New CO2 Calculation Methods and Models

ECTA RC Workshop - 14 September 2017

Jos Verlinden
Agenda

1. Background
2. Cefic-ECTA Guidelines for C02 measuring
3. GLEC Framework
4. IRU Commercial Vehicle of the Future
5. Way forward
Bottom-up rather top-down approach to securing country commitments
Intended Nationally Determined Contributions (INDCs)

International agreement to keep average global temperature ‘well below’ 2°C above pre-industrial times and ‘endeavor to limit’ them to 1.5°C

- No legal sanction on countries failing to meet targets

At present rate of greenhouse gas emissions:

9 years to stay with 1.5°C limit
19 years to stay with 2.0°C limit

Source: Tyndall Centre
Scale of the Climate Change Challenge for Freight

Transport

2010: 7bn tonnes of CO$_2$e
2050: BAU 12 bn tonnes of CO$_2$e
2050: Limit CO$_2$e from all activities to 20bn
2050: 14% transport share = 2.8 bn tonnes
Agenda

1. Background
2. Cefic-ECTA Guidelines for CO2 measuring
3. GLEC Framework
4. IRU Commercial Vehicle of the Future
5. Way forward
McKinnon Report – July 2010

Measuring and Managing CO₂ Emissions of European Chemical Transport

Professor Alan McKinnon
Dr Maja Plecyk

Logistics Research Centre
Heriot-Watt University
EDINBURGH, UK

Report prepared for cefic

Cefic/EFTA Guidelines for Measuring and Managing CO₂ Emissions from Freight Transport Operations
April 2011

- General framework
- Calculation method
- Default emission factors
- Calculation template
- Opportunities to reduce emissions

See www.cefic.org
Methods to calculate CO₂ emissions of freight transport operations

Activity-based approach (chemical companies)

**Objective:** obtain a rough estimate of total transport carbon emissions

\[ \text{CO}_2 = \text{tons transported} \times \text{average transport distance} \times \text{default CO}_2\text{-emission factor} \]
Default emission factors recommended by McKinnon

<table>
<thead>
<tr>
<th>Transport mode</th>
<th>gCO2/Ton - km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road transport</td>
<td>62</td>
</tr>
<tr>
<td>Rail transport</td>
<td>22</td>
</tr>
<tr>
<td>Barge transport</td>
<td>31</td>
</tr>
<tr>
<td>Short sea</td>
<td>16</td>
</tr>
<tr>
<td>Deep-sea container</td>
<td>8</td>
</tr>
<tr>
<td>Deep-sea tanker</td>
<td>5</td>
</tr>
<tr>
<td>Intermodal road / rail</td>
<td>26</td>
</tr>
<tr>
<td>Intermodal road / barge</td>
<td>34</td>
</tr>
<tr>
<td>Intermodal road / short sea</td>
<td>21</td>
</tr>
<tr>
<td>Pipelines</td>
<td>5</td>
</tr>
<tr>
<td>Airfreight</td>
<td>602</td>
</tr>
</tbody>
</table>
Methods to calculate CO$_2$ emissions of freight transport operations

Activity-based approach

$\text{CO}_2 = \text{tons transported} \times \text{average transport distance} \times \text{default CO}_2$-emission factor

Possibilities to reduce emissions:
- reduce transport volume
- reduce transport distance
- reduce the emission factor: use mode of transport with lower emission factor
Methods to calculate CO₂ emissions of freight transport operations

Energy-based approach

Most accurate way of calculating transport emissions

\[ \text{CO}_2 = \text{fuel consumption} \times \text{fuel CO2-emission factor} \]

* Emission factor of diesel = 2.63 kg CO₂ per liter
Methods to calculate CO$_2$ emissions of freight transport operations

Energy-based approach (transport companies)

Most accurate way of calculating transport emissions:

$$\text{CO}_2 = \text{fuel consumption} \times \text{fuel CO2-emission factor}$$

Possibilities to reduce emissions:
- use fuel with lower emission factor (diesel/biodiesel/gas/hybrid/electricity/hydrogen…)
- reduce fuel consumption of the vehicle (engine/tyres/aerodynamics/driving behavior)
ECTA RC KPI Reporting

Transport CO2 emissions calculations

- **Own road transport**: energy-based approach
- **Sub-contracted road transport**: activity-based approach
- **Intermodal transport**: activity-based approach

Comment ECTA

« McKinnon default emission factor for road transport is too high »
Possible evolution of carbon measurement proces

« At present the chemical industry has little choice but to adopt the ‘activity-based’ approach applying standardised carbon emission factors.

It will be desirable however to migrate to an ‘energy-based’ method of calculation, using fuel consumption data provided by the carriers. This will permit a much more accurate estimation of CO2 emissions.

As an interim measure it may be possible to develop a refined activity-based approach. »
Evolution of Carbon Measurement System

**shipper-dependent**

- Activity-based
  - tonnes
  - distance
  - tonne-km-based emission factor

**collaborative initiative**

- Refined activity-based
  - tonnes
  - distance
  - tonne-km-based emission factor
  - sample distance and energy data

**carrier-dependent**

- Energy-based
  - energy used
  - energy-based emission factor
  - standard values

**Improving Calibration**

- sector-specific
- company-specific
- product-specific

**Sample Distance and Energy Data**
Carbon Auditing of Freight Transport: 7 Years Later

Inventory of Carbon Measurement and Reporting Initiatives

freight transport / logistics / supply chain

Source: Marc Cottinge, ADEME
# Cefic Review meeting – Reducing the Carbon Footprint of Chemical Transport - 16 May 2017

<table>
<thead>
<tr>
<th>Session</th>
<th>Speaker/Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome and introduction</td>
<td>Frank Andreesen, Cefic SIG Chairman, Covestro</td>
</tr>
<tr>
<td>Background</td>
<td>Jos Verlinden</td>
</tr>
<tr>
<td>Freight transport in a low-carbon world – Opportunities for cutting emissions</td>
<td>Alan McKinnon, Professor, Kuehne Logistics University</td>
</tr>
<tr>
<td>The GLEC framework for logistics emissions measuring methodologies</td>
<td>Eszter Toth-Weedon, Global Logistics Emissions Council (GLEC)</td>
</tr>
<tr>
<td>A roadmap towards sustainable truck operations</td>
<td>Marc Billiet, Head EU Freight Transport, IRU</td>
</tr>
<tr>
<td>The ECTA RC emission reporting scheme</td>
<td>Evert de Jong, RC Manger, ECTA</td>
</tr>
<tr>
<td>A chemical company view</td>
<td>Luc Renier, European Transport Safety and Security Leader, Dow</td>
</tr>
<tr>
<td>Open discussion</td>
<td></td>
</tr>
<tr>
<td>Way forward - Conclusions</td>
<td></td>
</tr>
</tbody>
</table>
Agenda

1. Background
2. Cefic-ECTA Guidelines for C02 measuring
3. GLEC Framework
4. IRU Commercial Vehicle of the Future
5. Way forward
Global Logistics Emissions Council (GLEC)
Industry led and backed by experts

**GLEC Members**

<table>
<thead>
<tr>
<th>Companies</th>
<th>DB SCHENKER</th>
<th>DHL</th>
<th>Electrolux</th>
<th>GEODIS</th>
<th>Hapag-Lloyd</th>
<th>HP</th>
<th>KUEHNE+NAGEL</th>
<th>Maersk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sainsbury’s</td>
<td>STEF</td>
<td>TNT</td>
<td>DAMCO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Programs | BSR | CARGO | GREEN FRESH ASIA | | NTM |

| Associations | aef | CLECAT | JATA | RJ |

**GLEC Experts**

Experts: Buddy Polovick (US SmartWay), Colin Smith (EST), Jens Froese (Jacobs University), Kerstin Dobers (Fraunhofer IML), Marc Cottignies (ADEME)

**GLEC Consultees**

<table>
<thead>
<tr>
<th>Companies</th>
<th>ahlers</th>
<th>BNSF</th>
<th>Dearman</th>
<th>ERG</th>
<th>GREENCARRIER</th>
<th>N P R C</th>
<th>PenFinemore</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STC-GROUP</td>
<td>H&amp;M</td>
<td>HEINEKEN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Associations</th>
<th>ebu</th>
<th>ECTA</th>
<th>Responsible Care</th>
<th>ECTA</th>
<th>EICB</th>
<th>Fraunhofer</th>
<th>icct</th>
<th>ITBA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ESC</td>
<td>ECO</td>
<td>WORLDCARGO INSTITUTE</td>
<td>ECO</td>
<td>ECO</td>
<td>Fraunhofer</td>
<td>icct</td>
<td>ITBA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organizations</th>
<th>ACEEE</th>
<th>eco</th>
<th>WCE</th>
<th>EICB</th>
<th>Fraunhofer</th>
<th>icct</th>
<th>ITBA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WRI</td>
<td>ECO</td>
<td>WCE</td>
<td>EICB</td>
<td>Fraunhofer</td>
<td>icct</td>
<td>ITBA</td>
</tr>
</tbody>
</table>
The GLEC Framework
Covers all modes and builds on what exists
Launched in June 2016, it brings together existing emissions methodologies and fills the gaps, providing a single unified way of calculating logistics emissions.
GLEC Milestones

- 2014: GLEC formed
- 2016: GLEC Framework 1.0 launched
- 2018: 50+ companies adopted GLEC Framework
- 2021: Sector-wide adoption of GLEC Framework

Companies: HP, Schenker, Kuehne+Nagel, SNCF, Maersk, Geodis, Damco
GLEC Framework
Driving business logistics decisions

Measure 

Report + Verify

Business logistics decision

Use a universal methodology

Report to
• Management
• Public through corporate social responsibility reports
• Customers
• Programs and initiatives
• Governments

Use emissions data for
• Setting targets and tracking emissions
• Emission reduction strategies
• Transport chain and modal optimization
• Carrier performance
• Risk management
• Labels
• Carbon pricing

Smart Freight Centre
Comparison
Cefic/ECTA guidelines & GLEC Framework

- Activity-based approach (for cargo owners i.e. chemical companies) ✓
- Energy-based approach (for transport companies) ✓
- Principles regarding well-to-wheel approach, load factors & empty running etc. are sound ✓
- Fuel emission factor values do not match GLEC or EN16258 ✗
- Should use full GHG emission factors (CO₂e) rather than only CO₂ ✗
- Lists of default values a good starting point, but needs updating, greater accuracy and incorporating into wider GLEC +/-
- Ideally defaults should be used only when relevant information from transport company is not available – this link is missing, but is crucial if chemical companies want successful collaboration and impact ✗
- List of actions to reduce emissions very important ✓
GLEC Recommendations

- GLEC Framework to become the recommended methodology for CEFIC and ECTA members
- To ensure that this works in practice for chemical companies and their carriers
  - Test in practice
  - Develop implementation guidelines tailored to the chemical industry based on the GLEC Framework and reflecting the current CEFIC / ECTA guidance
- Develop a reporting template which
  - Considers existing data collected by ECTA
  - Follows the GLEC Framework recommendations
  - Has provisions for data quality assurance
  - Can be the basis for a future data collection interface/platform
Agenda

1. Background
2. Cefic-ECTA Guidelines for C02 measuring
3. GLEC Framework
4. IRU Commercial Vehicle of the Future
5. Way forward
The Commercial Vehicle of the Future (CVOF)
Road freight transport emission reductions
What could contribute?

### Vehicle
- Powertrain
- Aerodynamics
- Tyres
- Weights & Dimensions
- Connectivity

### Fuels - Propulsion
- Combustion engine – oil & gas
- Hybridisation – electrification
- Hydrogen
- Biofuels

### Operations
- Eco-driving
- Speed management
- Platooning – autonomous vehicles
- Load capacity
- Market access

### Infrastructure
- Pavements
- Bridges – Tunnels
- Parking
- Connectivity
- User charging - investment
## Potential emission reductions – long haul

<table>
<thead>
<tr>
<th>Long haul</th>
<th>2030</th>
<th>2050</th>
<th>Comment</th>
<th>cumulative reduction 2030</th>
<th>cumulative reduction 2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powertrain efficiency (diesel)</td>
<td>10%</td>
<td>15%</td>
<td>Includes engine, transmission, auxiliaries,…</td>
<td>10.0%</td>
<td>15.0%</td>
</tr>
<tr>
<td>Gas vehicles</td>
<td>2%</td>
<td>4%</td>
<td>Minimise methane emissions</td>
<td>11.8%</td>
<td>18.4%</td>
</tr>
<tr>
<td>Renewable fuels (gas &amp; liquid)</td>
<td>2%</td>
<td>24%</td>
<td>IEA general target, large increase in 2nd generation biofuels needed. Includes biogas.</td>
<td>13.6%</td>
<td>38.2%</td>
</tr>
<tr>
<td>Driver training and driver assistance systems</td>
<td>6%</td>
<td>8%</td>
<td>Includes ACC, PCC,…</td>
<td>18.8%</td>
<td>43.2%</td>
</tr>
<tr>
<td>Reduce max speed</td>
<td>2%</td>
<td>2%</td>
<td>To 80 km/h</td>
<td>20.4%</td>
<td>62.8%</td>
</tr>
<tr>
<td>ITS &amp; communications</td>
<td>1%</td>
<td>4%</td>
<td>Platooning</td>
<td>21.2%</td>
<td>46.5%</td>
</tr>
<tr>
<td>Aerodynamics</td>
<td>6%</td>
<td>10%</td>
<td>Important contribution expected from trailers and semi-trailers</td>
<td>25.9%</td>
<td>51.3%</td>
</tr>
<tr>
<td>Tyres</td>
<td>7.5%</td>
<td>12.5%</td>
<td>Includes super singles</td>
<td>31.5%</td>
<td>57.4%</td>
</tr>
<tr>
<td>Lightweighting</td>
<td>0%</td>
<td>0%</td>
<td>Compensated by increased weight from other measures</td>
<td>31.5%</td>
<td>57.4%</td>
</tr>
<tr>
<td>Pavement</td>
<td>3%</td>
<td>3%</td>
<td>Improved rolling resistance (maintenance or new pavement)</td>
<td>33.5%</td>
<td>58.7%</td>
</tr>
<tr>
<td>Reduce empty running, improve load factors, digitalisation</td>
<td>2%</td>
<td>10%</td>
<td>Rollout of coordinated system needed</td>
<td>34.8%</td>
<td>62.8%</td>
</tr>
<tr>
<td>More flexibility in weights and dimensions (including EMS)</td>
<td>3.5%</td>
<td>7.5%</td>
<td>Allowance of EMS in cross border transport in the EU</td>
<td>37.1%</td>
<td>65.6%</td>
</tr>
<tr>
<td>More renewables – hybridisation (2030) / electrification (2050) ?</td>
<td>3%</td>
<td>37%</td>
<td>For 2050, most from full electrification?</td>
<td><strong>39.0%</strong></td>
<td><strong>78.2%</strong></td>
</tr>
</tbody>
</table>
Contribution potential of the measures

- Electrification
- Gas
- Dual fuel
- Electric hybrids
- Hydraulic hybrids
- Electric feedback
- Telematics
- Improve fleet operation
- Platooning
- Autonomous vehicles
- Hydrogen
- High Capacity Vehicles

Barriers to mainstream adoption

Reduction of GHG – CO2: 10%, 20%, 30%

Direction of best solutions

Light weighting
Improved aerodynamics
Low energy refrigeration
Fuels and Lubricants
More efficient combustion
Improved transmissions
Routing congestion avoidance
Driver training
Agenda

1. Background
2. Cefic-ECTA Guidelines for C02 measuring
3. GLEC Framework
4. IRU Commercial Vehicle of the Future
5. Way forward
Cefic Network Sustainable Logistics

Background

- Low-emission mobility is an essential component of the global transition to the low-carbon economy. Greenhouse gas emissions from transport did not show the same reduction as those in other sectors and make up 23% of total EU emissions. It is the objective of the EU to reduce GHG emissions from transport by 60% by 2050 compared to 1990, focusing on 3 areas:
  - Optimizing the transport system and improving its efficiency (through digital mobility solutions, transport charging systems and multi-modality);
  - Scaling up of the use of low-emission alternative energy for transport (green electricity);
  - Moving towards zero-emission vehicles.
- In May 2017 the European Commission published its Mobility Package “Europe on the Move” in which it announced its ambition to make rapid progress towards a clean, competitive and connected mobility system integrating all means of transport by 2025. This Mobility Package contains a wide-ranging set of legislative proposals to make transport more sustainable.

Relevance to chemical industry

- The chemical industry represents about 10% of total freight emissions.
- Sustainable transport is a key part of the chemical industry’s Responsible Care program.
- There is a need to ensure that the EC initiatives are taking into account industry best practice and do not create obstacles for the free movement of goods and international trade.
- Appropriate emission measuring methods and reporting platforms should be developed to allow companies to demonstrate their efforts in reducing their emissions.

Advocacy objectives

- Foster the voluntary initiatives undertaken by the European chemical industry (McKinnon report; Best Practice Guidelines);
- Respond to concrete EC legislative proposals resulting from the recently issued Mobility Package.

Tasks/deliverables

- Update the Cefic Guidelines on measuring transport GHG emissions, taking into account the new GLEC (Global Logistics Emissions Council) framework.
- Contribute to the development of a pan European cross industry reporting platform.
- Influence the proposed EC Directives.

Stakeholders

- European Commission (DG MOBILITY and TRANSPORT) / EU Parliament (Transport Commission)
- Business Europe, European Shippers Council, European Chemical Transport Association

Governance

- Lead: PC Health, Safety and Environment; Chairperson: tbc
- Across PCs: Sustainability Forum / Advocacy Forum

Timeframe

- Start: Q4 2017 - Q4 2019

Requested expertise

- In depth knowledge of supply chain and logistics.
- Good knowledge of transport GHG emission measurement and reduction programs.
Decarbonisation of freight Logistics

➢ Supply chain structure (volume/distance)
➢ Modal split
➢ Asset utilisation (payload/empty running)
➢ Energy efficiency vehicle (engine/aerodynamics/tyres/driving behavior)
➢ Carbon intensity of energy source (diesel/gas/electricity)
Decarbonisation Framework for Logistics

- Weight of goods produced / consumed
- Weight of goods transported by road
- Road tonnes-lifted
- Road tonne-kms
- Total vehicle-kms
- Timing of deliveries
- Vehicle operation / fleet management
- Energy efficiency
- Energy consumption
- Carbon intensity of energy
- Carbon content of energy

Modal split

Supply chain structure

Asset utilisation

Energy efficiency

Aggregate key parameter - decarbonisation lever

Similar analyses for other modes