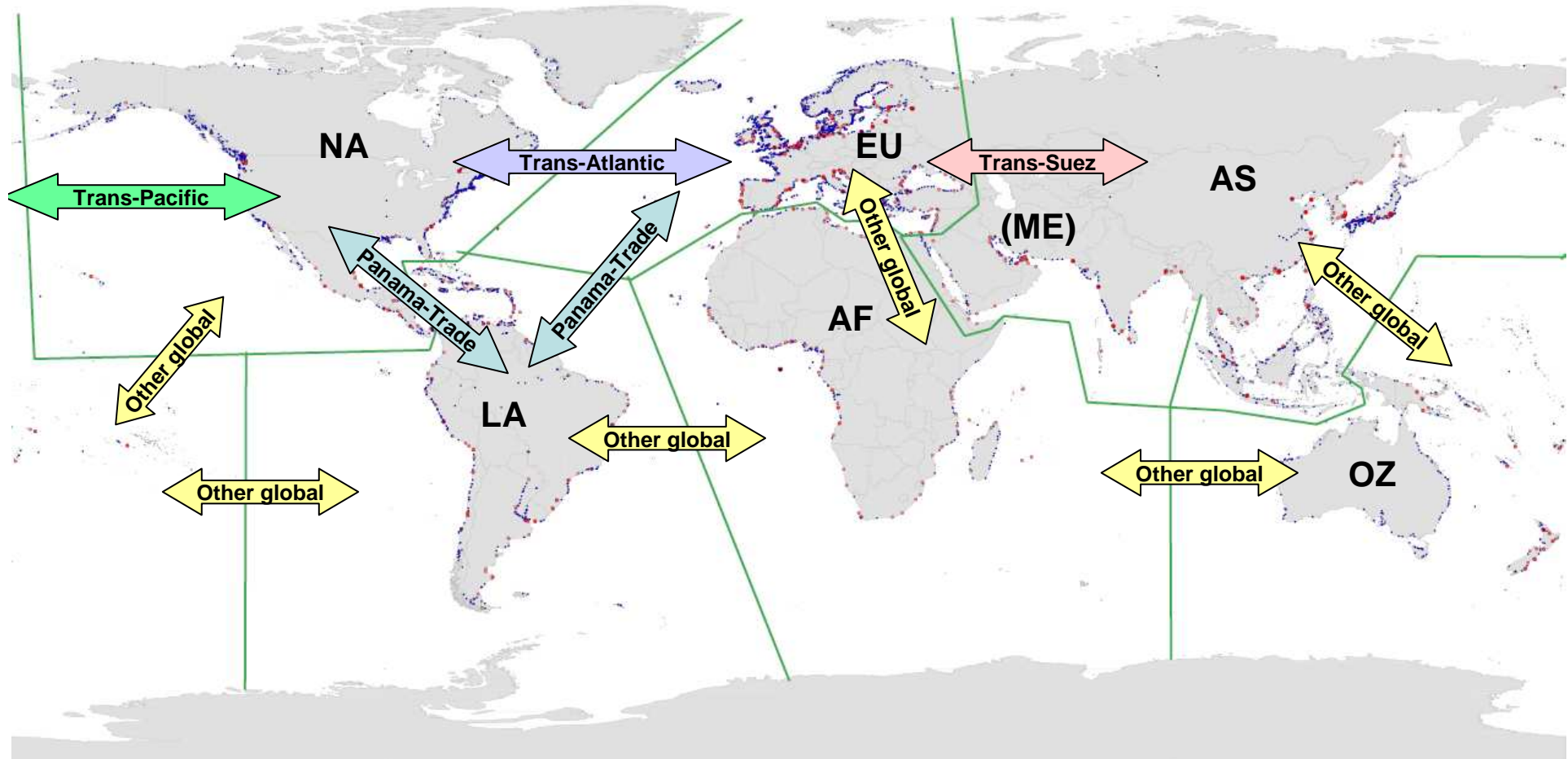
- **Introduction to Seaborne Freight Emission Calculations**
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Worldwide seaborne transport emissions modeling differs from other modes in EcoTransIT World



- Sea transport emissions depend most on the vessel type and size, which cannot be allocated to specific countries.
- EcoTransIT World combines sophisticated GIS routing and vessel selection with state of the art emission factors.
- Parameters that determine (default) seaborne trade include:
 - Sending location – receiving location and resulting trade lane.
 - The commonly employed vessels on those trade lanes.
 - The ports suitable to serve the employed vessels.
- Emission calculation is conducted with aggregated emission factors for vessel groups per trade lane or size categories.

The categorization of the ocean trade lanes



Ports

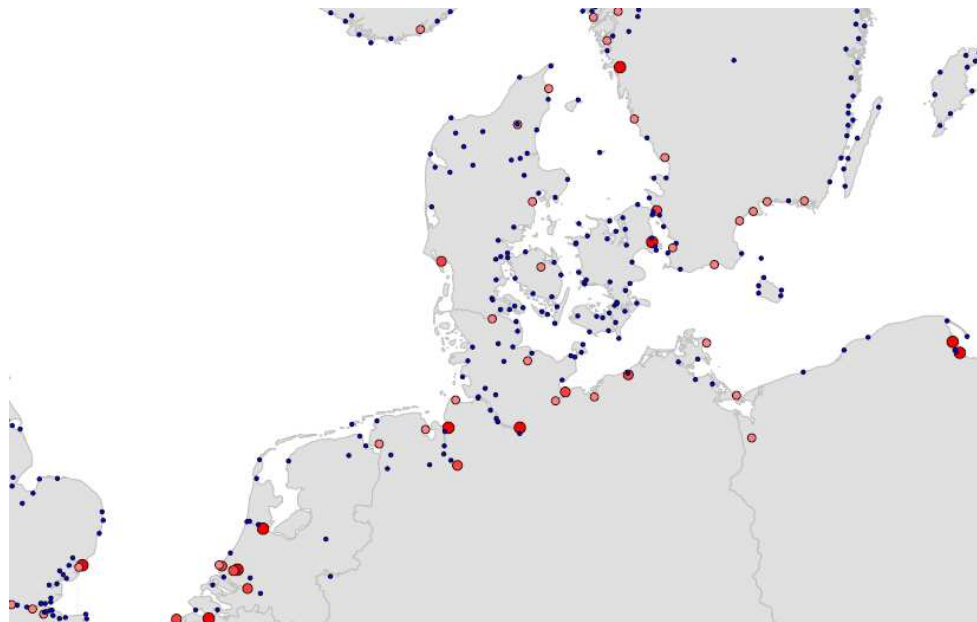
- Worldwide seaports are categorized in small, medium and large ports.
- The use of large vessel sizes is restricted to medium and large ports. Hinterland routing is conducted accordingly.
- Certain other restrictions (e.g. Panama Canal) exist.

Sea ports and marine layer

- 1 054 305 GIS edges
- 7 265 Seaports
 - 79 large
 - 168 medium
 - 370 small
 - 6648 not considered

Inland ports

- 1 133 inland water GIS edges
- 549 inland ports



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The emission factors are based on sample vessels

- For modeling marine emission factors approximately 4600 sample vessels were analyzed.
- For each vessel a theoretical year of transporting goods was modeled and then the emissions per tonne or TEU-km calculated.
- The “standard modus” differentiate automatically according to trade-lanes (e.g. Asia – Europe) for which typical vessels of different sizes are aggregated.
- Transport emissions can be calculated for
 - 3 size categories of general cargo ships,
 - 6 categories of dry bulk carriers,
 - 7 tankers and
 - 6 categories of container vessels.

Emission factor examples

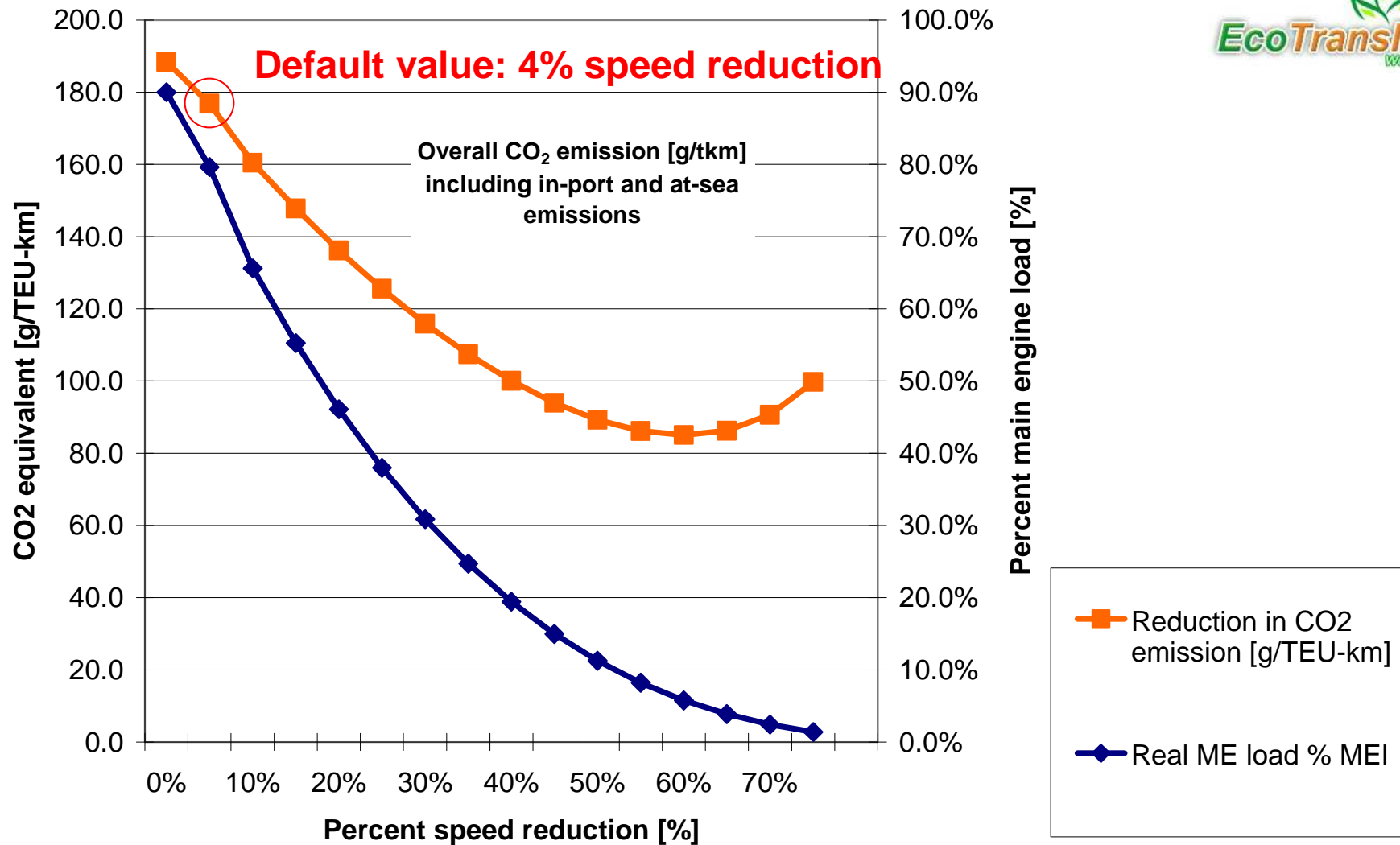
Table 53: Sample base emission factors for bulk and container vessels on particular trade lanes for emissions from main and auxiliary engines at sea and in port.

Vessel types (BC = bulk carrier; CC = container vessel GC = general cargo ship)	Trade and Vesselcategory names	Main Engine CO ₂ g/t-km [cc: g/TEU-km] at sea	Auxiliary Engine CO ₂ g/t-km [cc: g/TEU-km] at sea	Auxiliary Engine CO ₂ in port [g], normalized to t-km [cc: TEU-km]
BC (liquid, dry, and General Cargo)	Suez trade	4.45	0.14	0.26
BC (liquid, dry, and General Cargo)	Transatlantic trade	6.16	0.28	0.38
BC (liquid, dry, and General Cargo)	Transpacific trade	5.18	0.20	0.31
BC (liquid, dry, and General Cargo)	Panama trade	6.16	0.28	0.38
BC (liquid, dry, and General Cargo)	Other global trade	6.16	0.26	0.39
BC (liquid, dry, and General Cargo)	Intra-continental trade	8.19	0.40	0.54
CC	Suez trade	138.68	6.33	8.21
CC	Transatlantic trade	158.30	10.93	8.58
CC	Transpacific trade	156.21	9.74	8.55
CC	Panama trade	158.30	10.93	8.58
CC	Other global trade	171.42	12.69	8.83
CC	Intra-continental trade non EU	179.83	15.55	9.01
CC	Intra-continental trade EU	214.69	18.09	12.93
CC	EU SECA trade	215.95	18.20	13.01
Great Lakes BC		11.80	0.66	0.62

EcoTransIT world allows trade-lane specific calculations and the modification of parameters

- Slow steaming can be considered and individually altered.
- The emissions are calculated based on fuel consumed (g/kg) or power supplied (g/kWh); Different engine types and fuel types are considered; IMO Sulphur Emission Control Areas are considered.
- The trade-lane specific emission factors take the vessel utilization (cargo load and empty return) into account;
- The vessel utilization is the average over a return trip.
- Emissions of inland ships are modeled similarly.

Slow speed shipping provides an energy efficiency benefit to approximately up to -40% speed



The emission factors behind EcoTransIT World are state of the art

- EF sources (e.g. for CO₂ per kg fuel oil) include:
 - IMO 2009; IMO 2005; MEPC (IMO Environmental Committee)
 - IPCC 2006
 - CARB 2007
 - EPA 2009
- They bring EcoTransIT World in line with the emission baseline developed by IMO!
- The methodology is also compatible with current IMO vessel indexing schemes and industry proposals for calculating emissions.

EcoTransIT - Mozilla Firefox

http://www.ecotransit.org/ecotransit.en.phtml

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EcoTransIT Doodle: TK Data Clearinghous...

Stakeholder workshop

What is EcoTransIT?

- Guided Tour
- General information
- Covered influencing factors
- Covered environmental impacts

Whom does EcoTransIT serve?

- Target Group
- Freight & Environment
- References

Who is behind EcoTransIT?

- Project Partners
- Scientific Support

Contact: info@ecotransit.org

Weight: ? 10 Tons Type: average goods

Define handling: ?

Origin

Locationtype: City district Name: [be] Brussel Show

On-site rail track available ?

Type of transport

TK: **Transferpoint** [Harbour] Antwerpen (Antwerp) Show

Type of transport: Sea ship Ship class: Aggregate Ship type: BC Paname trade (35-80) Speed reduction: 4% Load factor: 55%

Transferpoint [Harbour] Oakland

TK: **Transferpoint** [Harbour] Antwerpen (Antwerp) Show

Type of transport: Sea ship Ship class: Aggregate Ship type: BC Transatlantic trade (3: Speed reduction: 4% Load factor: 55%

Transferpoint [Harbour] Newark

Via

Locationtype: Harbour UN/LOCODE: USNEK Name: [us] Newark Show

On-site rail track available ?

Transferpoint [Railway station] Bayonne

Type of transport: Train Train weight: 1000 t Emission standard: diesel Load factor: 60% ETF: 50% Ferry routing: avoid

Transferpoint [Railway station] Sacramento

Add transport chain

Destination

Locationtype: City district Name: [us] Sacramento Show

On-site rail track available ?

reset calculate

Impressum

Fertig zotero

Start 10 Micros... C:\Dokume... 4 Microso... 2 Microso... Brussel Sacr... EcoTransI... Desktop durchsuchen 15:06

EcoTransIT - Mozilla Firefox

http://www.ecotransit.org/ecotransit.en.phtml

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EcoTransIT Doodle: TK Data Clearinghous...

Locationtype: City district Name: [us] Sacramento Show

On-site rail track available ?

change reset calculate

Standard Graph Table Distances

Primary energy consumption and carbon dioxide

Show well to tank / tank to wheel ?

Energy unit: Megajoule Kilowatthours petrol equivalents

Train
 Inland ship
 Truck
 Sea ship
 Airplane
 Intermodal transfer

Primary energy consumption
Energy resource consumption
(Megajoule)

TK1 TK2

© EcoTransIT.org

Carbon dioxide
Greenhouse Gas, climate changes
(Tons)

TK1 TK2

© EcoTransIT.org

	TK 1	TK 2
Truck	2.183	801
Sea ship	15.723	6.314
Train	0	19.215
Sum:	17.886	26.130

	TK 1	TK 2
Truck	0,14	0,04
Sea ship	1,07	0,43
Train	0	1,27
Sum:	1,21	1,74

Impressum

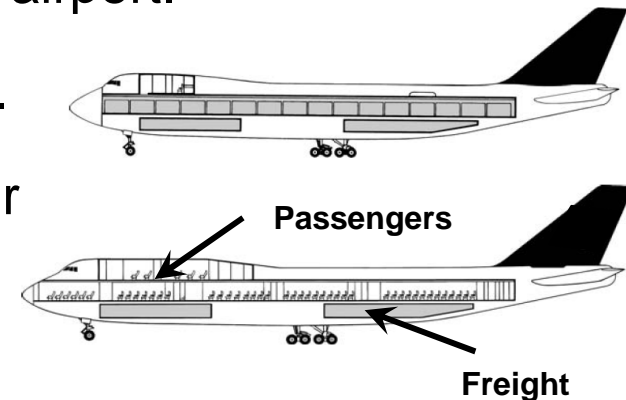
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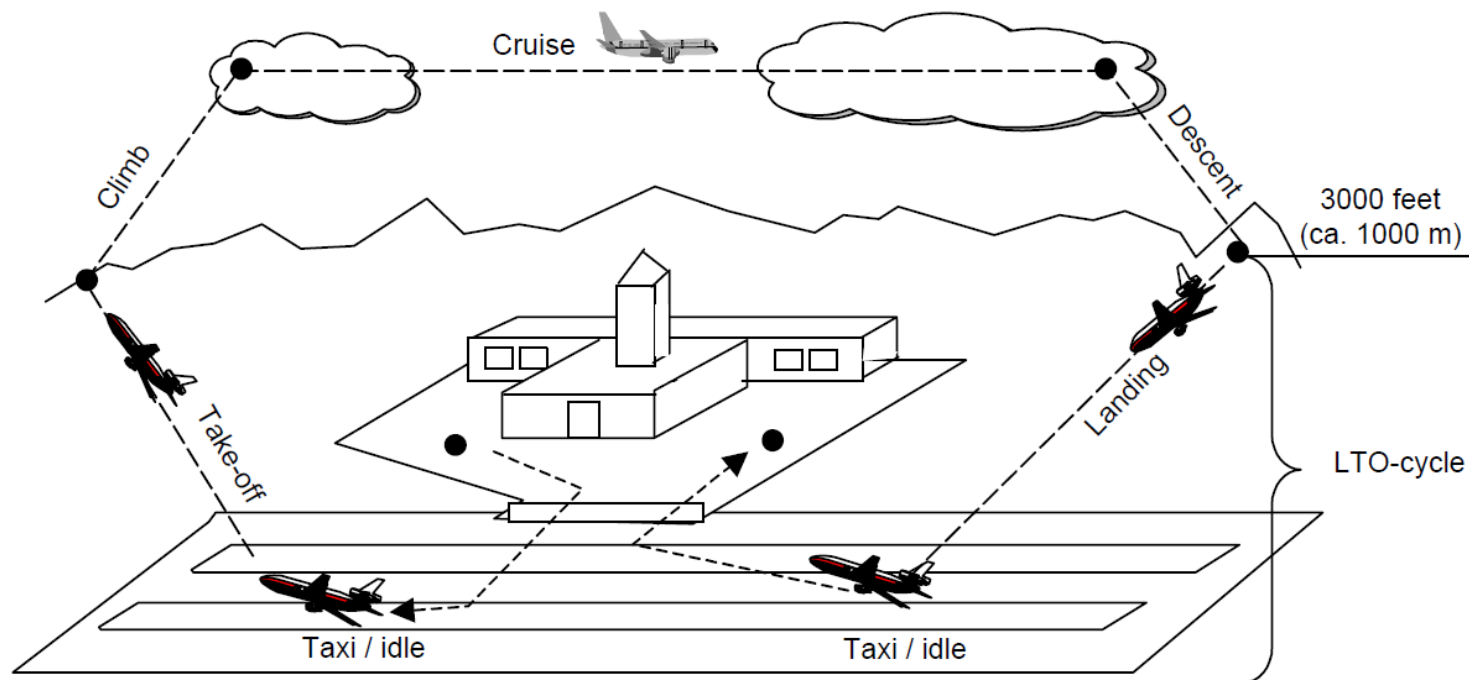
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Methode Details

- Aircraft emissions are calculated airport to airport.
- EcoTransIT assumes a typical flying cycle.
- A choice of 15 freighters and 16 passenger aircrafts available (with their specific seat capacity, load capacity etc.).
- „Hybrid“ aircrafts in standard mode merging freighter and passenger aircrafts 60:40 depending on route distance (short, medium, long haul).
- Emissions are distance-dependant and extrapolated for the airport to airport distance.



Standard flying cycle



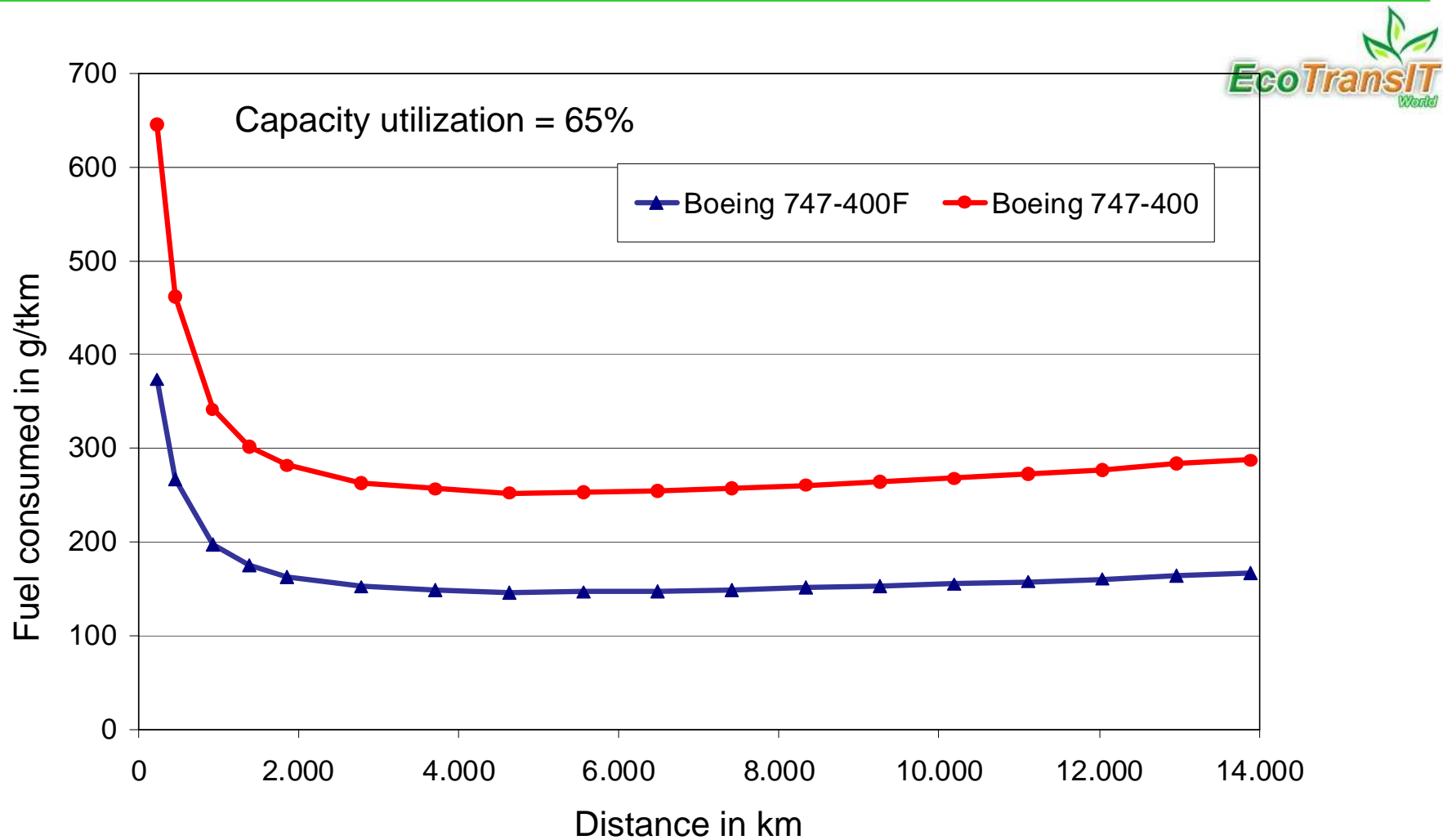
Source: IPCC:

Characteristics of selected aircrafts

- Hybrid aircraft: 60 % freighter and 40 % belly freight
- automatic split of route beyond maximum distance

Type	Distance Group	Type of aircraft	Aircraft code	Design Range (km)	Max. Payload (t)	Typical Seats (number)
Freighter	Short haul	Boeing 737-200C	B732F	2,240	17.3	
Freighter	Medium Haul	Boeing 767-300F	B763F	6,025	53.7	
Freighter	Long haul	Boeing 747-400F	B744F	8,230	112.6	
Belly Freight	Short haul	Fokker 100	F100	3,170	1.0	85
Belly Freight	Medium Haul	Boeing 757-200	B752	7,222	4	200
Belly Freight	Long haul	Boeing 747-400	B744	13,450	14	416
Sources: Lang 2007; Lufthansa Cargo 2007..						

Freighter and passenger aircrafts: energy use related to distance



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Thank you for your interest

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