Introduction to EcoTransIT World

Overview
Basics
Introduction to EcoTransIT World

1. Basics (Ralph Anthes, IVE mbH)
   - Principle
   - Features

2. Methodology I (Wolfram Knörr, Ifeu)
   - Upstream processes
   - Road / Rail

3. Methodology II (Stefan Seum, Öko-Institut)
   - Air / Sea ship / Inland waterway

4. Routing & Data (Ralph Anthes, IVE mbH)
   - Routing on different networks
   - Data basis
Standard mode

Origin

Choose transport mode:

Destination

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Extended mode

### Origin
- **Locality type:**
- **Name:** Hamburg

### Type of transport - Air
- **Transferpoint:** Hamburg Fuhlsbüttel
- **Type of transport:**
  - **Airplane:**
  - **Airline:**
  - **Ferry:**
  - **Train weight:**
  - **Train length:**
  - **Train type:**
  - **Electricity:**
  - **Load factor:**
  - **BT:**
  - **Ferry:**
  - **As of:**

### Via
- **Transferpoint:** München / Munich - Franz Josef Strauß

### Type of transport - Rail
- **Transferpoint:** MUENCHEN HBF
- **Type of transport:**
  - **Train weight:**
  - **Train length:**
  - **Train type:**
  - **Electricity:**
  - **Load factor:**
  - **BT:**
  - **Ferry:**
  - **As of:**

### True
- **Type of transport:** Truck
- **Vehicle type:**
- **Electricity:**
- **Load factor:**
- **BT:**
- **As of:**

### Destination
- **Airport:** MAD
- **Locality type:**
- **Name:** Madrid Barajas

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Result
Intermodal transfers

Truck

Weight classes: 3.5-7.5 / 7.5-12 / 12-24 / 24-40 / 60 [t], [lbs]

Train

Train weight [t]
Energy: Electrified / Diesel

Airplane

3 hybrid (40% belly / 60% freighter)
15 freighter, 16 belly / passenger

Sea ship / inland waterway ship

40 ship classes (dry, liquid, container, all classes also aggregated ship types)
4 inland waterway ship (Euro ship, ship canal class V, per Bulk and Container)
Simplified calculation work flow

Input:
- Definition of Origin / Destination / VIA
- Characters of transport

Calculation:
- Determination route for every transport chain
- Split of each route in small sections
- Result = \( \sum \) Emission factor \( \times \) Mass \( \times \) Distance

Results:
- Sum of all section results per transport chain

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Carbon dioxide (CO₂)

CO₂-equivalents

Primary energy consumption

Nitrogen oxides (NOₓ)

Sulphur dioxide (SO₂)

No methane hydrocarbon (NMHC)

Particles (PM₁₀)

Well to tank / tank to wheel
Introduction to EcoTransIT World

Upstream Processes
Road Transport
Rail Transport

Wolfram Knörr
www.ifeu.de

5th October 2010 - UIC Headquarters, Paris
Upstream Processes
System Boundaries: „WtT“ and „TtW“

Cumulative energy demand (included infrastructure)

- Primary energy consumption (without infrastructure)
- Energy consumption for the energy provision
- Energy production
- Energy distribution
- Final energy consumption on vehicles
- Construction, maintenance, operation and disposal of traffic route
- Construction, maintenance, operation and disposal of vehicles
- Infrastructure
- Vehicles
- Transport

Quelle: SBB, 2008

Not yet included
Energy Carriers for Electricity Generation

- Africa
- Asia and Pacific
- Australia
- Central and South America
- Europe
- North America
- Russia and FSU

Solid Fuels
Gas
Oil
Nuclear
Renewable
Others
CO$_2$-Emissions

Electricity Generation
Road Transport
Road Transport: Methodology and Data

- Different vehicle types available, differentiated into
  - Size classes (European and US classes)
  - Emission Standards (EURO- and EPA-Standards).
- Consideration of road category (highway, rural, urban)
- Key figures for energy consumption and emissions from European (HBEFA/ARTEMIS) and US sources (MOVES).

<table>
<thead>
<tr>
<th>Size classes</th>
<th>EU/Japan</th>
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Road Transport: Energy Consumption

Energy consumption for heavy duty trucks (40 t max. gross weight, Euro-V, motorway, hilly)

- **22.7 l/100 vehicle-km**
- **37.1 l/100 vehicle-km**

Load (t) vs. Specific Energy Consumption (g/km) and Specific Energy Consumption (g/tkm) graph.
Rail Transport
Rail Transport in EcoTransIT World
Rail Transport: Methodology and Data

- Emission calculation of rail transport based on numerous energy values of real trains e.g.:
  - More than 200,000 train runs from DB Railion
  - Several train runs from SBB
  - Annual average values of several European railway companies from UIC energy statistics
  - Annual average values of North American railway companies
  - Energy values of train runs in China
- Differentiation in diesel and electric trains
- Average emission factors for diesel trains, differentiation e.g. in emission classes (like truck) planned for the future
Rail Transport: Basic Data Energy Consumption

Electricity consumption of freight trains as function of gross tonne weight (Data sources)

- Hilly 2003
- Railion 2007
- EX-TREMIS 2008
- UIC Railway Data 2007

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Rail Transport: Energy Functions

Electricity consumption of freight trains as function of gross tonne weight (in EcoTransIT World)

- Hilly 2003
- Hilly 2009
- Flat 2009
- Mountain 2009

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Rail Transport:
Specific Energy Consumption

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Quelle: SBB, 2008

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Energy Carriers for Electricity Generation
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### Emission Standards

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Road Transport: Energy Consumption

Energy consumption articulated truck (40t) as function of load factor

Specific Energy Consumption (g)

Road Transport: Energy Consumption

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Rail Transport
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Rail Transport: Specific Energy Consumption

Specific energy consumption electric freight train (1000 gross tonnes)

Load weight of 1 waggon (tonnes)

Specific energy consumption (Wh/km)

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60

0 10 20 30 40 50 60 70 80 90 100

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Introduction to EcoTransIT World
Routing
GIS-Data

1st Stakeholder Workshop

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Routing on different networks

- Global networks of all transport modes available
- Automatic determination of transfer points
- Routing software identifies best way to / from any place in the world
- Best way includes preference e.g. highways instead of city streets
Automatic determination of transfer points (traffic type, emission class)
- Airports: Depending on distance between origin and destination
- Ports: Depending on origin and destination (trade lanes)
- Stations: Nearest location

<table>
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<th>Origin</th>
<th>Locationtype</th>
<th>Name</th>
<th>Show</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>City district</td>
<td>Hamburg</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On-site rail track available?</td>
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</tbody>
</table>

**Type of transport**

<table>
<thead>
<tr>
<th>TK 1</th>
<th>Transferpoint</th>
<th>[Airport] Billund</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type of transport</td>
<td>Belly freight</td>
</tr>
<tr>
<td></td>
<td>Airplane</td>
<td>80%</td>
</tr>
</tbody>
</table>

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<th>Transferpoint</th>
<th>[Airport] Beijing Capital</th>
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**Destination**

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<th>Name</th>
<th>Show</th>
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<td>Beijing</td>
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Available locations

- 964 airports with terminals
  big, medium, small
  Name, IATA

- 7,265 ports (sea and inland)
  Big, medium, small, tiny
  Name, LOCODE

- 36,754 railway stations
  17,556 UIC-coded within Europe
  Name, UIC-Code

- 849,457 places via Name, Zip
  Any selection via GoogleMaps
GIS-Data: Cities
GIS-Data: Ports

- 79 big container ports
- 168 medium sized
- 370 small
- 6648 regional
- 549 Inland ports
GIS-Data: Air ports

- 122 big air ports
- 296 big not via the ocean
- 360 intercontinental
- 186 small (only direct selection)
GIS-Data: Street network

• Street world wide (7,996,655 street kilometers, 1,816,882 street links)
• Data basis: Europe Teleatlas, remaining VMap0
• Attributes: street category, ferry
GIS-Data: Railway network

- Railway world wide (1,311,077 track kilometers, 72,625 rail links)
- Data basis: Europe different, remaining VMap0
- Attributes: Electrified, Freight corridor, ferry
Calculation formula:

Trimmed distance =
(great circle distance - 185,2 km) * 1,04 + 185,2 + 60 km
GIS-Data: See network

- Connects all sea ports via the shortest way (1,054,305 sea links)
- Data basis: IVE mbH (calculated)
- Attributes: Canals with maximum DWT and TEU
GIS-Data: Inland waterway

- Inland waterways world wide (1,133 waterway links)
- Data basis: world wide different (actual focus at Europe)
- Attributes: Canal class (from IV navigable, V all ship types)
EcoTransIT World

EcoTransIT world website

- Compares different transport chains (single calculation)
- http://www.ecotransit.org

EcoTransIT mass calculation

- Input: list of transports at once (upload e.g. via csv-files or xml)
- Output: accumulated result of the transport list as pdf, csv or rtf

Support

- Send your questions to info@ecotransit.org
- Ask right now :o)