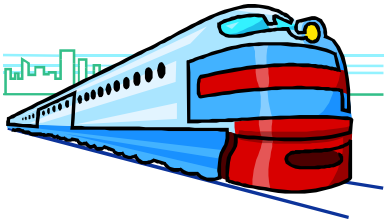
Information material for REPID software training session

REPID methodology – REPID application



Industrial environmental informatics, Chalmers University of Technology

Table of content

Introduction

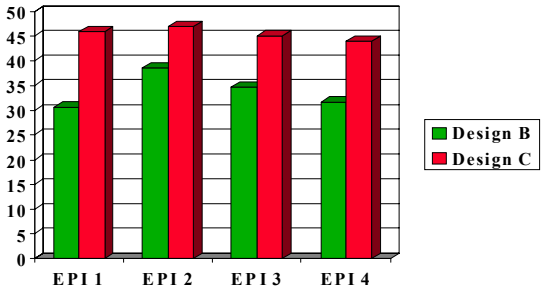
This information material is aimed to facilitate the understanding and use of the REPID application. The crucial steps used when working with the RAVEL/REPID methodology is illustrated and described.

Definitions of the agreed environmental performance indicators (EPIs) are included in appendix 1 and a list of relevant documents can be found in appendix 2.

This material has been made by Industrial Environmental Informatics (IMI) at Chalmers University of Technology. Please contact Karolina Flemström, +46 31 7728603, karolina.flemstrom@imi.chalmers.se for more information.

Usefulness of the REPID methodology

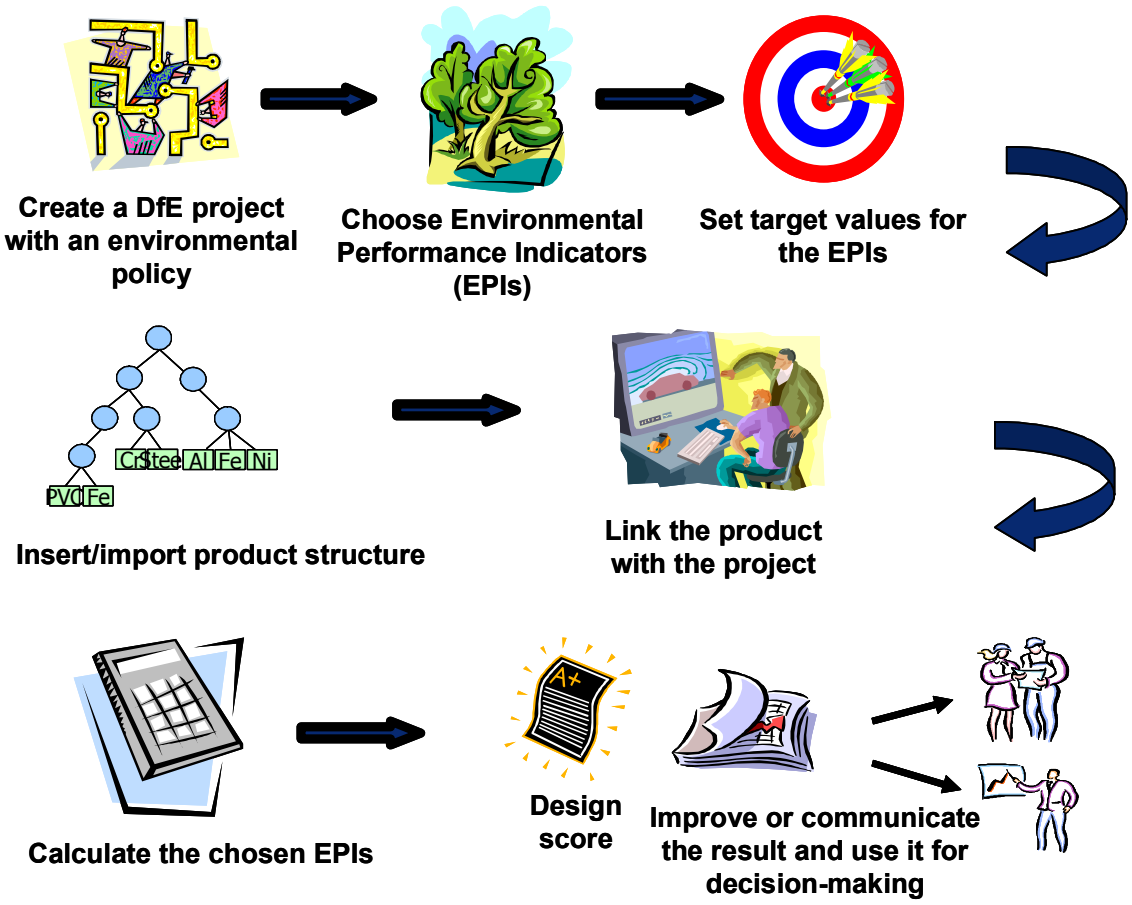
- The REPID tool is a design for environment (DfE) tool aiming to improve eco-efficiency for rail vehicles
- The REPID tool enables communication of environmental performance within the industry in terms of Environmental Performance Indicators (EPIs)
- The REPID tool measure environmental performance in the design phase



How to use the REPID application

The REPID application is based on a methodology developed in the RAVEL (Rail Vehicle eco-efficiency design) project, which has been further developed within the REPID project.

Below is a summary of the most important steps in the REPID application.

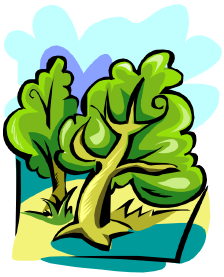


Create a DfE project with an environmental policy

First, a project is created, that has the task to design a specific part, for example a train. A Design for Environment (DfE) project manages fulfilment to the Eco-efficiency targets. DfE projects often relate to design projects in the organizations.

The REPID information platform complies with a structured management of design projects. Targets, designs and users are associated with projects, and projects are used to keep data about these entities together. A project can be organizationally broken down into smaller pieces.

Chose environmental performance indicators (EPIs)



- The chosen indicators (EPIs) should be in line with the company's environmental policy or in line with specific user requirement or legal requirements.

- There are 21 EPIs to choose from. The set of indicators covers the following areas: noise, energy, exhaust emissions, materials and recycling, electromagnetic fields and manufacturing. The whole life cycle of the train is included: production, operation and end-of-life. Not all 21 are implemented in the first version of the REPID tool.

- The EPIs have been designed and defined to follow state-of-the-art of scientific knowledge, environmental impact of rail vehicles, legal requirements and company policies.

- The REPID EPIs should be used when setting environmental targets, when measuring the environmental performance, when calculating an environmental baseline and when evaluating environmental performance.

- To calculate EPIs is to measure the eco-efficiency performance of a design.

- There are material related EPIs and non material related EPIs. A material related EPI requires basic data (material properties) from the materials in a component in order to be calculated, e.g. the EPI "Amount of prohibited materials" requires knowledge of which materials that are prohibited in order to be calculated. Non material related EPIs

are based on component properties e.g. system mass or on simulations, measurements, or estimations external to the REPID information platform.

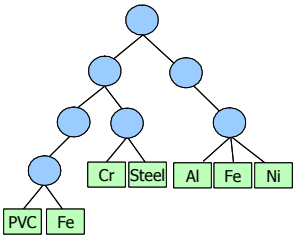
- For more information about each indicator read the short definitions available in the REPID application and in appendix 1 in this material.

- More detailed information about EPIs including inputs and outputs, material lists etc can be found in the reports listed in appendix 2.

Set target values for the EPIs

Setting and breaking down targets are important. Target values for the chosen indicators should be set according to requirement within or outside the company. The unit of the indicators should also be set here since target values and EPI values must have the same unit to be able to compare.

Insert product structure



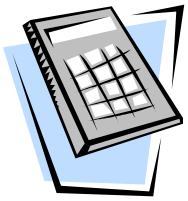
Create product structure including components and materials or import product structure from another file. You will select materials from a list of commonly used construction materials. It is important to note that these types of lists never are complete. If you, in your product, have a material not present on the list you must either exclude the material or do a best approximation by selecting a similar material. As a first choice you should always try to find an as similar material as possible. You must however then be aware of and consider these approximations when you interpret and communicate the result.

Link the product with a project

One or several products are linked to a project to make it possible to compare alternative designs and to confirm that the target is reached.

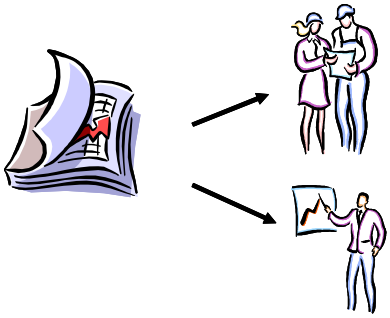
Calculate environmental performance indicators

Use the tool to calculate the indicators for your product. Each indicator has been defined in a structured way including a description of the function, an algorithm and a description of the input and output needed. The calculations are based on the REPID material list and material properties connected to these materials. For information about how the calculations are performed read the description in “How the calculations are performed”, page 8.

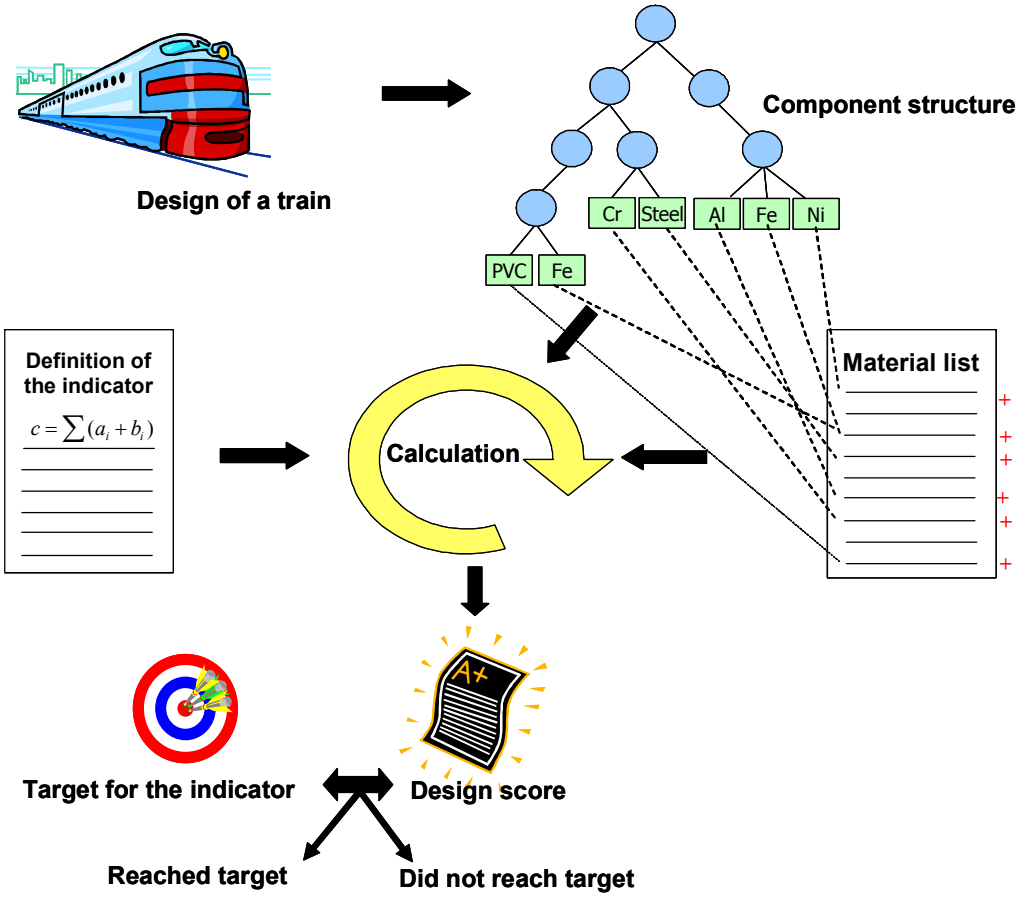


Improve or communicate the result and use it for decision- making

- Receive reports with information about indicators results, definitions of the indicators and also reports on how the calculations were performed.
- Compare the result with set target values for the EPIs.
- Compare the result for different alternative designs.

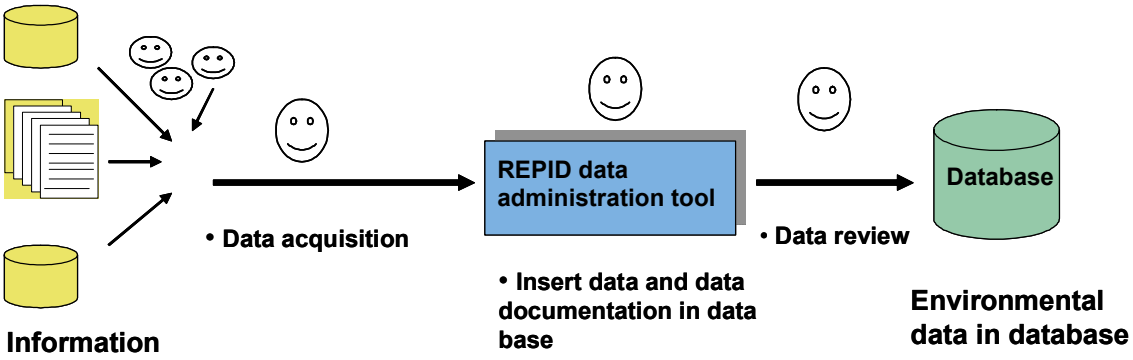


How the calculations are performed



- The design describes how the train is composed of different parts in a component structure.
- Each component is broken down into smaller pieces until materials in the REPID material list are reached.
- The calculations of the material related indicators are based on properties of the materials in the material list.
- By using algorithms described in the definition of each indicator, the properties for the materials in the analyzed component are aggregated and a score for the indicator in the component is reached.
- The evaluated score for a specific design can be compared to a target value for the design. An indicator can be calculated for any part in the component structure.

REPID Environmental database



- There are material related EPIs and non material related EPIs. A material related EPI needs basic data - Material properties – from the materials in a component in order to be calculated. This data can be found in the REPID environmental database.

- Data acquisition is performed through a structured procedure. Data has been gathered for example from literature study, personal communication and other databases.

- Industrial environmental informatics (IMI) at Chalmers University of Technology is responsible for the development and maintenance of the REPID environmental database.

- Data is inserted into the REPID database through the REPID data administration tool by IMI.

- IMI perform review of data to ensure that data is fulfilling documentation and data quality criteria.

For further information please contact:

Markus Erlandsson, markus.erlandsson@imi.chalmers.se
Karolina Flemström, karolina.flemstrom@imi.chalmers.se

Appendix 1: List of REPID indicators and short definitions

The REPID Environmental Performance Indicators (EPIs) are based on the indicators developed in the successful EU-funded project RAVEL. The EPIs are based on the international standard ISO 14031. Below the agreed REPID EPIs are presented. For more detail description see REPID EPI reports in appendix 2.

Key Topics	Indicator name	Definition
Noise Emissions	Pass by Noise	Monitor pass by noise emissions from interoperable vehicles (freight wagons, locomotives, multiple units and coaches) in compliance with TSI regulations.
	Stationary Noise	Monitor stationary noise emissions from interoperable vehicles (locomotives, multiple units and coaches) in compliance with TSI regulations.
	Starting Noise	Monitor stationary noise emissions from interoperable vehicles (locomotives, multiple units and coaches) in compliance with TSI regulations.
Energy	Traction energy use	Monitor energy use for traction of a train
	Energy use for comfort functions	Monitor the energy used for all kinds of comfort functions of a passenger rolling stock: heating, cooling, ventilation, lightning, toilets, doors and catering.
	Exhaust emissions from diesel vehicles	Monitor emissions from diesel vehicles in compliance with regulations. Emissions of CO, HC, NOx and PM (particles) are regarded.
Materials and recycling	Amount of forbidden materials	Monitor the amount of prohibited materials in the vehicle. Prohibited material means that the material is on the REPID list of prohibited materials.
	Amount of restricted materials	Monitor the amount of restricted materials in the vehicle. Restricted material means that the material is on the REPID list of restricted materials.
	Total vehicle mass	Monitor the total weight of the vehicle
	Materials inventory degree	Monitor the degree of declaration of materials in a vehicle. The material should be declared with name and weight.

Materials and recycling	Fraction renewable material	Monitor the weight fraction of renewable materials in the vehicle
	Fraction recycled materials	Monitor the weight fraction of recycled materials in the vehicle. The term 'Recycled' means that the material has been recycled through material recycling. Material recycling is defined as the reprocessing in a production process of the waste material for the original purpose or for other purposes but excluding energy recovery.
	Total number of material	Monitor the total number of materials, according to the REPID material list, in a product.
	Marking of polymers	Monitor the marking of polymers in the vehicle. This marking will help the material recycling. Marking should be performed according to ISO 11 469 or similar standard regulations.
	Material recycling rate	Monitor the fraction of materials that can be recycled through material recycling. Material recycling, often called recycling, means the reprocessing in a production process of the waste material for the original purpose or for other purposes but excluding energy recovery.
	Can be incinerated with energy recovery	Monitor the amount of material that can be incinerated with energy recovery. Energy recovery means the use of combustible waste as a means to generate energy through direct incineration with or without other waste but with recovery of the heat.
	Amount of potential hazardous waste	Monitor the amount of potential hazardous waste. The definition of hazardous waste is based on EU regulations.
Other environ-mental impacts	Emissions from wear	The aim of this indicator is to monitor the particulate emissions from brake pads. These particulate emissions can be harmful to the environment near the roadbed.
	Electromagnetic fields	Monitor compliance with regulations in different types of electromagnetic fields in the train.
Manufac-turing	Suppliers with EMS	The fraction of suppliers with Environmental Management Systems (EMS) is calculated.
	Existence of product environmental management support	Monitor the availability of different manuals. The following manuals should be checked: Environmental maintenance manuals and Environmental disassemble/scrapping manuals.

Appendix 2 Relevant documents developed within REPID:

There are some relevant documents that could be read as a complement to this material. The reports can be found on the REPID internal project site. Please contact IMI, Chalmers for further information about the reports.

Manual on data management for REPID information system
This manual aims to provide users of the REPID information platform with sufficient information about the data management. Data management includes data administration, standards for defining data and the way in which people perceive and use data. The manual includes information about how to interpret the result of EPI calculations and review the result through a better knowledge about the documentation procedure of the information platform etc. The manual is intended for users of REPID results and contains explanations of the content in the REPID environmental database.

Definition of REPID Environmental Performance Indicators (EPIs)
A set of EPIs has been defined according to a specified format. These definitions include description on how the calculations are performed, inputs and outputs required as well as descriptive function text of each indicator.

Material property specifications in the REPID database
Calculations of many of the EPIs depend on material properties. To gather material data for these properties the properties needs to be explicitly defined. The definitions can be found in this document, documented according to the documentation format described in the manual on data management for REPID information system.

Development method of the REPID Material list
The development of the REPID Material list is here described including groups and choice of material names in the list. The current material list, agreed on within the project is also presented.

Basic training programme for EPI methodology
The development of the REPID EPIs is here described including relation to the policy, economical aspects, baseline and interpretation and use about the result of EPI calculations.

Methodical management of handle data gaps
This report treats different methods that are used scientifically for handling data sets where data or information is missing and an artificial value has to be imputed. The results will be used to decide on the method to use when information gaps occur during compilation of environmental data for the REPID database.