

A blurred image of a high-speed train in motion, with a prominent red curved shape at the bottom of the frame.

Eco procurement guidelines - proven in use

InfraGuider workshop in Paris 2010-06-08

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Bombardier Transportation

2010-06-08

BOMBARDIER

Agenda

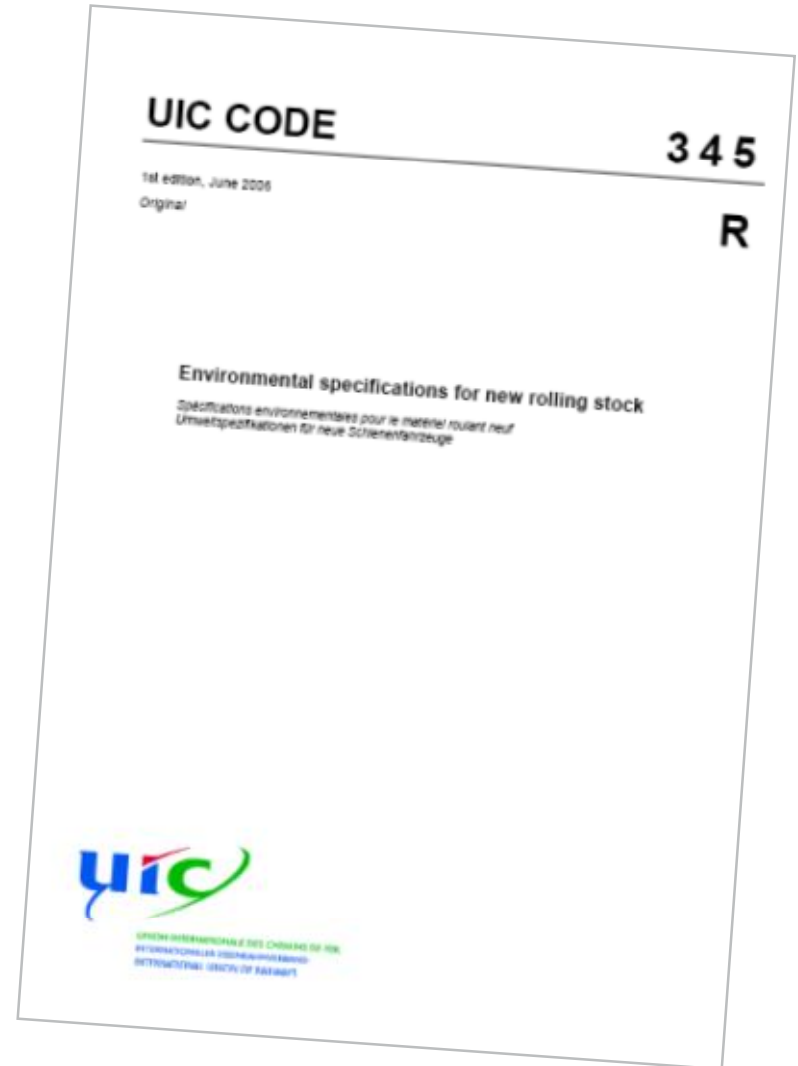
§ How does Bombardier deal with Design for Environment?

- History
- Important environmental aspects
- Main drivers
- Customer environmental requirements
- Organization
- Examples

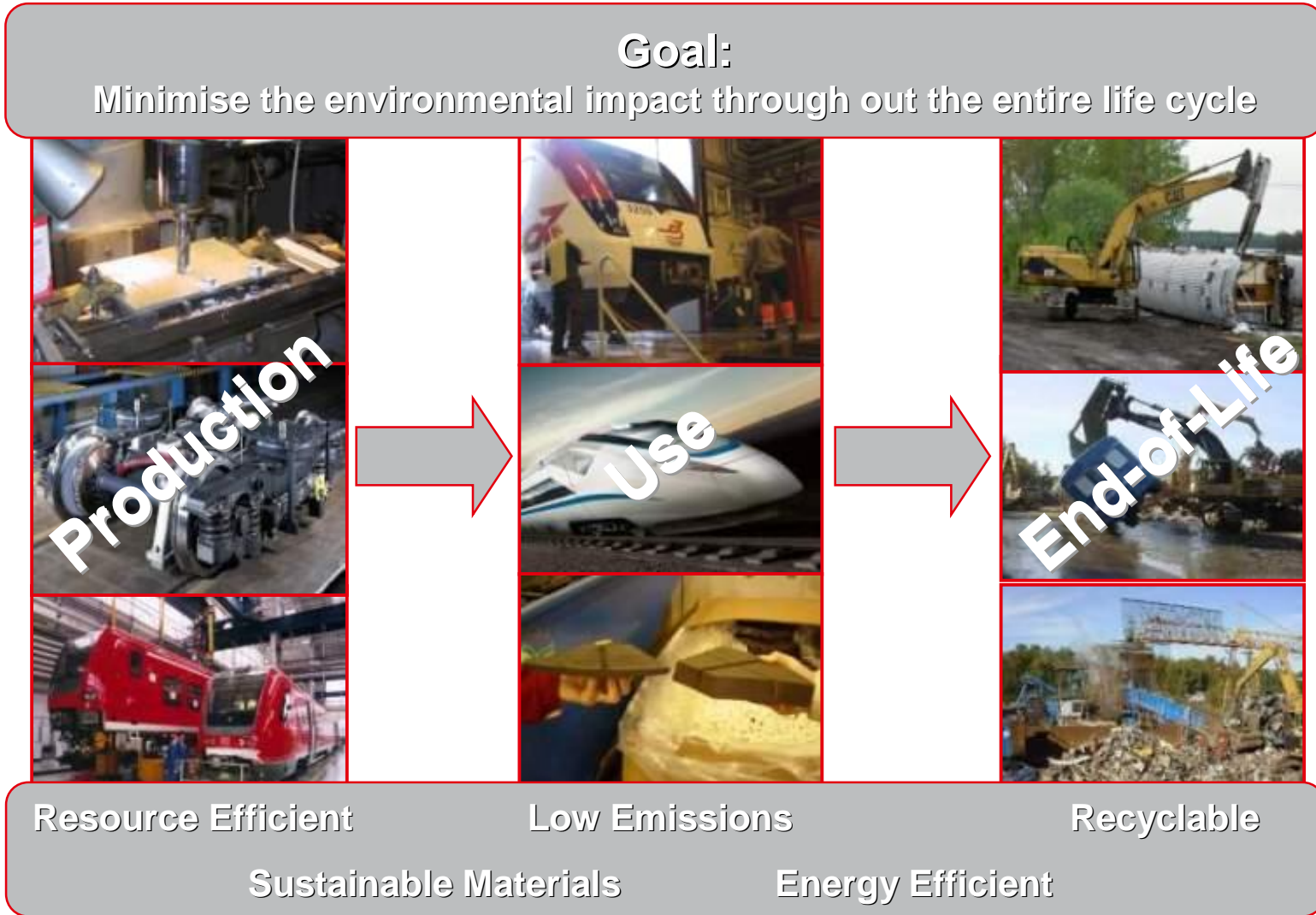
§ UIC Leaflet no. 345

- PROSPER => UIC Leaflet
- How has Bombardier used this document
- Environmental Performance Indicators (EPIs)

§ Summary and Recommendations for InfraGuider



Design for Environment



History - DfE at Bombardier Transportation

- § **Design for Environment at Bombardier started up in early -90**
 - Initiated by a customer with strong environmental requirements
- § **Today high environmental requirements requested by most customers in Europe**
- § **Also outside Europe the environmental requirements have increased dramatically**
- § **Standardization of products is required to cut costs and for this harmonized e.g. environmental requirements are a key!!**



Environmental aspects of rail vehicles

Emissions – CO₂, NO_x, SO₂ etc.

Noise

Particles

Energy consumption

Chemicals

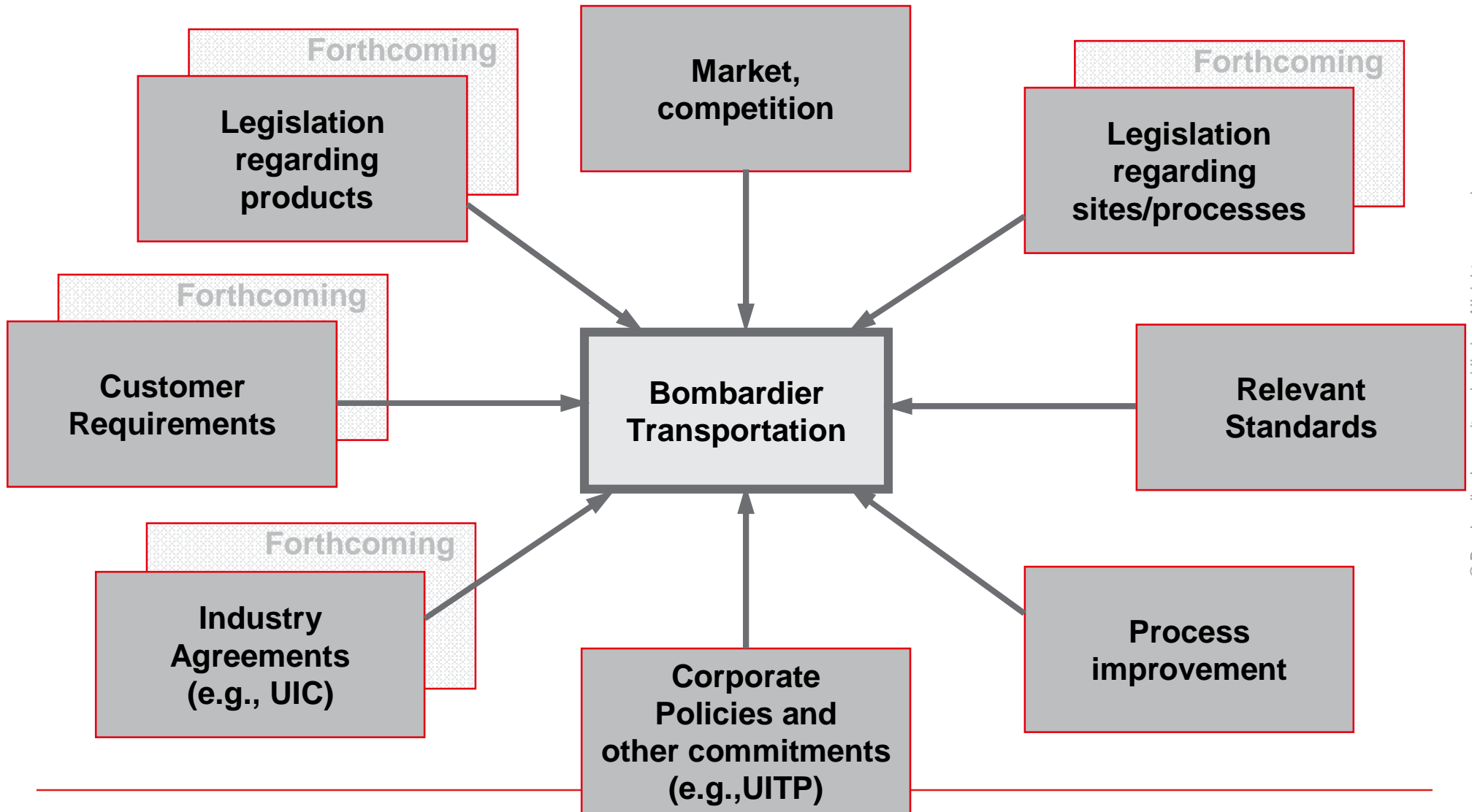
Electromagnetic fields

Materials

Land use

Recycling / deposit

Motivation / Drivers for DfE



Common Customer Environmental Requirements

- § **Environmental Management System**
- § **Restrictions on Materials**
 - Prohibited & Restricted Substances
- § **Specify all Materials used the vehicle**
 - To be used for homologation
- § **Safety Data sheets (SDS)**
 - To be provided for harmful materials
 - Legal requirements according to REACH
- § **Recycling highly prioritized**
 - Target values according to ELV Directive
 - Calculations applying ISO 22628
 - Specify recyclability of materials used
 - Use materials that are recyclable, and specify the amount
 - Marking of polymers to facilitate recycling
- § **Recycling Description / Manual**
- § **Life Cycle Assessment (LCA)**
 - According to ISO 14040
- § **Environmental Product Declaration**
 - According to ISO 14025
- § **Restrictions on Emissions**
 - Particulate e.g. brake pads, leakage of oil, greases etc
 - Air quality inside vehicles
 - Formaldehyde & VOC emissions verified
- § **Take-back obligation**
- § **Energy efficiency**



Bombardier Transportation Centre of Competence - Design for Environment

Global centre of competence
in Design for Environment,
with a company wide network
- to ensure harmonized and
high level of environmental
competence



BOMBARDIER

9-Jun-10

Bombardier DfE Projects Experiences - worldwide



§ Metro Delhi - India



§ HH DT5 - Germany



§ Talent 2 - Germany



§ Singapore DTL



§ SSL - UK



§ NAT - France



§ 20 EMU China



§ Gröna Tåget - Sweden

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Life Cycle Perspective

Monitoring and Improving the Environmental Impact and CO₂ Footprint

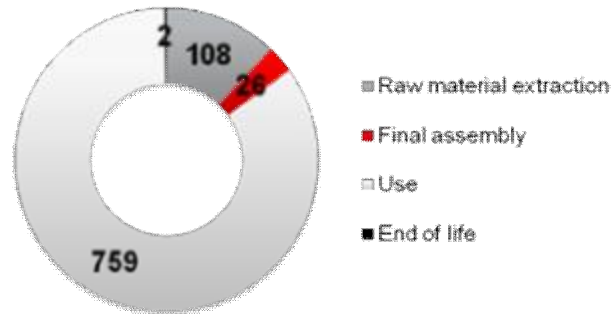
Features

- § Life cycle perspective - an integrated part in the design process at Bombardier
- § Life Cycle Assessment (LCA) is a tool to analyze the environmental impact of a product
- § LCA is used to further improve the environmental performance of our product

Example:
CO₂ footprint for Innovia ART 200



~ **9 gram** CO₂ for transportation
per passenger km



Unique Benefits

- § Takes all life cycle phases of a product into account;
 - Raw material production, manufacturing processes, vehicle operation as well as end-of life treatment
- § Applied according to the ISO 14040 standard
- § Results preferable presented in an Environmental Product Declaration (EPD) according to ISO 14025
- § Measurable product performance improvement

Improved Recyclability

Example from a French regional vehicle applying the ISO22628

Composites
2%

Polymers
5%

Metals
86%

Chemicals
1,5%

Other
Materials 4%

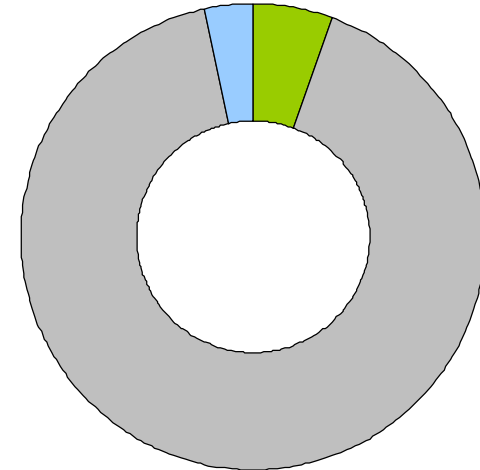


Electrical
Components 0,5%

Renewable
Materials 0,5%

Recyclability 97 %

Residues 3% Energy recovery 6 %



Material recycling 91%

Environmental Product Declarations (EPDs)

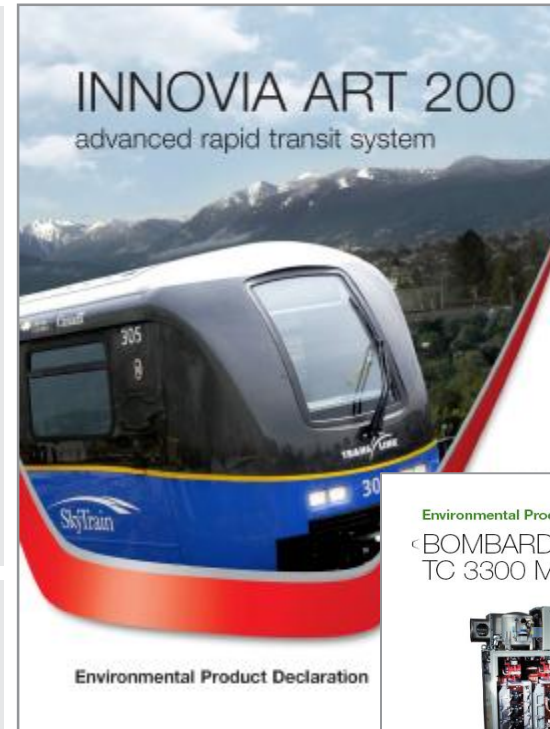
Communication of Environmental Performance

Features

- § Standardized way to communicate the environmental performance of a product
- § Summarize the technical and environmental performance of a product covering all life cycle phases:
 - **Technical performance**; Energy consumption, noise emission, material composition, recyclability, PM₁₀ and NO_x (for diesel vehicles)
 - **Environmental performance** (based upon a Life Cycle Assessment); Use of resources, waste generation and environmental impact expressed as e.g. CO₂ footprint

Unique Benefits

- § Bombardier Transportation was first within the rail industry to produce an EPD
- § EPDs are produced for both vehicles and components
- § Application of ISO 14025 as well as commonly agreed Product Category Rules for Rail Vehicles (PCR 2009:05)
- § Third party validation of information and results included
- § Bombardier is acting with full transparency to the benefit of our customers



Environmental Product Declaration
 « BOMBARDIER MITRAC TC 3300 MS V04 »

The BOMBARDIER MITRAC TC 3300 portfolio is the world-leading family of traction converters based on industry standard IGBT technology. The high performance period with high energy efficiency and integrated power management functions makes the MITRAC TC 3300 traction converters the right choice for environmentally sustainable locomotives and high speed power heads. Bombardier has and more than 1400 high power MITRAC TC 3300 traction converters.

The equipment is robust, easy to maintain, designed to withstand extreme environments, and includes a drive control system with high performance adhesion control. It covers all types of locomotive and high speed power head applications, from AC and DC to the system solutions for cross-border operation and diesel electric and dual power (supporting both electric and diesel operating locomotives to extend coverage into non-electrified areas). The benefits for our customers are propulsion and control systems that meet current and future requirements in an economic and environmentally sustainable manner, delivering maximum performance and reliability.

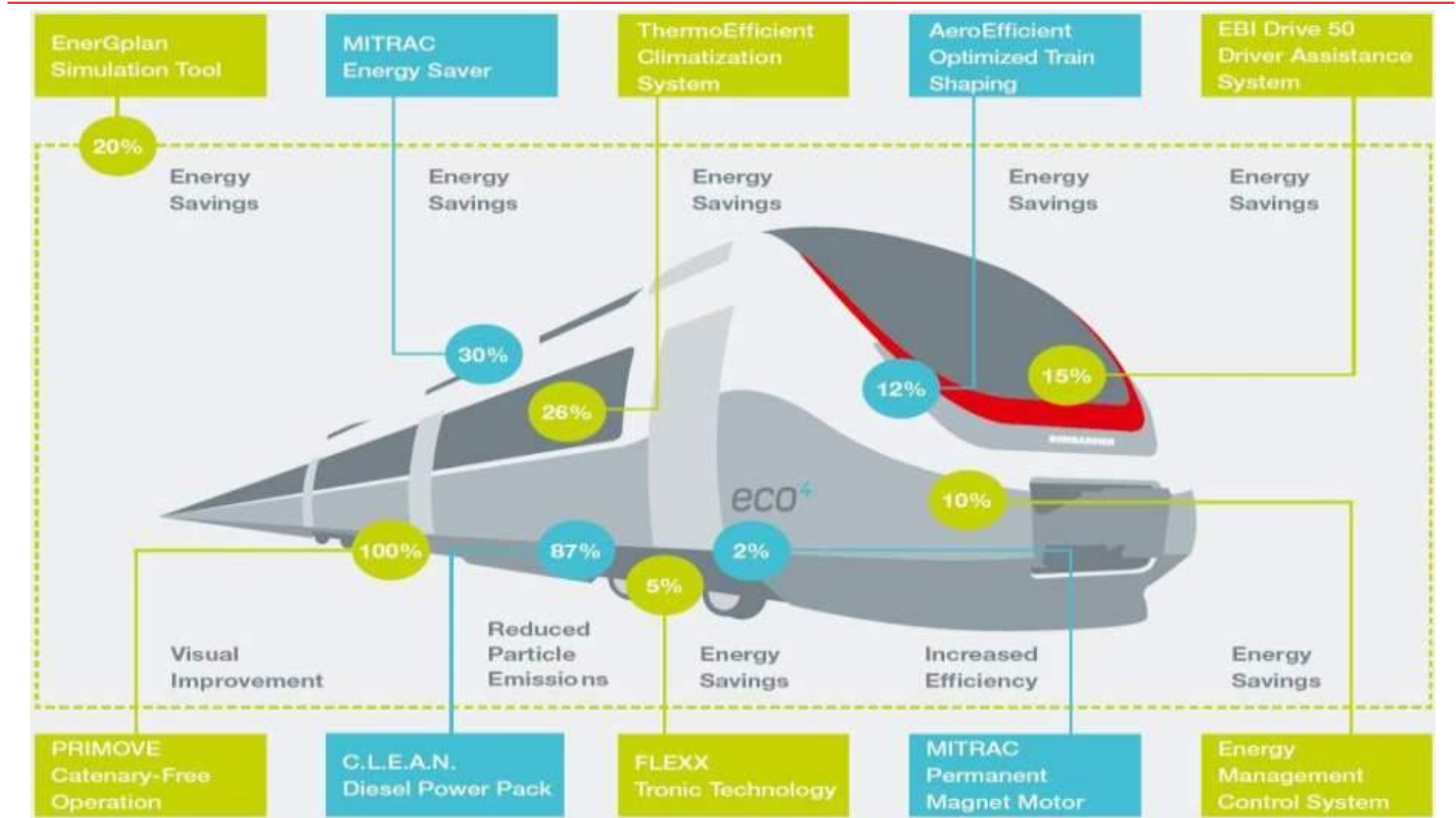
The newest members of the family, the MITRAC TC 3300 IGBT traction converters, are based on a unique concept guaranteeing maximum commonality and flexibility; one basic design can be adapted for a wide range of different applications to fit individual needs.

Propulsion and Controls  **BOMBARDIER**



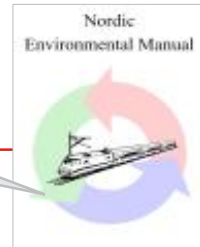
More information available at:
www.environdec.com

Energy efficient solutions



PROSPER project

Continuation of
Nordic Manual (1999)



Objectives:

- § To increase the overall "eco-efficiency"/ sustainable performance of new rolling stock
- § To assist railways in setting up environmental requirements and assessing tenders
- § To initiate a dialogue with users (railways) and stakeholders (UNIFE, manufacturers)

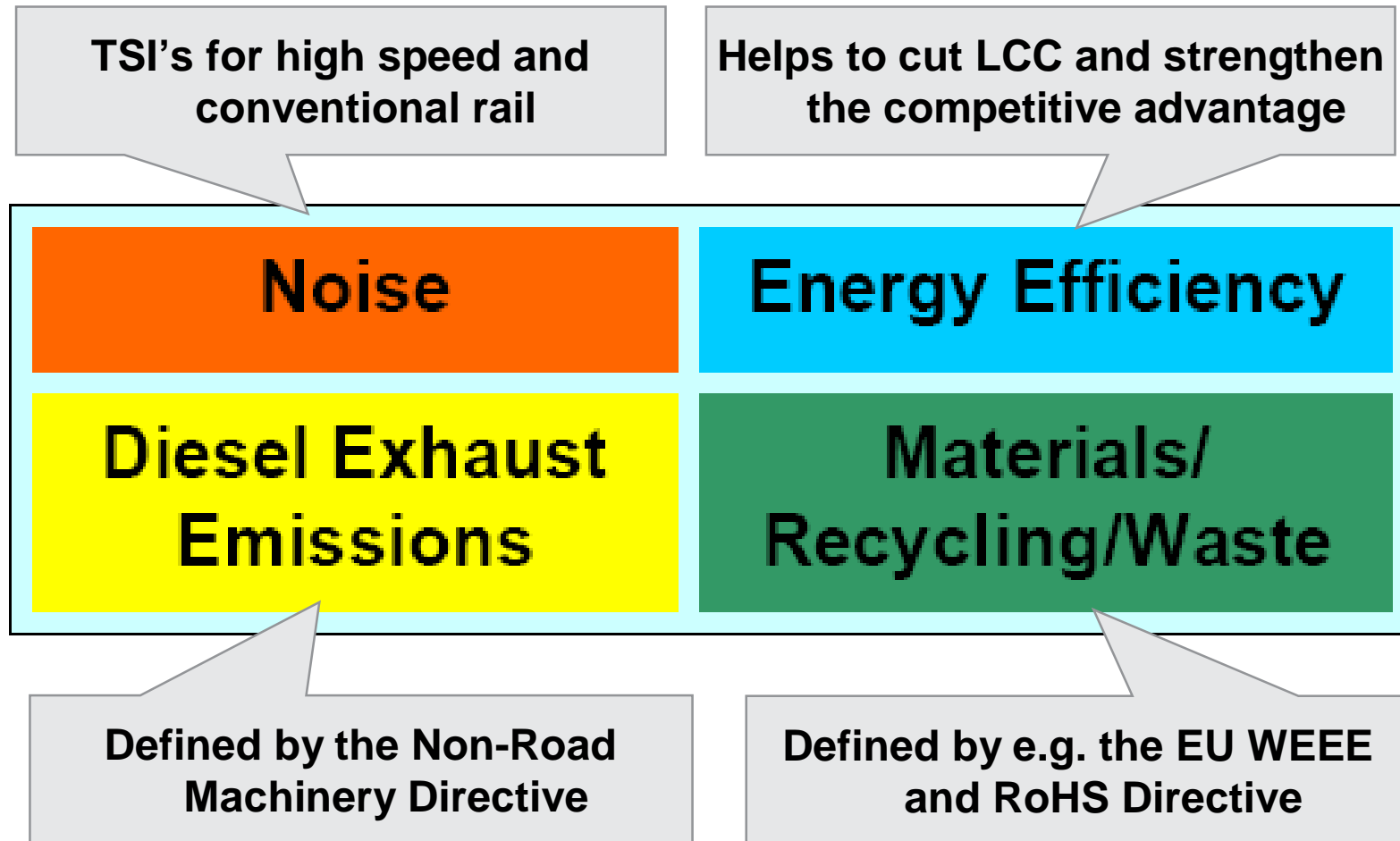
Results of the Project:

- § **a guideline** to assist in setting up environmental requirements and evaluating tenders
- § a set of **recommended qualitative environmental specifications** (defining performance values)
- § a **reference document** for experience, examples and state of the art of environmental relations and their economic cost/benefit aspects

Output: *Environmental Guideline for the Procurement of Rolling Stock (UIC leaflet)*

Key Environmental Areas for Railways

- identified by PROSPER



PROSPER Key Environmental Areas

Noise

- øPassing by noise
- øStationary noise
- øMeasurement procedure

Energy Efficiency

- øTraction efficiency
- øVehicle mass
- øE-management comfort
- øDiesel consumption
- øOn-board energy calculation
- øTraction energy calculation

Material/Rec/Waste

- øBlack list, Grey list
- øRecycling rate

Exhaust Emissions

- øNO_x, CO, HC, Particles

Electromagnetic Fields

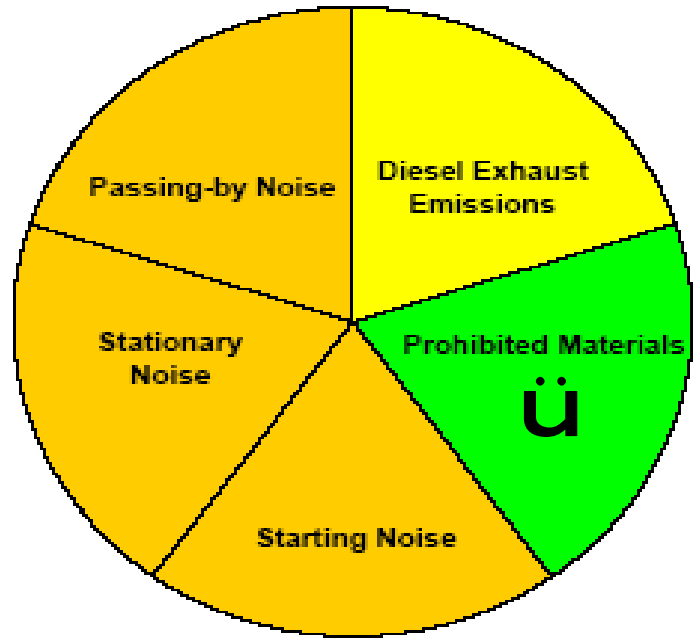
Other Emissions

- øBrake pads
- øPrevention of shedding

**Mandatory
Legislation**

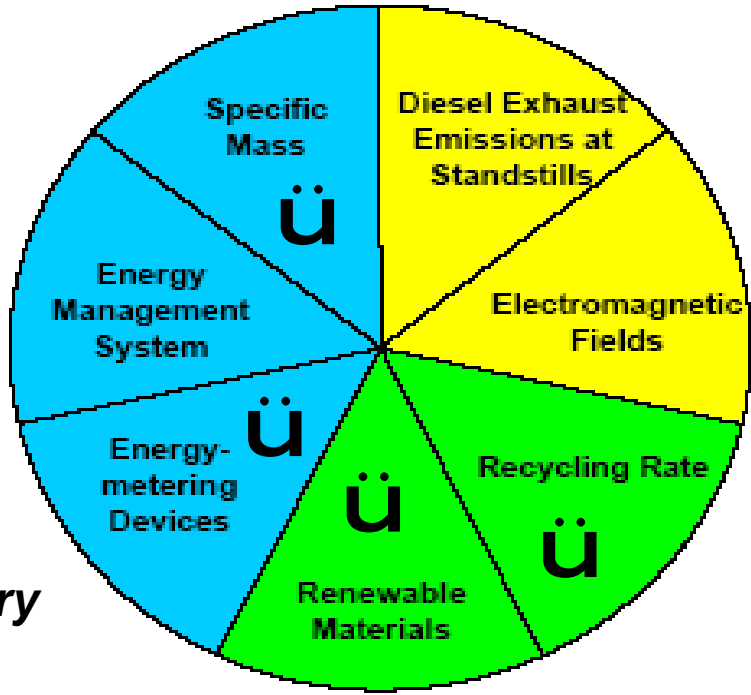
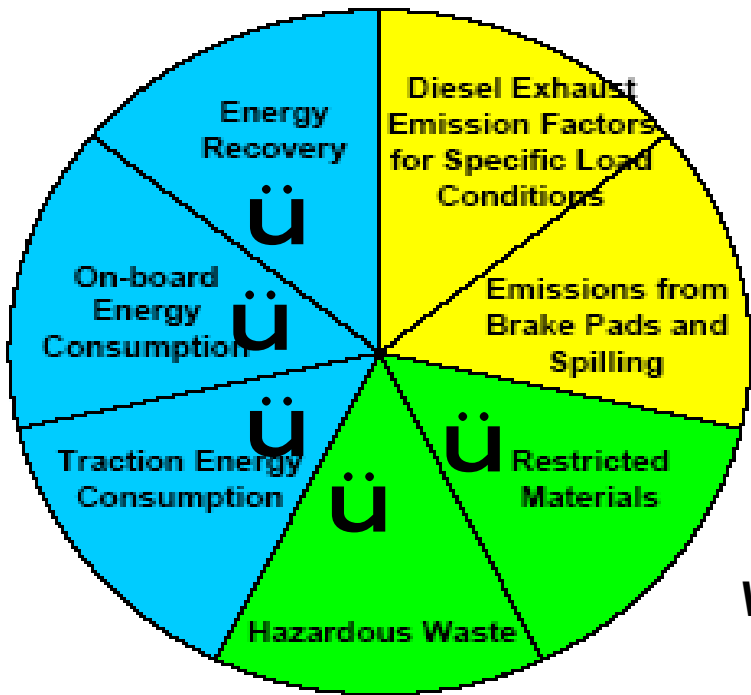
PROSPER
UIC Leaflet no. 345 "Environmental
Specifications for New Rolling Stock"

ü Implementation of indicators within Bombardier completed



Priority 1

Priority 2



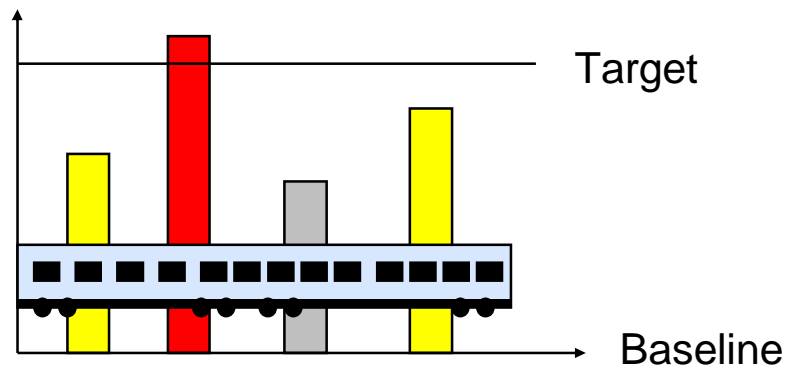
Voluntary

Environmental Performance Indicators – EPIs

- further elaborated at Bombardier

§ Bombardier have developed based upon PROSPER our own interpretation of the Indicators

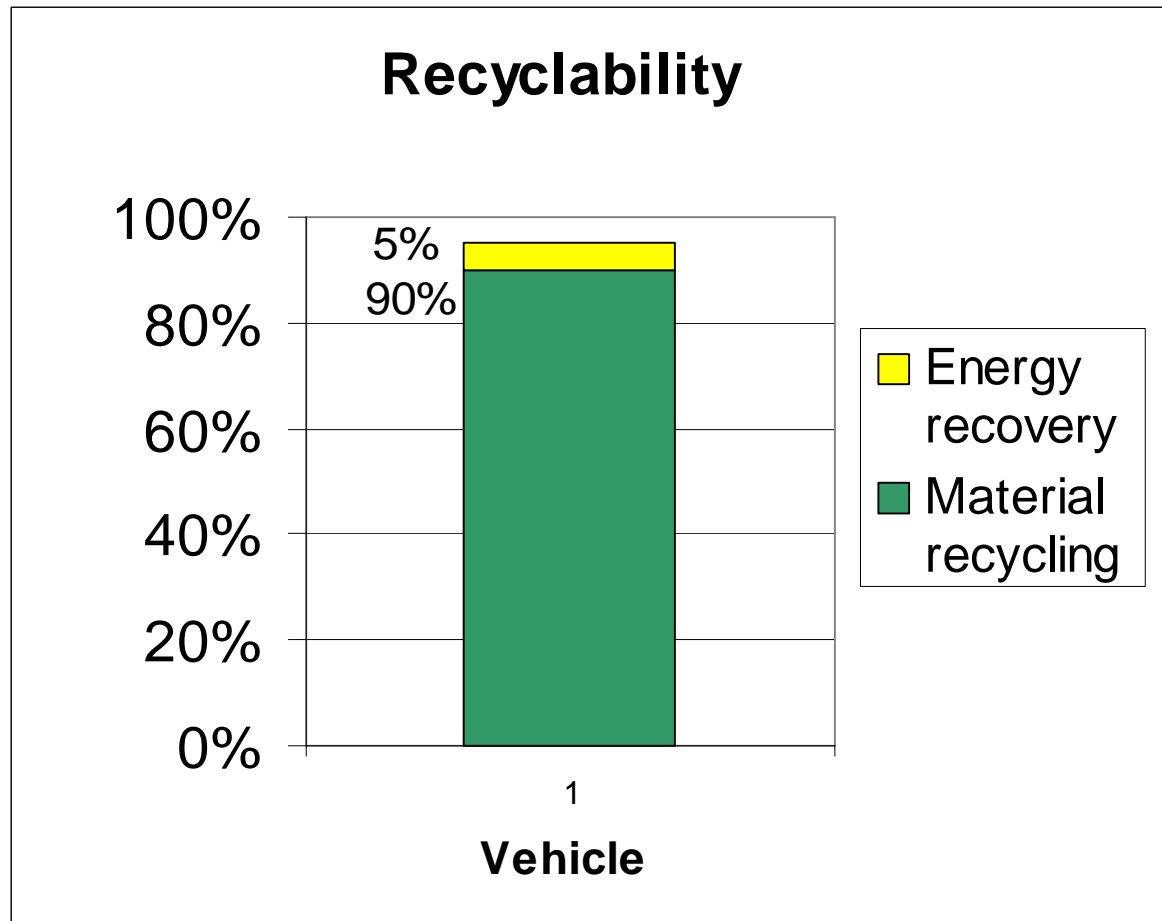
Eco-efficiency



1 Background.....	2
2 Key features.....	2
3 Business Impact.....	2
4 Typical Application Fields	3
5 Material EPIs.....	3
5.1 CE-Mat.....	3
5.2 Prohibited & Restricted Substances	3
5.3 Recycling.....	4
5.4 Renewable materials	4
5.5 Hazardous waste	5
6 Process EPIs.....	5
6.1 DfE training	5
6.2 DfE publications	6
7 Energy EPIs.....	6
7.1 Simulations.....	7
7.2 Energy EPIs	7
7.2.1 Mass	7
7.2.2 Running resistance (RR)	8
7.2.3 Energy recovery	8
7.2.4 Onboard energy consumption.....	9
7.2.5 Traction energy consumption.....	9
7.3 Complementary report	10

EPI – Recycling

- applying the ISO 22628



Functions: Reports

Reports:

- End-of-Life
- EPI
 - Hazardous Waste
 - Prohibited
 - Recycling
 - Renewable
 - Restricted
- Material
- Material Group
- Prohibited & Restricted
- Weight

Filter for:

- Project
- Supplier
- System
- Level of detail
- plus specific factors, e.g. Renewable materials only

End of Life report

BR 185 - Class 185.1 - Traax platform
Class 185.1 BT Zone
Class 185.1_

2006-05-09

Article name	Number	Total weight [kg]	Material recycling	Energy recovery*	Waste [kg]%
Class 185.1_		82 526.47	72 247.89 (88%)	4 384.77 (5%)	5 893.82 (7%)

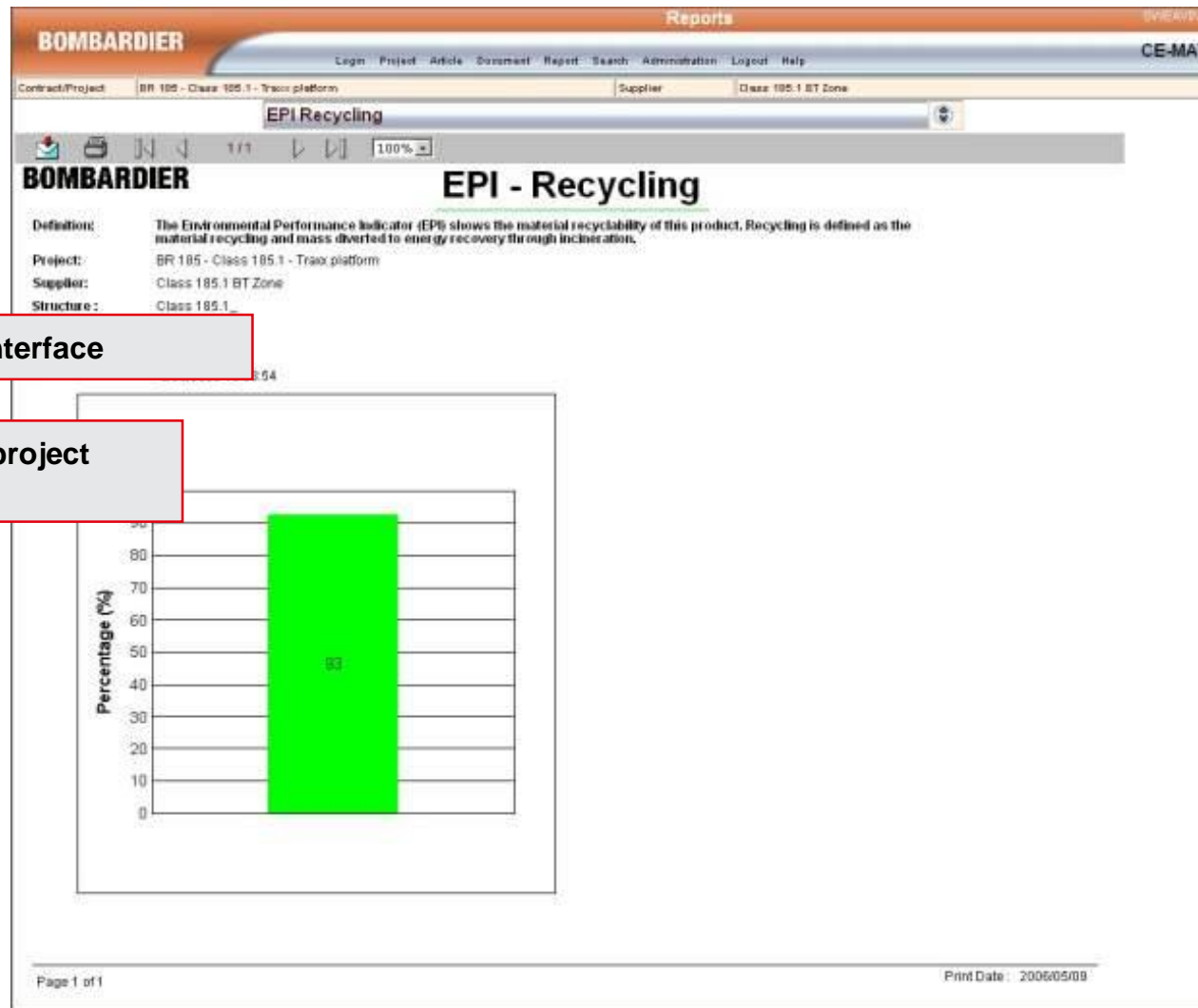
Hazardous	Material Name	Weight [kg]	Material recycling	Energy recovery*	Waste [kg]%
X	1,2,4-Trimethylbenzene	1.350000	0.000000	0.000000	1.350000
X	1-Decene, homopolymer, hydrogenated	0.260000	0.000000	0.000000	0.260000
X	1-Methoxy-2-propanol	7.150000	0.000000	0.000000	7.150000
X	2,2,4,6,6-Pentamethylheptane	66.000000	0.000000	0.000000	66.000000
X	25CrMo4 (EN 1.7218)	1 816.000000	1 816.000000	0.000000	0.000000
X	2-Methoxy-1-methyl ethyl acetate	9.200000	0.000000	0.000000	9.200000
X	2-Methoxy-1-propanol	0.047000	0.000000	0.000000	0.047000
X	2-Methoxypropyl acetate	0.020000	0.000000	0.000000	0.020000
X	3-Isocyanatomethyl-3,5,5-trimethylcyclohexyl-isocyanate	0.011800	0.000000	0.000000	0.011800
X	3-Methoxybutyl acetal	0.012000	0.000000	0.000000	0.012000
X	4-Methyl-2-pentanone	4.375000	0.000000	0.000000	4.375000
X	Acrylate based adhesives	0.020000	0.000000	0.000000	0.020000
X	Adhesives, tapes and putty compounds	12.400000	0.248000	0.000000	12.152000
X	Al-Cu-Si alloy	15.010000	15.010000	0.000000	0.000000
X	Aliphatic aromatic hydrocarbons	2.300000	0.000000	0.000000	2.300000
X	Al-Mg alloy	226.740000	226.740000	0.000000	0.000000
X	Al-Mg-Si alloy	101.200000	101.200000	0.000000	0.000000
X	Aluminium silicate	20.000000	0.000000	0.000000	20.000000
X	Aluminium	3 562.891000	3 562.891000	0.000000	0.000000
X	Antimony trioxide	0.064000	0.000000	0.000000	0.064000
X	Aramid, aromatic polyamide	6.000000	0.000000	6.000000	0.000000
X	Aromatic hydrocarbons	6.760000	0.000000	0.000000	6.760000
X	Barium sulphate	1.150000	0.000000	0.000000	1.150000
X	Benzyl alcohol	0.400000	0.000000	0.000000	0.400000

Page 1 of 12

Save as:

- pdf
- Word
- Excel

Functions: Reports, Example of an EPI report



Simple Interface

Quick to see project status

EPI – Traction energy consumption

Energy EPIs used as input to RailEnergy

kWh (consumed minus regenerated) for

- a certain track
- a certain speed profile including brake
- characteristics with a certain weight of the train
- a certain aux. power

$$\text{Energy index} = \frac{\text{Energy}}{\text{Size} \cdot \text{Distance}} \Rightarrow \text{kWh} / \text{passenger} \cdot \text{km}$$

Number of passengers at
a certain load factor

1 km

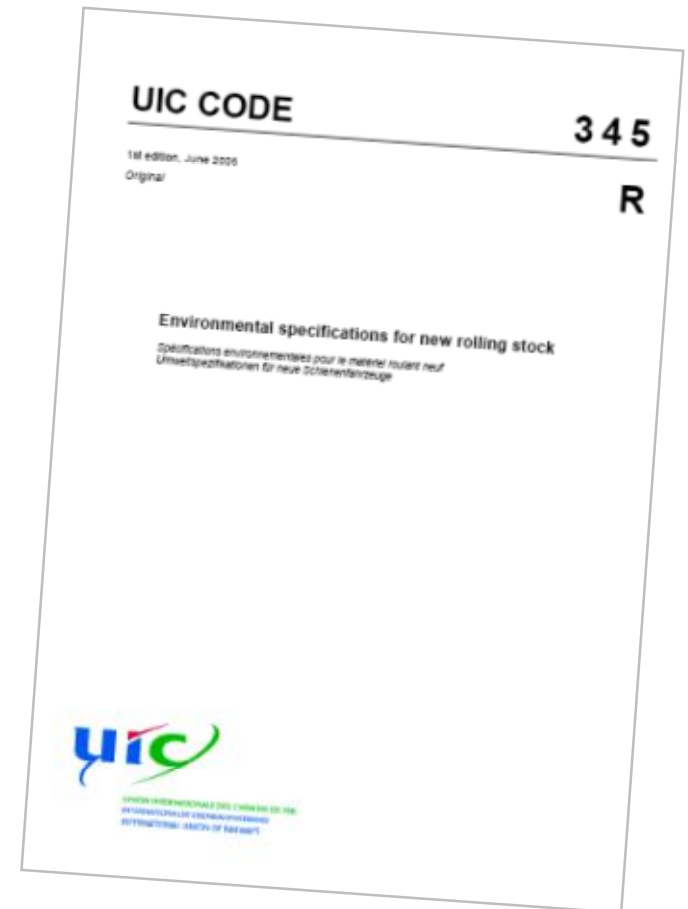
Summary and recommendations to InfraGuider

§ UIC Leaflet

- Highlight the areas of importance
- Target values are missing
- Algorithms are missing, makes the requirements difficult to work with
- Only reference to legislation - no added value!

§ Harmonized environmental requirements shall identify and explain the differences compared to legislation

§ Clear defined environmental requirement from “customers” are needed since this is an important driving force



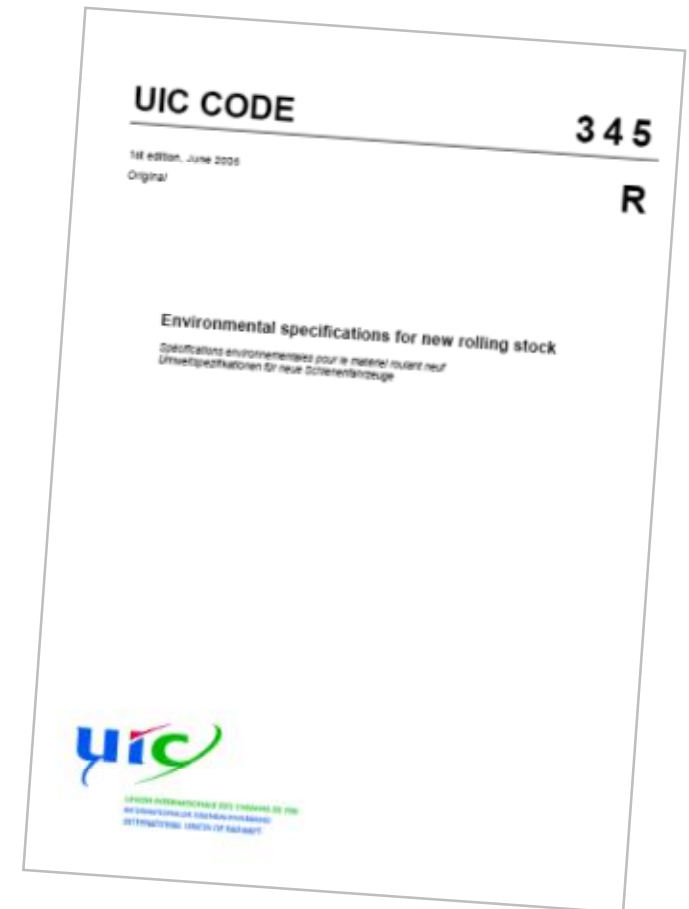
Summary and recommendations to InfraGuider cont.

§ Key success for harmonized environmental specifications are:

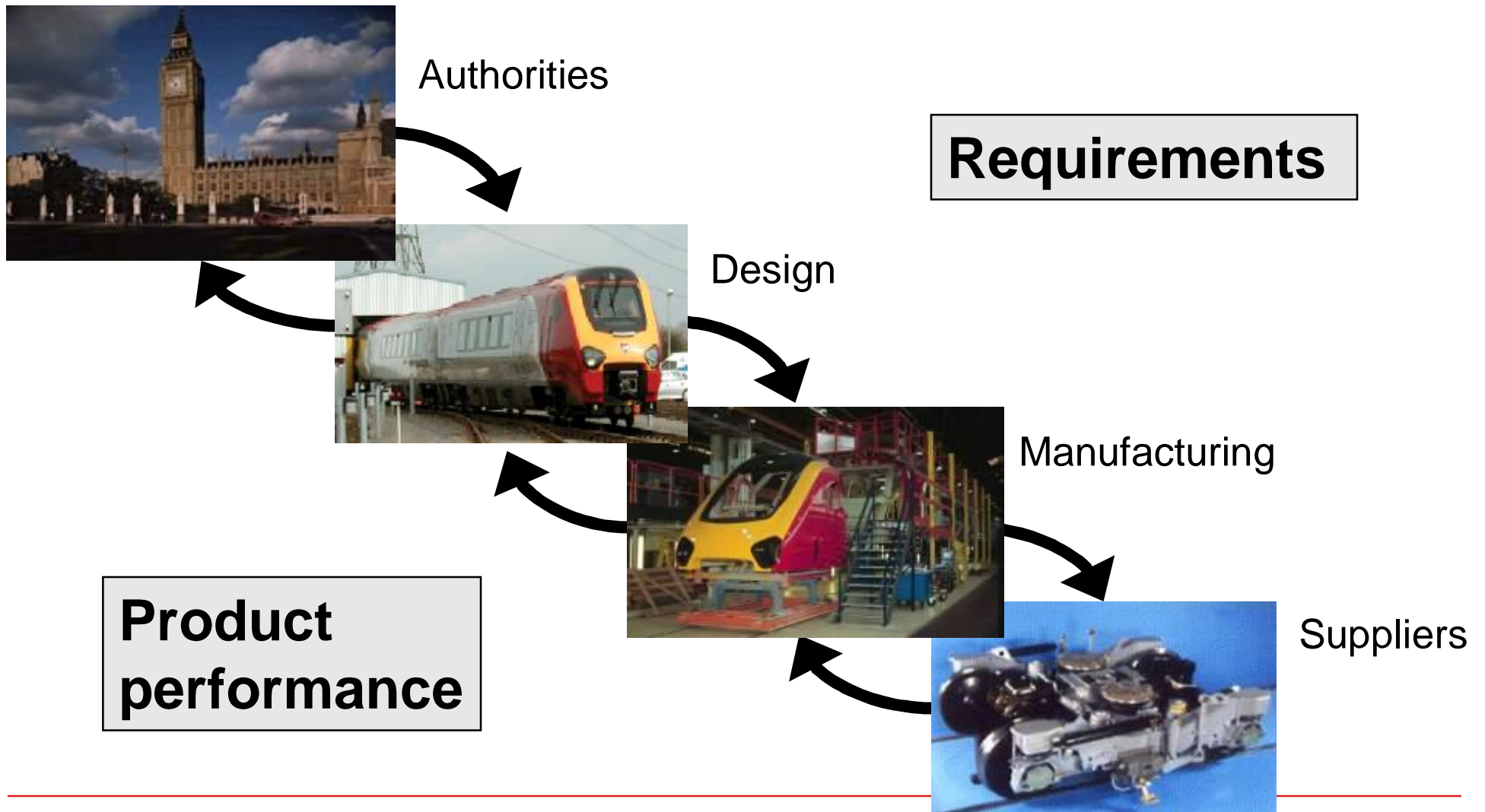
- Clear definitions and available algorithms
- Only “shall” requirements
- Identify differences to legislation, challenge
- Target values defined
- Measurable requirements
- Regular update / review

§ Availability of harmonized environmental specifications:

- Provide transparency and common understanding of focus areas
- Promote standardization of products
- Reduce the work for especially smaller companies, “copy & paste” exercise
- Key success to improved environmental performance on products!



Environmental Improvement Cycle



Thanks for your attention!



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