

NODES

D3.6.2. The development of a energy efficiency and environment good practice and transfer tool

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EUROPEAN COMMISSION

DG RESEARCH AND INNOVATION

NODES 'New tOols for Design and OpEratiOn of Urban Transport InterchangeS'

SMALL OR MEDIUM-SCALE FOCUSED RESEARCH PROJECT

GRANT AGREEMENT N. 314618

Table of Contents

Executive Summary	4
1. Introduction.....	5
2. E & E Benchmark tool	6
2.1 Self - assessment.....	6
2.2 Performance Indicators	9
3. Tools in Energy & Environment	23
3.1 List of tools in Energy Environment	23
3.2 Example of an general assessment tool.....	29
4. Conclusions	35
5. Used resources and publications	36

Executive Summary

The second deliverable of Work Package (WP) 3 task 3.6 on “The development of an energy efficiency and environment good practice and transfer tool” provides local interchange stakeholders (e.g. city administrations or public transport companies) with a handbook that will allow them to benchmark performance and identify the relevant tools including best practices in the field of Energy and Environment. This paper builds on the previous deliverable (D3.6.1) which gave a “Dedicated assessment of the Energy and Environment (E&E) of interchange design”

The deliverable includes a benchmark tool for a first self assessment and gives a list of tools which can be used from interchange stakeholders.

The benchmark tool gives an overview about the topic and aims at helping the interchange stakeholders to assess which tools in this topic are relevant for their specific case. The benchmark tool is based on the Key Performance Indicators which were identified in D3.6.1.

The list of tools provides solutions and offer good practice references. In this topic there are some general assessment tools. That’s why the Susstation tool is shown as an example.

These tools will be tested by the application sites in the frame of Work Package 4. Following the testing and evaluation phase, the tolls will be improved. The final set of tools will be contained in a toolbox, which through the project will become a European reference for interchange design.

1. Introduction

For an optimal energy balance it is necessary to use environmentally friendly and energy efficient focused design, materials and management practices. There are numerous techniques available. An energy and environment benchmark guide adapted to interchanges will allow each interchange manager / promoter to not only directly improve its own environmental performance, but also choose from a set of European good practices, that can be transferred to its own particular situation.

The second deliverable of WP3 task 3.6 “The development of an energy efficiency and environment good practice and transfer tool” provides interchange promoters and managers with a handbook that will allow to benchmark performance and identify the tools including best practices of improvement in terms of energy and environmental operations.

This paper builds on the previous deliverable (D3.6.1) which generates an overview and a better understanding on the theme “Energy and Environment”. This cross topic theme is linked to the other four topics:

- Topic 1: Integrated land use and infrastructure planning
- Topic 2: Interchange design “Connecting people to places”
- Topic 3: Intermodality and ICT
- Topic 4: Management and business models/ business case for the local economy

This deliverable has two main parts.

The first part deals with the benchmark tool. This tool together with the list of performance indicators that were identified, allow a comprehensive assessment of an interchange. They are divided into three subtopics that were developed in D3.6.1. Building on this “Energy and Environment” self-assessment, the objective is to guide interchange stakeholders. They should not only identify areas for improvement in interchanges that are in operation. This tool should also be used for reconstructing an interchange or for the planning of a new interchange.

In the second part, a list of tools provides solutions. Some of these tools will be tested by the demonstration sites of Work Package 4. Following the testing, the final set of tools will be contained in a toolbox.

The NODES Toolbox for innovative interchange design and operation will allow every interchange promoter to create a more efficient, effective and inclusive urban transport system, bringing together all elements of a clean, energy-efficient, safe and intelligent transport.

2. E & E Benchmark tool

The development of an energy efficiency and environment good practice and transfer tool enables local interchange stakeholders to assess the **current level of performance** of an interchange through different criteria and indicators.

As a first step, **areas of improvement** are identified. The relevant tools that are listed next to each area of assessment aim at providing solutions to improve performance. The tools are listed in more detail in chapter 3. The aim is to help stakeholders in matching the requirements with the relevant tools. It should be noted that the tools often deal with more aspects because of the interrelation of this topic with the other NODES topics. That's why a general assessment tool is further explained in chapter 3. In the second part of this chapter, the **Key Performance Indicators** are linked to the tools presented in chapter 3.

2.1 Self - assessment

Energy and Environment (T.3.6)

Fill in the form with the requested data and cross the appropriate boxes

Energy & Environment: Data Input.

Energy Management during construction / operation		<i>Relevant tool: 1, 2, 3, 5, 6</i>
Usage of Energy measurement Methods		
<input checked="" type="checkbox"/>	More than 2	
<input type="checkbox"/>	At least 1	
<input type="checkbox"/>	None: Non existent	
Usage of renewable energy		
x <input checked="" type="checkbox"/>	More than 50%	
<input type="checkbox"/>	between 20 and 50 %	
<input type="checkbox"/>	less than 20 %	

Water & Waste Management		<i>Relevant tool: 4, 7, 10</i>
Recovery rate of water	Percentage of total energy	
Recovery rate of waste	Percentage of total energy	
Combustible renewables and waste	Percentage of total energy	
Alternative models. The inclusion of alternatives modes, such as car sharing, car pooling or assistance to soft modes such as bicycle rentals, etc. - <i>Relevant tool: 11</i>		
Describe the model		
X		More than 1
		At least 1
		None: Non existent
Climate Change		<i>Relevant tool: 1, 9, 11</i>
Electrification of transport modes. The inclusion of electrification transport including grid connected vehicles.		
Describe the model		
X		More than 1
		At least 1
		None: Non existent
Emissions of transport modes.		
Describe the model		
X		less than xx g/C"2
		Between xx and xx g/ CO2
		more than xx g/C"2
Emissions from build structure		
Describe the model		

x		<i>less than xx g/CO₂</i>
		<i>Between xx and xx g/ CO₂</i>
		<i>more than xx g/CO₂</i>
Environmental friendliness. The combination of different types of environmental friendly materials designs and practices.		

Describe the model		
x		<i>High E&E level</i>
		<i>Medium E&E level</i>
		<i>Low E&E level</i>

Usage of renewable materials

Describe the model		
x		<i>More than xx%</i>
		<i>between xx and xx %</i>
		<i>less than xx %</i>

Noise level *Relevant tool: 8*

Describe the model		
x		<i>High level (more than xx)</i>
		<i>Medium</i>
		<i>Low</i>

Future Value *Relevant tool: 11, 12, 13, 14*

Describe the model		
		<i>Provision of future use</i>
		<i>Provision of adaptation</i>
		<i>none</i>

2.2 Performance Indicators

The indicators are divided into the **seven subtopics** that have been defined in the first deliverable D3.6.1; their aim is to offer a better understanding of the theme. These subtopics are:

1. Energy Management
2. Water and Waste Management
3. Climate Change
4. Renewable Energy Use
5. Materials (renewable, recycled)/ Resources
6. Biodiversity/Ecosystems
7. Noise

Again, each indicator is linked to the relevant tools that can be found in the detailed list of chapter 3. These indicators have been selected by the NODES project consortium.

Energy management

Performance indicator name	Final energy consumption (FEC) per fuel type (electricity, natural gas, etc.) during operation/construction
Performance indicator definition	TOE consumed
Measurement unit	TOE (tons of oil equivalent), kWh
Method of measurement	Direct Measurement
Frequency of measurement	daily, monthly, yearly
Target group for measurement	Interchange operators
Domain for measurement	Interchange area
Relevant tool	4, 5, 6, 11, 14

Performance indicator name	Total/final energy/electricity use per passenger
Performance indicator definition	TOE consumed
Measurement unit	TOE (tons of oil equivalent) /passenger
Method of measurement	Direct Measurement
Frequency of measurement	monthly, yearly
Target group for measurement	Interchange operators
Domain for measurement	Interchange area
Relevant tool	11

Performance indicator name	Electricity consumption during construction/operation
Performance indicator definition	TOE or kWh consumed
Measurement unit	TOE or kWh
Method of measurement	Direct Measurement
Frequency of measurement	monthly, yearly
Target group for measurement	Interchange operators
Domain for measurement	Interchange area
Relevant tool	4, 5, 6, 11, 14

Performance indicator name	Energy efficiency during construction/operation
Performance indicator definition	
Measurement unit	Percentage
Method of measurement	Direct Measurement
Frequency of measurement	Once/ monthly, yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	4, 5, 6, 11, 14

Water & waste management

Performance indicator name	Recovery rate of water during construction/operation
Performance indicator definition	Measurement of reused water
Measurement unit	Percentage of water reused
Method of measurement	Direct Measurement
Frequency of measurement	Once/ monthly, yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	7, 12

Performance indicator name	Recovery rate of waste during construction/operation
Performance indicator definition	Measurement of reused materials
Measurement unit	Percentage of materials reused
Method of measurement	Direct Measurement
Frequency of measurement	Once/ monthly, yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	7

Performance indicator name	Waste impacts
Performance indicator definition	Waste accumulated
Measurement unit	Kg/kWh
Method of measurement	Direct Measurement
Frequency of measurement	monthly, yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	7, 11

Performance indicator name	Waste production during construction/operation
Performance indicator definition	Waste accumulated
Measurement unit	Kg
Method of measurement	Direct Measurement
Frequency of measurement	Daily, monthly, yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	7, 11

Performance indicator name	Combustible renewables and waste
Performance indicator definition	Combustible renewables accumulated
Measurement unit	Percentage of total energy
Method of measurement	Direct Measurement
Frequency of measurement	monthly, yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	7, 11

Performance indicator name	Sustainable drainage scheme
Performance indicator definition	
Measurement unit	Existent of Sustainable drainage scheme
Method of measurement	Survey
Frequency of measurement	Once
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	10

Climate Change

Performance indicator name	Emissions from transport modes
Performance indicator definition	Measurement of transport mode emissions
Measurement unit	Tonnes CO ₂ , NO _x , Sox, ...
Method of measurement	Direct Measurement
Frequency of measurement	yearly
Target group for measurement	Local Authorities
Domain for measurement	Interchange area
Relevant tool	9, 11

Performance indicator name	CO2/GHG emissions from build structure
Performance indicator definition	Measurement of build structure emissions
Measurement unit	Tonnes CO ₂ /GHG
Method of measurement	Direct Measurement
Frequency of measurement	yearly
Target group for measurement	Local Authorities
Domain for measurement	Interchange area
Relevant tool	1, 2, 3, 5, 11

Performance indicator name	CO2/GHG emissions from interchange operation
Performance indicator definition	Measurement of interchange operation emissions
Measurement unit	Tonnes CO ₂ /GHG
Method of measurement	Direct Measurement
Frequency of measurement	monthly, yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	1, 2, 3, 5, 11

Performance indicator name	CO2/GHG emissions from waste management
Performance indicator definition	Measurement of waste management emissions
Measurement unit	Tonnes CO ₂ /GHG
Method of measurement	Direct Measurement
Frequency of measurement	monthly, yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	7,11

Performance indicator name	Carbon content of energy consumption
Performance indicator definition	Measurement of carbon content
Measurement unit	g CO ₂ /TOE
Method of measurement	Direct Measurement
Frequency of measurement	yearly
Target group for measurement	Local Authorities
Domain for measurement	Interchange area
Relevant tool	9

Performance indicator name	Carbon dioxide emissions damage
Performance indicator definition	Measurement of carbon dioxide emissions
Measurement unit	Total EUR per year
Method of measurement	Direct Measurement
Frequency of measurement	yearly
Target group for measurement	Local Authorities
Domain for measurement	Interchange area
Relevant tool	12

Renewable energy use

Performance indicator name	Renewable energy consumption
Performance indicator definition	Percentage of renewable energy consumption
Measurement unit	TOE or percentage
Method of measurement	Direct Measurement
Frequency of measurement	yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	2,3,11,12,14

Performance indicator name	Share of renewables in final energy consumption
Performance indicator definition	Percentage of renewable energy in final energy consumption
Measurement unit	Percentage
Method of measurement	Direct Measurement
Frequency of measurement	yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	2,3,11,12,14

Performance indicator name	Local production of renewable energy
Performance indicator definition	Measurement of local renewable energy consumption
Measurement unit	kWh
Method of measurement	Direct Measurement
Frequency of measurement	yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	12

Performance indicator name	Alternative fuel use
Performance indicator definition	Measurement of alternative fuel use
Measurement unit	Cubic metre biofuel, hydrogen, natural gas per year
Method of measurement	Direct Measurement
Frequency of measurement	yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	11

Performance indicator name	Smart grid operation and control
Performance indicator definition	Existence of Smart grid operation and control
Measurement unit	Existence of synergies measurements
Method of measurement	Survey
Frequency of measurement	Once
Target group for measurement	Interchange operators
Domain for measurement	Interchange area
Relevant tool	14

Materials (renewable, recycled)/ Resources

Performance indicator name	Level of use of durable/ renewable material
Performance indicator definition	Renewable material accumulated
Measurement unit	Percentage
Method of measurement	Direct Measurement
Frequency of measurement	yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	7,11

Performance indicator name	Minimise effects of resource depletion
Performance indicator definition	
Measurement unit	Measure by inquiry/survey
Method of measurement	Survey
Frequency of measurement	yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	11, 12

Performance indicator name	Usage of low or zero carbon technologies for energy supply
Performance indicator definition	low or zero carbon technologies used
Measurement unit	Measure by inquiry/survey
Method of measurement	Survey
Frequency of measurement	yearly
Target group for measurement	Interchange operators
Domain for measurement	Interchange area
Relevant tool	1, 3, 6, 13

Performance indicator name	Reduce impact of material usage
Performance indicator definition	Material usage accumulated
Measurement unit	Measure by inquiry/survey
Method of measurement	Survey
Frequency of measurement	yearly
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	7,11

Biodiversity/ Ecosystem

Performance indicator name	Land use impacts from normal operation
Performance indicator definition	Measurement of damaged Fraction
Measurement unit	Potentially Damaged Fraction (PDF)=*m2*a/kWh
Method of measurement	Direct Measurement
Frequency of measurement	yearly
Target group for measurement	Local Authorities
Domain for measurement	Interchange area
Relevant tool	11, 14

Performance indicator name	Ecological enhancement measures
Performance indicator definition	
Measurement unit	Measure by inquiry/survey
Method of measurement	Survey
Frequency of measurement	Once
Target group for measurement	Interchange operators/ Local Authorities
Domain for measurement	Interchange area
Relevant tool	11, 12

Performance indicator name	Urban biodiversity
Performance indicator definition	Biodiversity observed
Measurement unit	Number of threatened/protected species (classification)
Method of measurement	Direct Observation
Frequency of measurement	Once
Target group for measurement	Local Authorities
Domain for measurement	Interchange area
Relevant tool	11, 12

Performance indicator name	Biodiversity enhancement measures
Performance indicator definition	
Measurement unit	Measure by inquiry/survey
Method of measurement	Survey
Frequency of measurement	Once
Target group for measurement	Local Authorities
Domain for measurement	Interchange area
Relevant tool	11, 12

Noise

Performance indicator name	Noise level
Performance indicator definition	Measurement of noise level
Measurement unit	Number of DB (A)/ formulas ISO
Method of measurement	Direct Measurement
Frequency of measurement	monthly, yearly
Target group for measurement	Local Authorities
Domain for measurement	Interchange area
Relevant tool	8

3. Tools in Energy & Environment

3.1 List of tools in Energy Environment

The list of tools in task 3.6 “Energy and Environment” which will support operators / managers of interchanges has been developed thanks to the input of task 3.6 participants and the feedback received from the User Group. The list includes **14** different tools in **six** categories. The range of these tools varies from specific tools for one topic (e.g. noise) to general assessment tools (e.g. Susstation or ESD GUIDE).

The tools were split into the following categories.

- Energy management.
- Water & Waste management.
- Noise.
- Climate Change.
- Biodiversity/Ecosystems.
- General assessment tools.

Using the results of the demonstrations (which will be done in WP4) and the evaluation (WP5), the tools will be updated in order to be included in the final NODES Toolbox. The tools aim at helping stakeholders to improve their interchange performance, based on the evaluation through the benchmark tool. Due to the fact that “Energy and Environment” is a cross topic issue, it is most likely that stakeholders will not use these tools alone but will combine them with the “business planning” tools for example.

In order to better understand each tool, they are grouped according to ‘tool type’. The following seven types have been identified:

Tool type:

C: Cultural/ social approach

L: Legislative/ regulatory

F: Economic/ financial

O: Organisational

T: Technical (software, technology)

M: Methodological (Method, Strategy, planning)

N: New materials

The list of tools relating to the “Energy and Environment” topic are the following:

N°	Tool title	Type	Tool description – Tool category	Reference / Good practice
1	ESD guide	L/M	Useful overall guide to environmentally sustainable building design . Covers a range of issues including minimising transport impact. This isn't the same as delivery a high quality interchange and tends to view transport as a problem to be solved. Examples listed but don't include a specific transport interchange application. However good background and well worth reading in more depth. Category: Energy Management	http://www.environment.gov.au/resource/esd-design-guide-office-and-public-buildings
2	BREEAM	M	BREEAM (Building Research Establishment Environmental Assessment Method) is designed to assess the environmental performance of any type of building, both new and existing. The assessment methods offered by BRE are in a constant state of evolution in order to respond to the changing priorities of developers. Category: Energy Management	http://www.breeam.org/
3	Building Management System	T	A Building Management System is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems. Category: Energy Management	http://www.johnsoncontrols.com/content/us/en/products/building_efficiency/products-and-systems/building_management.html

N°	Tool title	Type	Tool description – Tool category	Reference/ Good practice
4	Sustainable Building (SB)	M	<p>Developed in an INTERREG IVB NEW project</p> <p>SBTOOL (Sustainable Building Tool) allows to directly compare the results of different national assessment schemes and is usable outside the design, control and occupation phases. It was devised under the framework of the International Green Building Challenge, which saw the participation of international organisations and institutions with the greatest expertise in this field.</p> <p>The tool allows inclusion of energy analysis, but also evaluation of the wider social and environmental aspects (e.g. materials, construction techniques, comfort for occupants etc). The methodology can be applied to any type of building. It considers the entire lifespan of the building (design, construction, occupancy and demolition) and can be applied irrespective of the geographical and regulatory context, no matter what the local construction practices are. Furthermore it forces the assessor to consider the national or regional context in which the building will exist. It is more complex than some other tools, but allows future use of the building to be taken into consideration.</p> <p>Category: Energy Management</p>	http://www.programme-regain.eu/-Methodology-Introduction-
5	eQUEST	T	<p>eQUEST is a sophisticated, yet easy- to- use building energy use analysis tool which provides professional-level results with an affordable level of effort. It was designed to perform detailed analysis of today's state-of-the-art building design technologies using today's most sophisticated building energy use simulation techniques but without requiring extensive experience in the "art" of building performance modeling. This is accomplished by combining a building creation wizard, an energy efficiency measure (EEM) wizard and a graphical results display module with an enhanced DOE-2-derived building energy use simulation program.</p> <p>Category: Energy Management</p>	http://energydesignresources.com/resources/software-tools/equest.aspx

N°	Tool title	Type	Tool description – Tool category	Reference/ Good practice
6	IT-Toolkit	T	<p>The IT-Toolkit for Energy Efficient Retrofit Measures out of IEA Annex 46 is a collection of computer tools for public buildings. The toolkit supports owners and planners of public buildings at the following tasks: identification of buildings with too high energy uses, energy efficient operation of buildings, detailed inventory and building documentation, ideas for energy efficient refurbishments, development of an energy efficient retrofit concept based on DIN V 18599 (compatible to EPBD CEN standards) and economical evaluation of energy performance contracts.</p> <p>Category: Energy Management</p>	<p>http://www.annex46.de/tool_e.html</p>
7	Waste Management plan	M	<p>The Waste Management plan includes:</p> <ul style="list-style-type: none"> • Identification of the types and quantities of waste that would be generated during operations, and the areas in which waste will be stored prior to removal; • standards and performance measures for dealing with this waste; • a detailed description of how this waste would be reused, recycled and, if necessary, appropriately treated and disposed of in accordance with the EPA's guidelines on the Assessment, Classification and Management of Liquid and Non-Liquid Waste; • a description of how the effectiveness of these actions and measures would be monitored over time; and a description of what procedures would be followed to ensure compliance if any non-compliance is detected. <p>Category: Waste Management</p>	<p>http://www.redox.com/Content/pdf/MintoWasteManagementPlan.pdf</p>

N°	Tool title	Type	Tool description – Tool category	Reference/ Good practice
8	Environmental noise control	L/T	<p>Noise control activities include:</p> <ul style="list-style-type: none"> legislating noise emission; limits on equipment sold and used in our communities, influencing; the location and the construction techniques of new highways and buildings, legislating noise emission limits at property boundaries and regulating aircraft flight procedures. <p>Category: noise</p>	http://cafefoundation.org/v2/pdf_tech/Noise.Technologies/PAV.Envirion.Noise.B&K.pdf
9	Measuring air quality	L/T	<p>There are four main methods of measuring air pollution: Passive sampling methods, Active sampling methods, Automatic methods, Remote optical / long path-analysers.</p> <p>Category: Climate Change</p>	http://www.enviropedia.org.uk/Air_Quality/Measuring.php
10	Sustainable Drainage System (SuDs)	L/M	<p>Sustainable Drainage techniques have been developed to collect, store and clean runoff before their release to the environment.</p> <p>Category: Biodiversity/Ecosystems</p>	http://web.sbe.hw.ac.uk/staffprofiles/bdqs/a/11th_International_Conference_on_Urban_Drainage_CD/ICUD08/pdfs/753.pdf
11	SUSSTATION Assessment Tool	T/M	<p>The SUSSTATION Assessment Tool is a web-based software tool to measure how sustainable an existing station or a station design is. It helps the owner or architect to make choices when designing, constructing and maintaining stations by steering on the basis of sustainability ambitions. It can also be used in the communication with other stakeholders, such as cities and regions.</p> <p>Category: General Assessment tool</p>	http://www1.deutschebahn.com/ecm2-susstation/start/projects/assessment_tool.htm
12	Sustainability Life Cycle Assessment (SLCA)	M	<p>SLCA can be described as an assessment tool and an accompanying process that gives you a strategic overview of the full scope of social and ecological sustainability at the product level</p> <p>Category: General Assessment tool</p>	http://www.naturalstep.org/en/sustainability-life-cycle-assessment-slca

N°	Tool title	Type	Tool description – Tool category	Reference/ Good practice
13	CEEQUAL	M	<p>CEEQUAL (Civil Engineering, Environmental Quality Assessment and Award Scheme) aims to encourage improved sustainable practices within engineering and public realm projects. The framework is appropriate for the assessment of roads, railways, airports, power stations and retail parks.</p> <p>Category: General Assessment tool</p>	http://www.ceequal.com/
14	RETScreen Software Suite	T	<p>The RETScreen Software Suite is a unique decision support tool developed with the contribution of numerous experts from government, industry, and academia. The software can be used worldwide to evaluate the energy production and savings, costs, emission reductions, financial viability and risk for various types of Renewable-energy and Energy-efficient Technologies (RETs).</p> <p>Category: General Assessment tool</p>	http://www.retscreen.net/ang/software_and_data.php

3.2 Example of an general assessment tool: Susstation assessment tool

An excellent example for the development of an energy efficiency and environment good practice and transfer tool, is the “SusStation Assessment Tool”. It was developed from an EU Interreg project with different partners like for example “Deutsche Bahn”. Moreover it was tested on several interchanges in Europe.¹

The tool itself gives a wide overview. It collects a lot of data and calculates the environmental friendliness of an interchange. The tool is divided in different layers: first there is a general layer and then it is necessary to fill out specific data for “Energy”, “Environment”, “Health”, “Quality of Use” and “Future Value”.²

Demo NODES » Osnabrück - bus station Neumarkt » current situation
Sustainable Station Version 4.0

Input

General characteristics

Project Information i ✎

Name of station	Osnabrück - bus station Neumarkt
Variant 1 name	current situation
Variant 2 name	new development
Location	Osnabrück
Construction year	0

Type of project i ✎

Specification	In-Use ▼
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Station characteristics

Floor area [m2 gross floor area]: current situation i ✎

forecourt and rear	5	5%
concourse	5	5%
(commercial) areas occupied by personnel	10	10%
transfer and circulation routes	20	20%
platforms	60	60%
Total	100	100%

Boarding, alighting + transferring passengers per day: current situation i ✎

Status	Forecast ▼
Year	2013
Number of people per day	60000

Floor area [m2 gross floor area]: new development i ✎

forecourt and rear	5	5%
concourse	5	5%
(commercial) areas occupied by personnel	10	10%
transfer and circulation routes	20	20%
platforms	60	60%
Total	100	100%

Boarding, alighting + transferring passengers per day: new development i ✎

Status	Forecast ▼
Year	2016
Number of people per day	70000

¹ Deutsche Bahn AG, SusStation, <http://www1.deutschebahn.com/ecm2-susstation/start/projects/>

² Deutsche Bahn AG, SusStation, http://www1.deutschebahn.com/ecm2-susstation/start/projects/assessment_tool.html

Demo NODES » Osnabrück - bus station Neumarkt » current situation
Sustainable Station Version 4.0

		Variant 1	1000	Variant 2	1000																				
1 Energy		6.2	1000	6.2	1000																				
1.1 Energy consumption		0.0	0	0.0	0																				
1.1.0 Start value, standard = 6.0		0	0	0	0																				
1.1.1 Energy consumption measured per visitor (i) (edit)																									
Are energy consumption figures available? (i) (edit)																									
<div style="display: flex; justify-content: space-between; align-items: center;"> Electricity consumption last year data unknown </div>																									
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1.1.2 Bonus or points deducted	<div style="display: flex; justify-content: space-between; align-items: center;"> none none </div>	0	0	0	0																				
1.2 Sustainable energy		6.0	200	6.0	200																				
1.3 Electricity consumption lighting and boarding points		6.6	600	6.6	600																				
1.4 Heating and Cooling		5.2	200	5.2	200																				

Demo NODES » Osnabruck - bus station Neumarkt » current situation		Sustainable Station Version 4.0					
2 Environment		Variant 1		Variant 2			
		6.0	1000	6.2	1000		
2.1 Water		6.0	200	6.0	200		
2.1.0 Start value, standard = 6.0		120	120	120	120		
2.1.1 Water saving aids							
<input type="checkbox"/>	Water-saving toilet systems	6 litres	6 litres	0	14	0	14
<input type="checkbox"/>	% urinals for men and flushing activation	> 50%, or sensors	> 50%, or sensors	0	4	0	4
<input type="checkbox"/>	water saving taps	with volume limiters	with volume limiters	0	3	0	3
<input type="checkbox"/>	prevent water losses from leaks	no facilities	no facilities	0	1	0	1
<input type="checkbox"/>	% rainwater, used usefully	0%	0%	0	5	0	5
2.1.2 Water management							
<input type="checkbox"/>	% roof, with green roof system	0%	0%	0	16	0	16
<input type="checkbox"/>	% roof, drainage via infiltration	0%	0%	0	16	0	16
<input type="checkbox"/>	type of drainage system	mixed	mixed	0	8	0	8
<input type="checkbox"/>	% paving that is porous	0 - 25%	0 - 25%	0	8	0	8
<input type="checkbox"/>	% parking spots with oil and sludge drainage	0%	0%	0	4	0	4
2.1.3 Bonus or points deducted		none	none	0	20	0	20
2.2 Environmental management		6.1	300	6.0	300		
2.3 Materials		6.0	500	6.4	500		

Demo NODES » Osnabruck - bus station Neumarkt » current situation		Sustainable Station Version 4.0			
		Variant 1		Variant 2	
3	Health	6.2	1000	6.2	1000
3.1	Noise	5.9	300	6.0	300
3.1.0	Start value, standard = 6.0	180	180	180	180
3.1.1	Concourse				
<input type="checkbox"/>	background noise level	acceptable	5	acceptable	5
<input type="checkbox"/>	reverberation time	acceptable	2	acceptable	2
3.1.2	(Commercial) areas with personnel				
<input checked="" type="checkbox"/>	background noise level	low	12	acceptable	12
<input type="checkbox"/>	reverberation time	acceptable	4	acceptable	4
3.1.3	Platforms (including transfer and circulation routes)				
<input type="checkbox"/>	through goods trains	incidental	31	incidental	31
<input type="checkbox"/>	through passenger trains	occasional	18	occasional	18
<input checked="" type="checkbox"/>	canopy	partial canopy over p	31	partial canopy over p	31
<input checked="" type="checkbox"/>	other noise sources	continuous + limited	12	incidental	12
<input checked="" type="checkbox"/>	noise reduction measures	no measures	6	no measures	6
3.1.4	Bonus or points deducted	none	30	none	30
3.2	Air quality	6.0	100	6.0	100
3.3	Thermal comfort	6.1	400	6.1	400
3.4	Light and visual comfort	6.8	200	6.8	200

Demo NODES » Osnabrück - bus station Neumarkt » current situation		Sustainable Station Version 4.0				
4 Quality of Use		Variant 1	1000	Variant 2	1000	
		6.2		6.0		
4.1 Accessibility		6.2	300	6.0	300	
4.1.0 Start value, standard = 6.0		180	180	180	180	
4.1.1 Accessibility of station area						
<input checked="" type="checkbox"/> pedestrians	satisfactory	satisfactory	0	7	0	7
<input checked="" type="checkbox"/> bicycles, motorbikes and scooters	satisfactory	satisfactory	0	10	0	10
<input checked="" type="checkbox"/> public transport other than train	good	satisfactory	5	10	0	10
<input checked="" type="checkbox"/> car	poor	satisfactory	-2	3	0	3
<input checked="" type="checkbox"/> taxi	satisfactory	satisfactory	0	3	0	3
4.1.2 Access to the station						
<input checked="" type="checkbox"/> bicycles, motorbikes and scooters	satisfactory	satisfactory	0	6	0	6
<input checked="" type="checkbox"/> public transport other than train	good	satisfactory	5	9	0	9
<input checked="" type="checkbox"/> car	poor	satisfactory	-2	3	0	3
<input checked="" type="checkbox"/> taxi	satisfactory	satisfactory	0	3	0	3
4.1.3 Accessibility of station for people without restricted mobility						
<input type="checkbox"/> forecourt and rear	satisfactory	satisfactory	0	2	0	2
<input type="checkbox"/> concourse	satisfactory	satisfactory	0	6	0	6
<input checked="" type="checkbox"/> (commercial) areas occupied by personnel	satisfactory	satisfactory	0	2	0	2
<input checked="" type="checkbox"/> transfer and circulation routes	satisfactory	satisfactory	0	6	0	6
<input checked="" type="checkbox"/> platforms	satisfactory	satisfactory	0	6	0	6
4.1.4 Accessibility of station for people with restricted mobility						
<input type="checkbox"/> forecourt and rear	satisfactory	satisfactory	0	2	0	2
<input type="checkbox"/> concourse	satisfactory	satisfactory	0	6	0	6
<input checked="" type="checkbox"/> (commercial) areas occupied by personnel	satisfactory	satisfactory	0	2	0	2
<input checked="" type="checkbox"/> transfer and circulation routes	satisfactory	satisfactory	0	6	0	6
4.2 Functionality		5.8	300	6.0	300	
4.3 Social safety		6.4	400	6.0	400	

Demo NODES » Osnabrück - bus station Neumarkt » current situation		Sustainable Station - Version 4.0					
5 Future value		Variant 1		Variant 2			
		5.9	1000	7.4	1000		
5.1	For the Future	6.3	200	10.0	200		
5.1.0	Start value, standard = 6.0	120	120	120	120		
5.1.1	Provision for future use						
<input checked="" type="checkbox"/>	stricter energy/CO2 requirements	limited	large	0	15	15	15
<input checked="" type="checkbox"/>	increase in number of people with restricted mobility	limited	large	0	10	10	10
<input checked="" type="checkbox"/>	increasing requirement for quality	limited	large	0	5	5	5
5.1.2	Provision for adaptation						
<input checked="" type="checkbox"/>	focused on extending the station	limited	large scale	3	6	6	6
<input checked="" type="checkbox"/>	aimed at new technology	limited	large scale	3	6	6	6
<input type="checkbox"/>	aimed at sustainable demolition	none	none	0	3	0	3
5.1.3	Efficiency of intermodal connection						
<input checked="" type="checkbox"/>	diversity of public transport to and from station	1 extra option	> 3 extra options	0	6	6	6
<input checked="" type="checkbox"/>	diversity of public transport	satisfactory	high quality	0	3	3	3
<input checked="" type="checkbox"/>	location in relation to potential users	standard surrounding	very intensive surrou	0	15	15	15
<input checked="" type="checkbox"/>	coordinates with other user functions	satisfactory	high quality	0	6	6	6
5.1.4	Promotion of sustainable behaviour						
<input checked="" type="checkbox"/>	use of educational means	no use	much use	0	7	7	7
5.1.5	Bonus or points deducted	none	none	0	20	0	20
5.2	Flexibility	6.0	400	7.2	400		
5.3	Amenity value	5.6	400	6.4	400		

This tool contains almost all KPIs that were identified in NODES for what concerns the “Energy and Environment” topic. We can learn how the different fields “Energy”, “Environment”, “Health”, “Quality of Use” and “Future Value” interrelate with each other. In addition it shows how difficult this topic is. It needs a lot of efforts to obtain data for all the indicators which are needed to fill out this tool. However, it is possible to use only some parts of this tool to improve an interchange in terms of energy and environmental design.

The Susstation tool will be tested in two NODES application sites (Osnabrück and Reading). The results will be shared with the consortium of the former EU Interreg project. This project already has send an questionnaire and the NODES application sides have a test account to use the tool.

4. Conclusions

This deliverable provides a deeper understanding of the topic Energy & Environment following the first deliverable of the NODES project. Through its development, it has shown the interrelated character of this topic with the other NODES topics, in particular for what concerns the general assessment tools.

It also sets the basis for the tools testing by the NODES reference sites as it demonstrates the links between the benchmark tool and the specific tools. The list of tools provides solutions for achieving optimised conditions for both the stakeholders and the end-users.

The combination of the work that has been performed so far in relation to this NODES topic aims to offer a comprehensive overview and guidance to offer solutions for an improved environmental usage of interchanges.

5. Used resources and publications

Australian Government, Dept. of the Environment and Water Resources (2007), ESD Design Guide – Office and Public Buildings, Edition 3.

Deutsche Bahn AG, SusStation, <http://www1.deutschebahn.com/ecm2-susstation/start/projects/>

Deutsche Bahn AG, SusStation, http://www1.deutschebahn.com/ecm2-susstation/start/projects/assessment_tool.html