SOUTH EAST EUROPE
Transnational Cooperation Programme

seta
South East Transport Axis

European Union

EVALUATION OF SETA MEASURES

(WP 5.3)

MARCH 31ST, 2014

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Vienna

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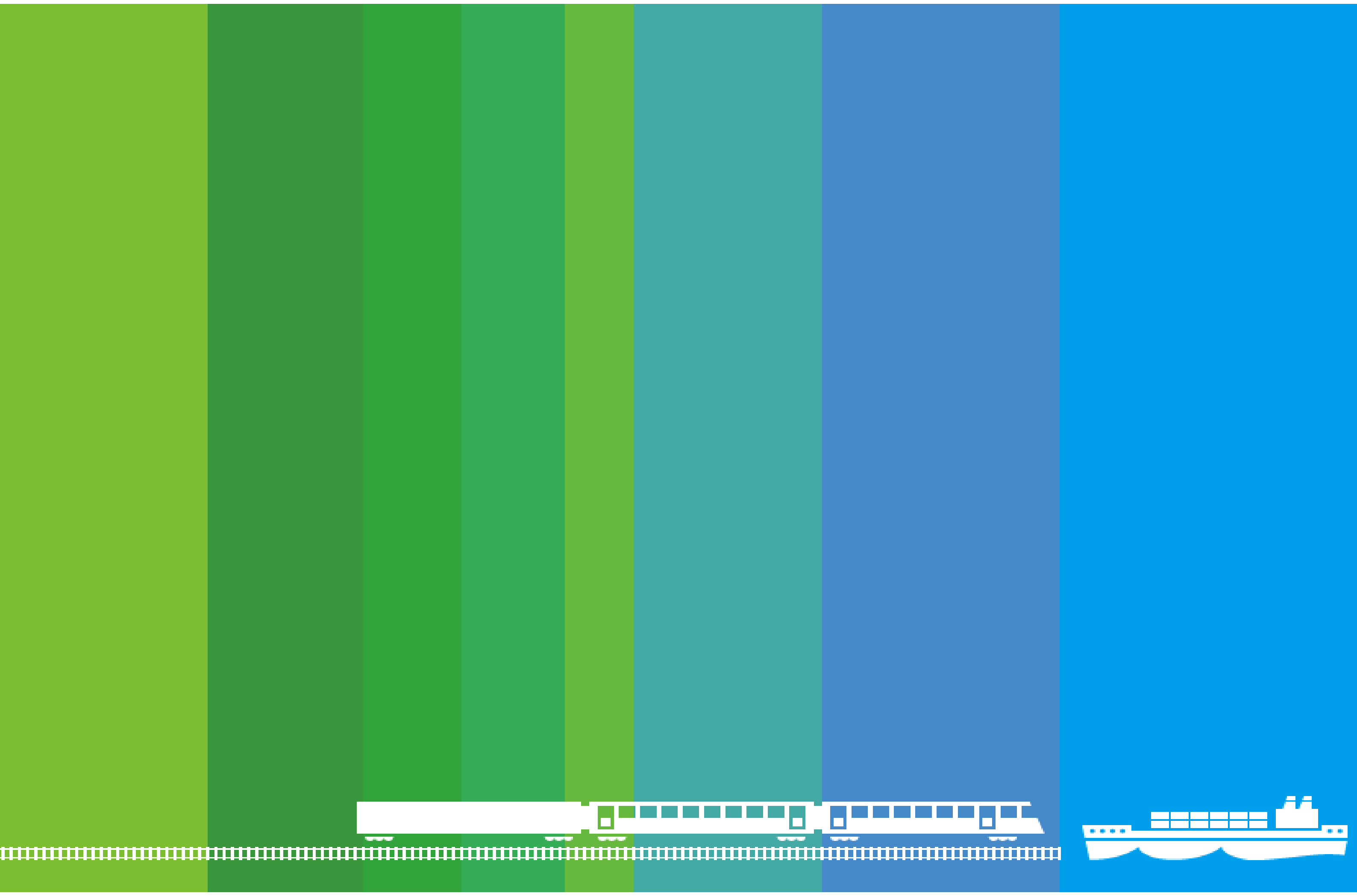

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1 Introduction (IHS)

Infrastructure projects lie at the centre of almost every development strategy. Both their installation costs and their effects on well-being in the regions involved can span over decades. What impacts is the South European Transport Axis (SETA) project expected to have on economic growth, employment, society and the environment? How does improved accessibility affect the investing regions? Do the potential benefits justify the financial investments in the project? These are the questions we intend to answer in the following chapters.

Following the EU 2020 cohesion policy of investment in smart, sustainable and inclusive growth, the proposed measures in the SETA project were designed with the goals of identifying bottlenecks in rail transport and providing efficient solutions towards a green transport future in the SETA region. This study aims to provide a broad insight into the socio-economic effects of SETA measures on a range of levels from the regional impacts of reductions in air pollutants to employment effects and impacts on European GDP.

In order to be able to tackle these questions adequately, crucial data input was required from the project partners, an aspect which is explained in more detail in Chapter 3.

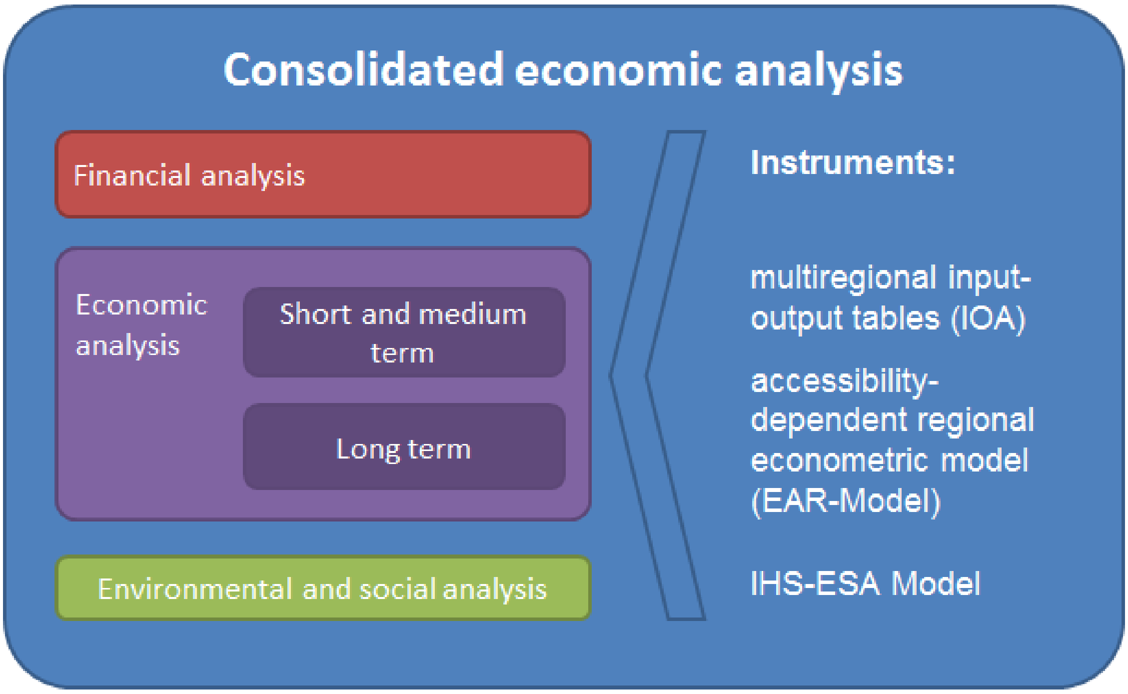
This report is organised as follows:

First, a methodological introduction to the chosen evaluation approach is given (Chapter 2) and is followed by a description of inputs derived from previous Work Packages (Chapter 3). The subsequent chapters contain the Financial Analysis (Chapter 4), the estimation of Economic Effects (Chapters 5 and 6) and the Environmental and Socio-Economic Evaluation (Chapter 7). The results obtained are then aggregated in the central element of this evaluation study, the Consolidated Economic Analysis (Chapter 8), which also offers some conclusions on the viability of different SETA scenarios.

2 Consolidated Economic Analysis (IHS)

The Institute for Advanced Studies' (IHS- Institut für Höhere Studien) approach to a Consolidated Economic Analysis (see Figure 1) consists of four parts and follows the overall goal of providing a complete analysis of an investment project, including its effects on the economy, society and the environment.

Figure 1: The IHS approach to consolidated economic analysis



Source: IHS - Institute for Advanced Studies, 2013

These four parts are as follows:

1. **Financial analysis:** The financial analysis concentrates on analysing effects from the point of view of a railway operator or railway infrastructure company. It takes account of investment costs, maintenance and operating costs as well as operating revenues. The financial analysis does not include any external effects.

2. **Short term economic analysis**: The assessment of short and medium term effects is based on multiregional input-output analysis methods. The IHS model concentrates on detailed regionalised input-output tables, which are compiled as appendices to national accounts and show the links between the individual production sectors in an economy and between its various regions.

3. **Long term economic analysis:** The economic benefits of infrastructure projects only become apparent with time. To estimate these effects, IHS has developed an accessibility-dependent regional model (EAR), which follows a Bayesian spatial econometric approach. Since improvements in accessibility facilitate a higher degree of economic interaction, the emphasis in this model lies on the evaluation -

on a NUTS2[1] level- of improved infrastructure in terms of additionally generated gross domestic product (GDP) or gross value added (GVA).

4. **Environmental and social analysis:** New or upgraded infrastructure does more than just improve accessibility between regions and nations. It also reduces the overall level of negative externalities, such as accidents, air pollution, noise and global warming. The IHS ESA model takes these external effects into account and supplies information on environmental and social effects on a local, national and international level.

In accordance with the 2008 EU Cost-Benefit Analysis (CBA) guidelines[2], two performance indicators are of particular importance in a cost-benefit analysis, namely **financial net present value (FNPV)** and **economic net present value (ENPV)**.

Whereas the FNPV represents the railway operator or railway infrastructure company perspective, the ENPV of a project includes not only economic effects but also social and environmental impacts. Both values represent a discounted monetary value of costs and benefits. In the case of the SETA, the evaluation and supplied information for decision makers are condensed into the ENPV.

Only a few infrastructure projects have a positive FNPV (see Figure 2 for a project that is profitable in the long run), and in many cases of infrastructure projects this value stays negative.

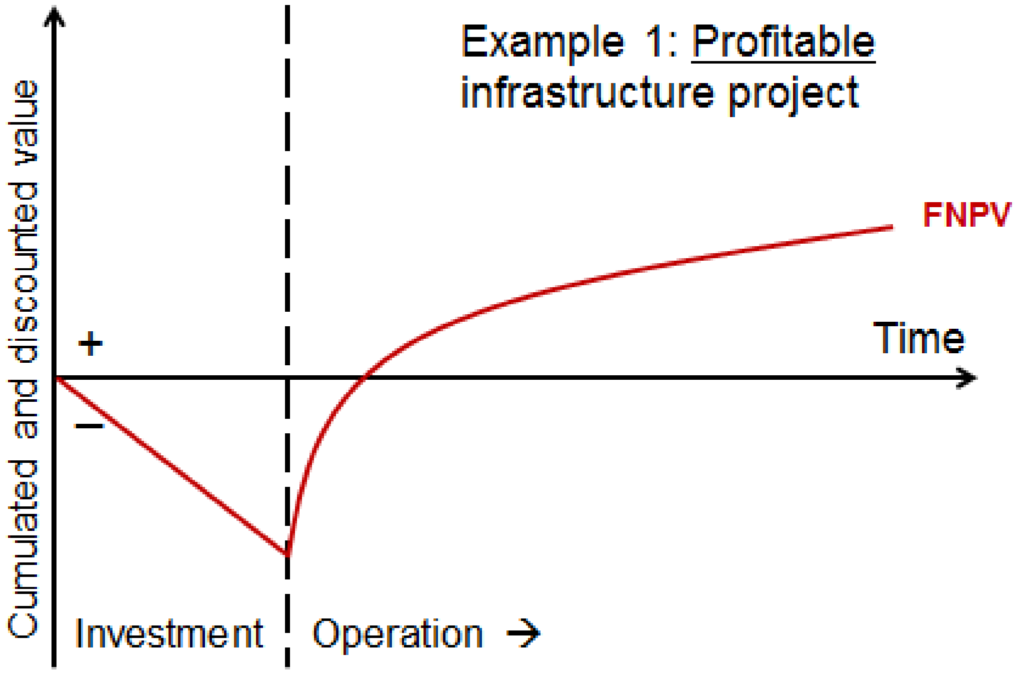
The ENPV, however, might still be positive (see Figure 3) since it includes the external effects of such infrastructure projects, such as increased accessibility for the regions involved, reduced number of accidents and a reduction in pollutant emissions. This, in turn, means that even though a project might not be profitable for an operator, it can be beneficial for society and should therefore still be implemented since the societal benefits (which in this case need to be monetized for comparison reasons) exceed the investment costs.

In order to correctly identify the overall costs and benefits of investments, the IHS approach focuses on the **economic net present value (ENPV)** of a project, i.e. the value which includes not only its economic effects but also its social and environmental impacts.

[1] NUTS (Nomenclature of Territorial Units for Statistics) is a geocode standard for referencing the subdivisions of countries for statistical purposes used in the European Union.

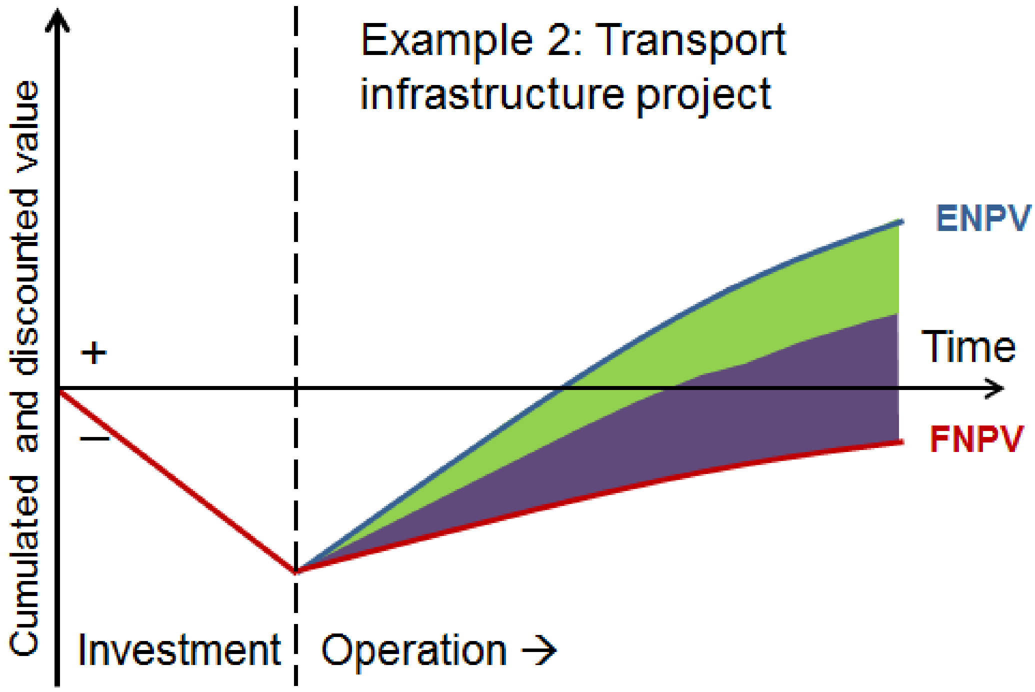
[2] European Commission (2008)

Figure 2: Profitable infrastructure investment project



Source: IHS – Institute for Advanced Studies, 2013.

Figure 3: Infrastructure project with negative FNPV and positive ENPV



Source: IHS - Institute for Advanced Studies, 2013.

3 The SETA project and inputs from earlier work packages (IHS)

The SETA corridor provides an efficient railway connection on existing tracks between the European Core Network Corridors (CNC), the Baltic Adriatic Corridor, the Mediterranean Corridor, the Orient/East-Med Corridor and the Rhine-Danube Corridor.

Figure 4: The SETA corridor

The following railway sections are included in the SETA corridor:

- The Austrian section Wien Meidling - Wr.Neustadt – Sopron and Wien Meidling – Ebenfurth – Sopron
- The Slovak section from Bratislava hl st. – Rajka (Hungarian border)
- The Hungarian sections Sopron - Szombathely – Zalaszentiván – Nagykanisza – Gyékényes (Croatian border)
- The Hungarian sections Rajka – Hegyeshalom – Csorna – Porpác – Szombathely
- The Hungarian sections Zalaszentivan – Hodoš (Őrihodos)
- The Slovenian sections Hodoš – Murska Sobota – Pragersko, Pragersko – Zidani most – Ljubljana – Pivka - Divača – Villa Opicina, Divaca – Koper and Pivka –Šapjane
- The Croatian sections Botovo – Koprivnica – Zagreb – Karlovac – Rijeka and Rijeka – Šapjane
- The Italian sections Villa Opicina – Trieste, Trieste - Monfalcone

Inputs from previous Work Packages and project partners - especially WP 4 on traffic system analysis - provide an essential background for the evaluation of SETA measures. The goal in WP 4 was to define requirements for the transport system (especially rail transport) as well as to develop strategies and network scenarios to eliminate deficiencies (bottleneck analysis) and allow the implementation of an effective, competitive (rail) transport service.

3.1 Bottleneck analysis

3.1.1 Objective

The objective of the **bottleneck analysis** (Output 4.4.1 by TMC, will further on be referred to as Bottleneck Report) was to identify obstacles which hamper the SETA corridor in providing a competitive connection between the CENTROPE region[3] and the Northern Adriatic seaports of Rijeka, Koper and Monfalcone. All types of bottlenecks (technical, administrative, legislative, information) were included in the analysis. In addition, a reduction in greenhouse gas emissions was sought to ensure any improvements to the transport infrastructure were sustainable.

The main results of this analysis include scenario definitions (see 3.1.2 below), detailed descriptions of the SETA railway network and transport conditions as well as a list of SETA bottleneck elimination measures for the scenario years 2015, 2020 and 2030[4].

No alternative routes were calculated in the SETA corridor, since any future developments will lie not in the construction of new buildings but in the customized upgrading of the existing (and already operational) railway lines. To produce a continuous rail corridor that meets the same technical and infrastructural requirements in all sections and to allow direct train links between the SETA regions and the Northern Adriatic Ports, both the infrastructure measures envisaged in the national development plans for the period to 2030 within the scope of the reference cases 2015-2030 (RC) and the necessary additional measures (AM) required to resolve the “bottlenecks”[5] were considered.

3.1.2 Scenarios

According to the different time horizons necessary for the implementation of proposed infrastructural measures the dates 2015, 2020 and 2030 were chosen. In addition to infrastructural measures, the bottleneck scenarios also include organisational measures designed primarily to reduce the clearly high passenger and freight waiting times in the existing rail transport network. Corresponding expansions in the rest of the European transport network were also taken into account for all expansion periods. Special attention was paid to measures and periods of planned expansion in the adjoining Baltic Adriatic Corridor (BATCO).

[3] An INTERREG IIIA project to establish a multinational region in Central Europe encompassing four European countries: Slovakia, Austria, Hungary and Czech Republic.
[4] see Bottleneck Report, p. 119
[5] see Bottleneck Report, p. 119

The following scenarios were specified in the bottleneck analysis[6]:

- **Scenario 2015 "short-term measures"**
  "For the year 2015 changes of design speed from 140 km/h to 160 km/h are only foreseen for the section Krizevci-Dugo Selo on the Croatian line Gyekenyes/Botovo – Zagreb, where also a 2nd track is available for this section after the year of 2015. Also till 2015 the Hungarian Dieses section Szombathely should be electrified. In all the other part of the SETA railway network till 2015 no other measures are expected to be completed, design speed, number of tracks and traction should remain more or less on the existing level in the SETA-network.

  Additional measures, which are feasible as short term measures till 2015 are primarily organizational measures. Nevertheless these measures are able to reduce the travel time between Vienna and Zagreb at about 50 minutes.

  At 2015 direct railway connections between the CENTROPE region and he Northern Adriatic ports will not yet be available, on the one hand due to the missing interoperability, which is focused on the section Szombathely – Zalaszentivan, and on the other hand due to the changing of traction in the Austrian section Wr.Neustadt – Sopron ad on the Hungarian section Zalaszentivan – Nagykanisza."

- **Scenario 2020 "medium-term measures"**
  "In this period till 2020 most of the national renewal and recovery programs should be finished, so that the aspired level of 120 km/h for passenger and 100 km/h for freight trains can be achieved for a large part of the SETA network. Additional measures will allow reducing travel time for passenger trains between Vienna and Zagreb of 37 Minutes. Together with the additional measures of 2015 the reduction amounts to 1 h 30 minutes, together with the increased speed, a travel time of less than 4 hours can be expected.

  Direct trains could run the whole SETA Corridor to the Northern Adriatic ports of Rijeka, Koper and Monfalcone. The bottlenecks on the Croatian sections will be solved; a comparable safety system will allow interoperability and the operation of direct trains."

- **Scenario 2030 "long-term measures"**
  "In this period the last measures (Moravice – Rijeka) will be finished. The planned renewal and upgrading of the SETA railway network will be completed. For this period no additional measures have been generated.

  Special attention is to spend to the complementary European railway network, in particular to the BATCO axis. The planned completion of the new axis was given at 2023/24. For the period till 2030 the new axis has to be taken into consideration."

[6] Bottleneck Report, p. 121

3.1.3 Reference case and additional SETA measures

Based on the scenario descriptions above and their corresponding tables[7], the infrastructure measures for the reference case and the additional SETA measures that were developed are described in Tables 1 and 2 below.

Table 1: Reference case infrastructure measures

REFERENCE CASE INFRASTRUCTURE MEASURES (national development plans)				
country	SETA - RAILWAY SECTION	TYPE OF MEASURE	INVESTMENT COSTS (million EUR)	YEAR OF REALISATION
AT	Wien-Meidling - Wien Blumental	2nd track, upgrading of stations and alignment	0.7	2018
	Wien-Blumental - Wampersdorf	2nd track	583.9	2020/2023
HU	Mosonszolnok - Porpac	Electrification	42.4	2015
	Szombathely - Zalaszentivan	Electrification	26.4	2015
HR	Koprvinica -Krizevci	2nd track, upgrading of stations and alignment, clearance gauge, axle load 22,5 t	237.8	2019
	Krizevci - Dugo Selo	2nd track, upgrading of stations and alignment, clearance gauge, axle load 22,5 t	175.9	2017
	Dugo Selo - Zagreb GK (Zapresic)	2nd track, upgrading of stations and alignment, freight train bypass, axle load 22,5 t	798.2	2022
	Zagreb GK - Karlovac	new double track line Leskovac-Karlovac, axle load 22,5	341.6	2018
	Karlovac - Ostarije	new double track line	202.2	2020
	Ostarije - Moravice	reconstruction of the existing railway line	376.8	2025
	Moravice - Skrljevo	reconstruction of the existing railway line, axle load, 20 t, double track on few sections	1 244.7	2024
SLO	Koper - Divaca	realignment of a double track raillway line	1 197.4	2030
Total	Investment costs (million EUR)		**5 228.0**	

Source: Austrian Federal Railways: Rahmenplan 2013-2018

Source: TMC, 2013.

Please note that the above measures represent those infrastructure measures that are already planned and are included in the relevant country's national development plan. The implementation of these measures is used to establish the reference case. They thus do **not** form part of the financial, economic and socio-environmental effects of the SETA measures described below.

[7] see Bottleneck Report, p. 122, 124, 126

Table 2: Additional SETA measures

ADDITIONAL SETA MEASURES (NOTE: The measures shown here do NOT form part of the respective country's national development plan, BUT do form part of the additional SETA measures)				
Country	SETA - RAILWAY SECTION	TYPE OF MEASURE	INVESTMENT COSTS (MEUR)	ANTICIPATED YEAR OF REALIZATION
AT	Neudörfl, Sauerbrunn, Mattersburg	Side tracks	To be determined in financial analyis	2015
	Wr.Neustadt - Sopron	Electrification		2020
	Ebenfurth	Loop		2020
	Steinbrunn	Side track		2020
HU	Bősárkány & Csorna	Reduction of block distance		2015
	Hegyeshalom-Csorna	Increasing the loading class		2020
	Szombathely	Reduction of block distance + reconstruction of station		2020
	Csorna-Porpác	Increasing the loading class		2020
	Nagycenk &Lövő	Electrification of third side track		2015
	Körmend-Zalalövö	Electrification		2020
	Vasvar & Egervár	Lengthening of side tracks		2020
	Szombathely - Zalaszentivan	Increasing axle loading class		2020
	Zalaszentivan - Nagykanizsa	Electrification		2020
	Zalaszentiván	Loop		2020
	Zalaszentivan - Nagykanizsa	Increasing axle loading class		2020
	Nagykanizsa	Lenghten side track		2020
	Gyekenyes/Zarkany	Loop		2020
HR	Koprvinica-Kotoriba	2nd track		2020
	Skrljevo-Rijeka-Matulj	Dry port connection		2020
SLO	Koper - Divaca	3 side tracks		2020

Source: TMC, 2013.

The additional SETA measures described here form the basis of all further evaluations within the SETA project. Their costs, for instance, were evaluated and subsequently entered into the financial analysis in Chapter 4 on page 10.

The additional SETA measures also have implications for passenger and freight transport demand. Thus, they also form the basis for the transport demand model (Work Package 4.3.1 by IBV Fallast). The next section provides a brief summary of the results of that particular Work Package. The results of the transport demand model are needed as inputs for the consolidated economic analysis.

3.2 Transport demand model results

In order to provide an economic impact analysis as described in Chapter 8 (consolidated economic analysis), the effect(s) of the additional SETA measures have to be analysed using a transport demand model. With the help of the TRANSTOOLS traffic model, the measures in the “reference cases” and the “additional measures” were simulated in terms of changes in passenger and freight transport. Results from the bottleneck analysis[8] were fed into transport demand model (Output 4.3.1 by IBV Fallast) with the aims of showing the current state of traffic flows, forecasting future traffic flows and examining the additional effects of the SETA measures along the SETA corridor. Outputs supplied by this transport model report include changes in travel time(s), goods volume(s) and passenger traffic flows due to SETA measures.

Output of the transport demand model needed for further analysis:

[8] Bottleneck Report

- Travel time for passenger trains (origin/destination matrix)
- Travel time for freight trains (origin/destination matrix)
- Volume of passengers transported by rail (origin/destination matrix)
- Volume of goods transported by rail (origin/destination matrix)

- Travel time for cars (origin/destination matrix)
- Travel time for trucks (origin/destination matrix)
- Volume of passengers transported by road (origin/destination matrix)
- Volume of goods transported by road (origin/destination matrix)

All of the above are needed for the following cases in order to evaluate the changes resulting from the SETA measures:

- Reference case 2015 and case including the SETA measures 2015
- Reference case 2020 and case including the SETA measures 2020
- Reference case 2030 and case including the SETA measures 2030

Further, the transport demand model was needed to derive input values for the following environmental and socio-economic variables[9]:

- CO_2 (carbon dioxide)
- NOx (nitrogen oxide)
- PM_{10}, $PM_{2.5}$ (particulate matter)
- NMHC (non-methane hydrocarbons)
- SO_2 (sulphur dioxide)
- N_2O (nitrous oxide)
- CH_4 (methane)

All of the above are then included into the consolidated economic analysis.

3.3 Alternatives

So far, the only differentiation has been between

1.) the reference case or reference scenario (which is sometimes also referred to as the 'BAU' or 'business-as-usual' scenario) and
2.) the SETA scenario, which consists of measures at three different points in time (2015, 2020, and 2030)

The term "scenario" is in fact somewhat misleading here, since the three "scenarios" - scenario 2015, scenario 2020 and scenario 2030 - developed in the bottleneck analysis are actually one scenario consisting of measures at three different points in time.

During the process of determining the costs for each individual additional SETA measure the need for a further differentiation became apparent for the following reason:

Since not every measure included in the list of additional SETA measures (see Table 2) has the same cost or effect and to permit the identification of the most effective and

[9] Ideally, data on severe injuries, minor injuries and noise levels would also be considered.

economic measure, the results of the bottleneck analysis were also used to categorise the additional SETA measures into three alternatives.

These three alternatives were developed based on the following considerations:

- **Alternative 1** includes all measures that reduce travel time.

- **Alternative 2** includes all measures that reduce travel time (Alternative 1) AND eliminate capacity constraints on the Skrljevo-Rijeka line.

- **Alternative 3** includes all measures that reduce travel time (Alternative 1) AND eliminate capacity constraints on the Skrljevo-Rijeka line (Alternative 2) AND improve capacities, especially by improving axle loading class.

In other words, Alternative 1 is a subset of Alternative 2, which is a subset of Alternative 3, which represents all measures identified as additional SETA measures.

For reasons of completeness and brevity, some results of the financial analysis are anticipated below, namely the costs of each individual SETA measure.

Note: The assessment of the three different alternatives was only possible in the financial analysis. However, the transport demand model is only set up in line with Alternative 2, since Alternative 2 (which includes Alternative 1) captures all travel time changes and assumes the installation of all measures that reduce capacity constraints (a working assumption of the accessibility-dependent regional model (version 2.0) that was subsequently applied).

Table 3: Costs of individual additional SETA measures

ADDITIONAL SETA MEASURES Investment costs in million EUR				
country	SETA - RAILWAY SECTION	2020 Alternative 1	Alternative 2	Alternative 3
AT	Side tracks Neudörfl, Sauerbrunn, Mattersburg	2.8	2.8	2.8
	Electrification Wr.Neustadt - Sopron	28.4	28.4	28.4
	Loop Ebenfurth	44.8	44.8	44.8
	Side track "Steinbrunn"	13.0	13.0	13.0
HU	Bősárkány & Csorna reduction of block distance	0.7	0.7	0.7
	Hegyeshalom-Csorna increasing the loading class*			33.9
	Szombathely reduction of block distance + reconstruction of station	7.5	7.5	7.5
	Csorna-Porpác increasing the loading class*			47.9
	Nagycenk &Lövő electrification of third side track	0.3	0.3	0.3
	Upgrading of Körmend-Zalalövö line (and electrification)			22.1
	Vasvar & Egervár lengthening of side tracks	0.6	0.6	0.6
	Increasing axle loading class Szombathely - Zalaszentivan*			44.4
	Electrification Zalaszentivan - Nagykanizsa	31.0	31.0	31.0
	Zalaszentiván loop	6.0	6.0	6.0
	Increasing axle loading class Zalaszentivan - Nagykanizsa*			44.5
	Nagykanizsa lenghten side track	2.4	2.4	2.4
	Loop Gyekenyes/Zarkany	6.0	6.0	6.0
HR	2nd track Koprvinica-Kotoriba			161.9
	Dry port connection Skrljevo-Rijeka-Miklavje		189.1	189.1
SLO	3 side tracks Koper - Divaca	6.8	6.8	6.8
Total	Investment costs (million EUR)	**150.2**	**339.3**	**694.0**

Source: TMC, 2013.

4 Financial analysis (TMC)

4.1 Financial analysis approach

4.1.1 Evaluation of measures within the SETA process

The SETA corridor includes sections of railway lines in Austria, Slovakia, Hungary, Croatia, Slovenia and Italy, and the proposed rail infrastructure improvements measures affect seven national railway companies. All these railway companies have presented – in coordination with their respective national government – development plans for their railway infrastructure to 2020 and 2030. In the course of the “bottleneck analysis”, it was verified whether these proposed measures would be sufficient to ensure the following objective defined for the whole SETA corridor:

Creation of a continuous rail link with direct connections between the CENTROPE regions, the other SETA regions and the northern Adriatic ports of Rijeka, Koper and Monfalcone/Trieste.

This requires uniform conditions for the transport of passengers and goods throughout the SETA corridor in relation to

- traction
- safety standards
- speed
- axle loads
- organisation.

In addition to infrastructure measures by national railway companies for the expansion of individual sections of the SETA corridor, all additional measures (not provided for in national development plans) required to implement a continuous, competitive rail corridor were identified and determined in WP4.4 under the lowest cost premise. Examples of such measures include:

- the electrification of continuing diesel routes (even after implementation of the planned expansion programmes)
- small measures (e.g. connection loops) to speed up the traffic flow
- selected measures for the unification of security systems
- measures for the uniform increase of axle loads
- small measures to increase the line capacity (Dodge)
- organisational measures to reduce waiting time.

The objective of this report is to assess the financial, economic and ecological relevance and feasibility of these additional measures as a basis for their subsequent financing.

The cost-benefit analysis (CBA) for investment projects is explicitly required in the new EU regulations for the Structural Fund (SF), the Cohesion Fund (CF) and the structural instruments for the preparation of EU accession (ISPA) for all projects with a total budget in excess of 50 million EUR, 10 million EUR and 5 million EUR respectively. While Member

States are responsible for the initial assessment, the Commission has to assess the quality of these projects to authorize the proposal for co-financing and to set the co-financing rate.

Co-financing of infrastructure projects by the Structural Fund (SF), the Cohesion Fund (CF) and ISPA are an important support for the implementation of EU regional policies (cohesion policy). According to EU regulations, infrastructural and productive investments may be financed by one or more of the Community's financial tools - mainly grants (SF, CF, but also as repayable aid for the ISPA), loans and other financial tools (European Investment Bank).

According to SF Reg. 1260/1999, Art. 26, CF Reg. 1265/1999, Art. 1 and ISPA Reg. 1267/1999, Annex II (C), the Commission is responsible for the prior appraisal of major projects on the basis of information given by the proposer.

Community regulations indicate which information must be included in the respective application form for the purposes of allowing an effective evaluation on the part of the Commission. Article 26 of SF Reg. 1260/99, which covers the co-financing of major projects, asks for:

- a cost-benefit analysis,
- a risk analysis,
- an evaluation of the environmental impact (and the application of the Polluter Pays Principle), and
- an assessment of impact on equal opportunities and employment.

In addition to stating that the proposals for co-financing must contain a cost-benefit analysis, a risk analysis and a detailed indication of the alternatives rejected, the regulations regarding the Cohesion fund and the ISPA also require the inclusion of some indications of the criteria to be applied to ensure the quality of the evaluation.

For the period from 2014 – 2020, the plan is to attach more importance to the regional impact of infrastructural measures than to CBA. The SETA evaluation approach also satisfies this condition.

4.1.2 The SIC! financial analysis approach

The approach to financial analysis applied within the present project follows the one eveloped in the Interreg IIIb CADSES project "**S**ustrain **i**mplement **c**orridor" (SIC!), Vienna 2007.

With the separation of railway companies into separate sales and infrastructure divisions (EU Directive 91/440/EC) and the financing of infrastructure maintenance and operating costs through charges for its use (access charges), the question of the evaluation of infrastructure measures has to be asked anew. As an essential (ongoing) income from the infrastructure, the access charge (AC) deserves special interest. Assuming that a) the assessment relates to the whole SETA corridor and b) that any measures taken by a railway company in one country will affect the other railway companies in the corridor, a cost-benefit assessment based on the optimal benefit to each individual company is not possible. The optimal measures for the individual railway companies are not necessarily identical with the optimal measures for the entire corridor.

The consideration of the impact of infrastructure measures for the railway company and revenues are therefore also not the content of the assessment of infrastructure measures. In the SETA financial analysis, revenues are limited to the proceeds of infrastructure use (access charge). While in the case of road funding the high proceeds derived from toll revenues can be used to refinance, no comparable high revenues are available in the case of railway infrastructure from access charges/IBE. In addition, even if this might have been the original intent, the high investments required in the rail sector from an economic perspective cannot be refinanced – in contrast to their counterparts in the roads sector – entirely through the access charge. The rail sector is therefore reliant on federal grants for refinancing. This fact is reflected in the financial analysis, where the changing contribution of access charges and their contribution to the repayment of the investment is taken into account to cover the infrastructure operating costs (with consistent federal grants). The revenues considered in the financial analysis are those that accrue to the owner of the infrastructure. This method has some advantages over the recommendation that consideration be given to revenues accruing to the operational users of the infrastructure.

Table 4: Comparison of CBA guidelines and SETA methodology

	Guide to CBA (European Commission)	SETA Methodology
Investment Analysis •Investment costs per section •Operations / Maintenance (O&M) costs •Revenues from infrastructure usage fees **Calculation of...** → Financial Net Present Value (FNPV) → Financial Internal Rate of Return (FIRR)		
Conclusions Investment Analysis	Simplyfied, „textbook" conclusions: *„If FNPV is negative or FIRR < than the discount rate → „Leave it""*	As long as accumulated debt (including interest pay back) decreases, **investment might be feasible, dispite negative FNPV!**
Finance / Funding: Including an analysis of funding options into the investment analysis		
Overall Approach	Strong focus on **ECONOMIC** evaluation with often „heavy" returns from monetarised external effects (time savings!) Economic viability serves as the basis for investment decision.	Clear focus on **FINANCIAL** viability to avoid unaffordable „long term loss leaders". **Economic viability** serves as additional „political" argument.

Source: TMC, 2013.

The financial analysis follows the EU's recommendations and is based on the internal interest rate method. It consists of three parts:

- the **financial analysis**, which determines the financial rate of return of capital employed

- the **economic analysis**, where costs and benefits are discounted and compared according to the net present value method. As an evaluation measure, the value of capital, economic profitability and the cost-benefit ratio are determined.
- the **risk analysis**, in which the critical variables (or assumptions) are varied (sensitivity analysis) in order to document the stability of earnings, describe the risks and discuss measures to reduce existing risks.

PPP considerations (SIC! approach)

Back in 2002, the European Commission had already urged a reinforced coordination of public financing instruments for the railway sector and the development of adequate procedures for public-private partnership (PPP) projects. Funding opportunities through EU venture capital funds and guaranties were announced. In the case of the rail sector, the Commission clearly realised that there is a large financing gap on the one hand and only limited experience with PPP projects on the other. The financial analysis therefore also sought to evaluate the reasonableness of the use of private capital for the financing of infrastructure projects.

Prominent examples of PPP projects in the European rail sector can be found for the following high speed lines:

- Channel Tunnel Rail Link (UK)
- HSL Zuid (NL)
- Perpignan-Figueras (E/F)

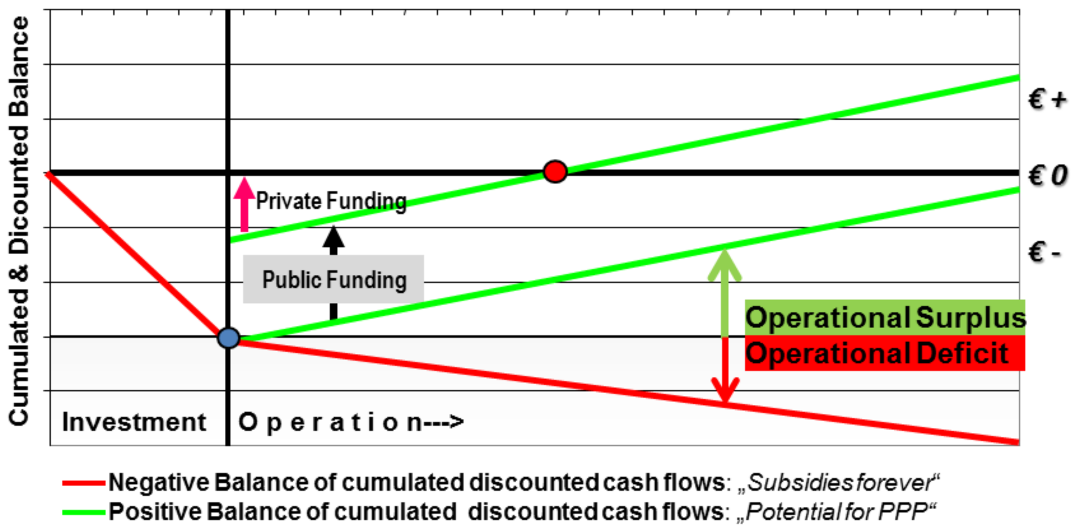
All these projects aimed - in addition to a cost-efficient construction of infrastructure – to improve the speed and reliability of rail transport. The private shares in the projects were financed through deployment payments (such as the shadow tolls used for the HSL Zuid line) but also through user fees (real tolls such as in the case of Perpignan-Figueras).

In the PPP considerations for the SIC! Project, the fundamental issues were:

1. Given the defined investment volume for new and upgraded lines, can the charges obtained for infrastructure usage (“real tolls”) cover the running costs for operation and maintenance (O+M) of the line?
2. Will there be a surplus after deduction of O+M which could be used to cover interest and capital costs?

This can be presented in a simplified graphic way as follows:

Figure 5: Financial evaluation: basic scheme and data requirements



Source: TMC, 2013.

This scheme will also be used as a base for the financial analysis of the SETA project.

4.1.2.1 The future railway development scenarios (2015-2020-2030)

Scenarios of future development usually consist of different alternative routes. In the SETA project no alternative routes were calculated, but 3 different levels of investment measures as SETA does not rely on high investment as a basis of future development but in the customized upgrading of the existing (and already operating) railway lines. To produce a continuous rail corridor that meets the same technical and infrastructural requirements in all sections and to allow direct train links between the SETA regions and the Northern Adriatic Ports, both the infrastructure measures envisaged in the national development plans for the period to 2030 within the scope of the reference cases 2015-2030 (RC) and the necessary additional measures (AM) required to resolve the “bottlenecks” (see Bottleneck Report p. 127ff) were considered. In addition to the infrastructural measures, the bottleneck scenarios also include organisational measures designed primarily to reduce the clearly high passenger and freight waiting times in the existing rail transport network. Corresponding expansions in the rest of the European transport network were also taken into account for all expansion periods. Special attention was paid to measures and periods of planned expansion in the adjoining BATCO corridor.

The starting point for the scenario calculation is the year 2012. Based on the frequencies of rides and the infrastructure required for passenger and freight transport in this year, and with the help of the TRANSTOOLS traffic model, the measures in the “reference cases” and the “additional measures” were all simulated in terms of the change in frequencies of rides in the passenger and freight transport.

The calculations were carried out for the following scenarios (see Bottleneck Report p.123ff):

- **Scenario 2015 “short-term measures”**

  Includes the scheduled measures specified in the national development plans. Additional measures are primarily measures that lead to a considerable reduction in waiting times. Infrastructural measures were proposed only to a limited extent. There are no continuous uniform transport connections for passengers or freight.

- **Scenario 2020 “medium-term measures”**

  By this point in time, the majority of the measures envisaged in the national development plans will be completed. These are not all measures that are necessary to enable continuous, uniform transport conditions across the entire corridor Additional measures were developed and grouped into three alternatives. The continuous electrification of the entire SETA corridor, for example, should be completed by 2020 as a result of the additional measures. There will be a few bottlenecks on sections of the Zagreb-Rijeka line, which can only be eliminated in the 2020-2030 period through infrastructure measures implemented in line with the national development plans.

- **Scenario 2030 “long term measures”**

  This scenario represents the maximum transport potential for sections of the SETA corridor. We distinguish between two different variants in the “long term measures” scenario:

  – The expected passenger and freight volumes in 2030 (identified using the traffic demand model) were taken as the base of the financial analysis.

  – The maximum freight volume assumes that the maximum loading capacity foreseen for trains in the ports of Koper and Rijeka in 2030 can actually be used (90 trains per day for Koper and 128 trains per day for Rijeka). This is equivalent to an annual railway tonnage of around 15 million tons in Koper or 23 million tons in Rijeka, or 2.5 T EUR per year (Bottleneck Report, p.38ff)

In an additional scenario (2030 maximum incl. BATCO scenario), the completion of the Baltic Adriatic Corridor (BATCO) was assumed and its impact in relation to the shift of traffic flows for freight traffic was calculated. On the basis of these calculations, a reduction of the transport substrate on the SETA axis of around 7 % is to be expected. These “shifting potentials“ will be exceptionally high for Slovenian destinations, with drive shifts of up to 20 % calculated on the Slovenian rail lines in the SETA corridor. On the other hand, increases in train frequencies for connections to the BATCO corridor can also be expected. In contrast, the competition through the expanded BATCO axis will be of no importance for Croatian destinations. A comparison with a moderate development in freight traffic (2030 RC) shows that the following requirements are a necessity for the management of the maximum traffic volume (2030 max): a twin-track continuous expansion of the Zagreb-Rijeka line, a direct port connection and a continuous connection between Skrljevo-Rijeka-Opatija-Sapjane. As far as the interpretation of these results is concerned, it should also be mentioned that the designated values are valid for the entire section. Trains which only use parts of the sections (e.g. local suburban services) were not taken into account in the calculations.

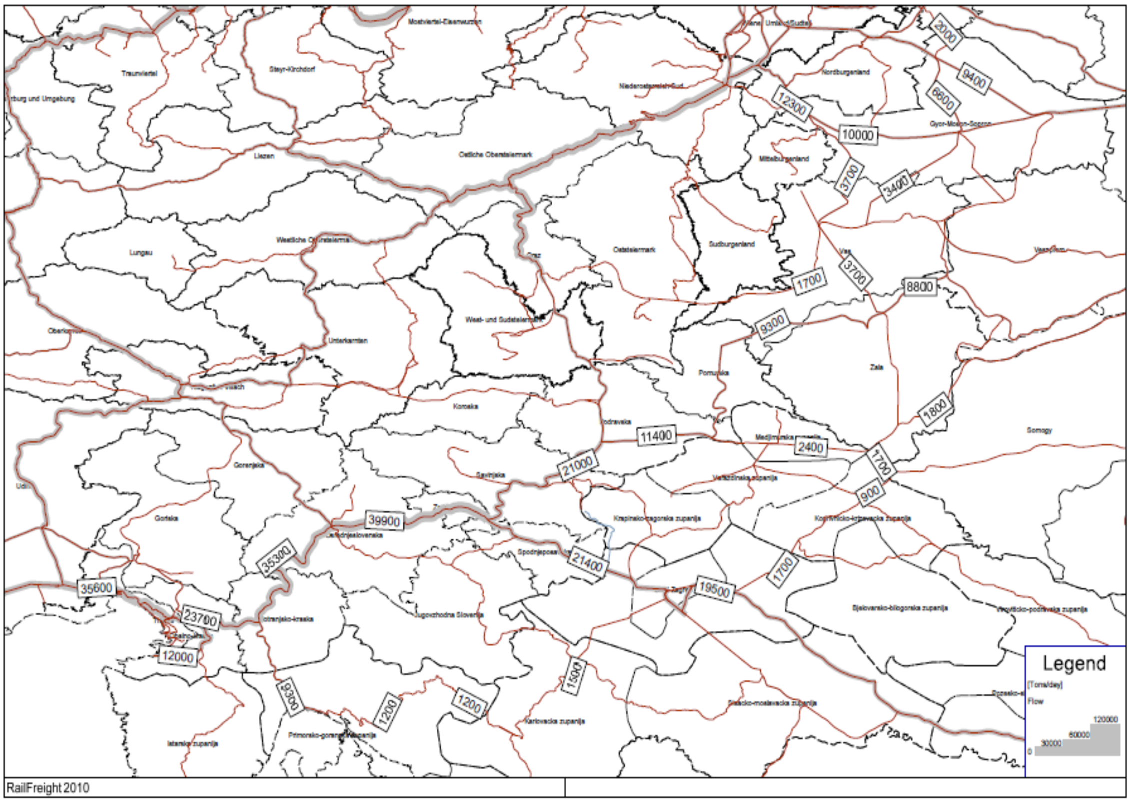
Table 5: SETA corridor: Railway freight traffic scenario results (volume of freight, number of trains)

SETA - Project: Scenarios of railway development 2012 - 2030 — Railway traffic flows	Freight Traffic (t/d)									Freight Traffic (number of trains both directions)								
SETA Corridor: Railway sections	Current	2015 RC	2016 RC All	2020 RC	2020 RC All	2030 RC	2030 RC All	2030 max	2030 max (+BATCO)	Current	2015 RC	2016 RC All	2020 RC	2020 RC All	2030 RC	2030 RC All	2030 max	2030 max (+BATCO)
Wien - W. Neustadt	14 800	14 800	14 800	14 800	14 800	14 800	14 800	14 800	14 800	33	33	33	33	33	33	33	33	33
W. Neustadt - Sopron										0	0	0	0	0	0	0	0	0
Wien - Ebenfurth	11 000	17 000	17 000	29 300	32 000	32 000	46 200	63 800	62 900	38	38	38	65	71	71	100	142	140
Ebenfurth-Sopron Terminal	12 900	14 800	16 000	16 300	18 700	18 700	22 000	27 700	25 300	27	33	36	36	42	42	48	62	56
																0	0	
Bratislava Nove Mesto - Rajka	2 000	2 900	3 100	3 300	5 200	4 200	5 300	6 200	4 300	4	6	7	7	12	9	12	14	10
Rajka - Szombathely	3 400	5 900	6 200	7 300	10 700	8 900	11 800	16 700	14 300	8	13	14	16	24	20	26	37	32
Sopron-Szentgotthard																0	0	
Sopron - Szombathely	3 300	5 600	5 700	6 400	8 600	7 200	8 400	16 500	13 400	8	12	13	14	19	16	19	37	30
Szombathely - Kormend	1 700	3 500	3 600	3 100	2 300	2 300	4 600	3 700	6 500	4	8	8	7	5	5	10	8	14
Kormend - Szentgotthard	1 700	3 500	3 600	3 100	2 300	2 300	4 600	3 700	6 500	4	8	8	7	5	5	10	8	14
Szombathely-Gyekenyes																0	0	
Szombathely - Zalaszentivan	3 700	5 100	5 500	3 900	8 500	8 500	11 900	25 200	18 200	8	11	12	9	19	19	26	55	40
Zalaszentivan - Nagykanizsa		2 500	2 700	4 500	5 200	5 200	6 000	14 200	11 300	0	6	6	10	12	12	13	32	25
Nagykanizsa - Murakeresztur	2 700	2 800	2 900	4 800	5 200	5 200	6 400	32 100	30 300	5	6	6	11	12	12	14	71	67
Murakeresztur - Gyekenyes	1 700	2 100	2 900	5 600	8 100	8 100	9 100	29 400	28 500	4	5	6	12	18	18	20	65	63
Gyekenyes-Dugo Selo																0	0	
Gyekenyes - Koprivnica	900	1 900	2 500	6 900	10 400	10 400	12 100	37 300	36 100	2	4	6	15	23	23	27	83	80
Koprivnica - Krizevci	1 800	2 200	2 600	7 100	12 300	12 300	14 800	43 300	42 300	4	5	6	16	27	27	33	96	94
Krizevci - Dugo Selo	1 800	2 200	2 600	7 100	10 400	10 400	12 900	43 300	42 300	4	5	6	16	23	23	29	96	94
Dugo Selo - Zagreb GK	19 800	21 500	22 800	28 000	29 700	29 700	29 800	72 000	68 900	44	48	51	62	66	66	66	160	153
Zagreb-Rijeka																0	0	
Zagreb - Karlovac	7 600	9 900	10 800	9 900	12 300	12 300	15 100	73 000	71 900	17	22	24	22	27	27	34	162	160
Karlovac - Oštarije	7 900	9 500	10 000	9 500	11 400	11 400	13 800	72 600	71 500	16	21	22	21	25	25	31	161	159
Oštarije - Moravice	7 900	9 500	10 000	9 500	11 400	11 400	13 800	72 600	71 500	16	21	22	21	25	25	31	161	159
Moravice - Skrljevo	7 900	9 500	10 000	9 500	11 400	11 400	13 800	72 600	71 500	16	21	22	21	25	25	31	161	159
Skrljevo - Rijeka	7 900	9 500	10 000	9 500	11 400	11 400	13 800	72 600	71 500	16	21	22	21	25	25	31	161	159
Pragersko-Zidani Most																0	0	
Pragersko - Celje	21 700	28 500	28 500	31 200	32 300	32 300	29 200	86 700	74 100	47	63	63	69	72	72	65	193	165
Celje - Zidani Most	21 700	28 500	28 500	31 200	32 700	32 700	29 700	87 100	74 500	47	63	63	69	73	73	66	194	166
Pragersko-Hodos																0	0	
Hodos-Murska Sobota	9 000	12 500	12 500	14 900	20 900	20 900	18 800	30 800	24 200	20	28	28	32	46	46	42	68	54
Murska Sobota - Ormoz	9 700	12 600	12 600	14 600	21 100	21 100	19 100	31 000	24 400	20	28	28	32	47	47	42	69	54
Ormoz - Pragersko	10 700	14 100	14 100	16 600	22 000	22 000	19 300	37 100	28 200	24	31	31	37	49	49	43	82	63
Zalaszentivan-Hodos																0	0	
Zalaszentivan - Zalalovo	9 000	12 500	12 500	14 900	20 900	20 900	18 800	30 800	24 200	20	28	28	32	46	46	42	68	54
Zalalovo - Hodos	9 000	12 500	12 500	14 900	20 900	20 900	18 800	30 800	24 200	20	28	28	32	46	46	42	68	54
Zidani Most-Ljubljana	36 300	44 600	44 600	52 700	53 500	53 500	51 900	107 800	92 900	82	99	99	117	119	119	115	240	206
																0	0	
Ljubljana-Pivka-Villa Opicina-Trieste-Monfalcone																0	0	
Ljubljana - Pivka	30 300	39 300	39 300	48 700	49 700	49 700	48 700	125 300	116 600	69	87	87	108	110	110	108	278	259
Pivka - Divaca	29 000	28 500	28 500	33 700	35 500	35 500	38 800	68 500	67 400	51	63	63	75	79	79	86	152	150
Divaca - Sezana	21 500	26 700	26 700	31 300	34 000	34 000	36 400	61 500	59 500	48	59	59	70	76	76	81	137	132
Sezana - Villa Opicina	21 500	26 700	26 700	31 300	34 000	34 000	36 400	61 500	59 500	48	59	59	70	76	76	81	137	132
Villa Opicina - Trieste	21 500	26 700	26 700	31 300	34 000	34 000	35 700	61 500	59 500	48	59	59	70	76	76	79	137	132
Trieste - Monfalcone	35 000	40 900	40 900	46 300	46 800	46 800	52 100	69 300	69 600	78	91	91	101	102	102	116	154	155
Divaca-Koper	12 000	15 200	15 200	17 900	17 900	17 900	21 200	46 300	46 300	27	34	34	40	40	40	47	103	103
Pivka - Rijeka																0	0	
Pivka - Sapjane	2 700	2 100	2 100	2 200	2 100	2 100	9 900	70 900	64 300	5	5	5	5	5	5	22	158	143
Sapjane - Rijeka	2 700	2 100	2 100	2 200	2 100	2 100	9 900	70 900	64 300	5	5	5	5	5	5	22	158	143

Source: IBV Fallast, TMC, 2013.

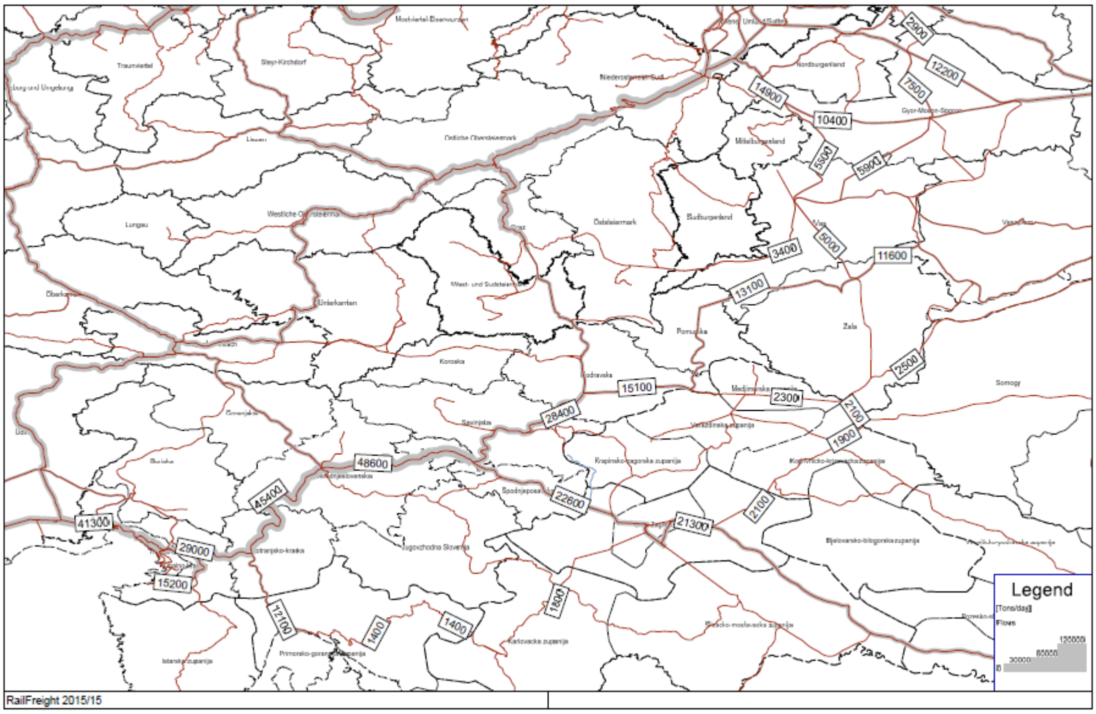
In passenger transport terms, average increases in passenger volumes of up to 25 % were calculated for all periods (2012-2030). However, the additional measures could lead to a potential increase of 40 %. It is quite evident - particularly for the period from 2012 – 2020 - that the measures planned in the national development plans (RC) will only result in small increases in passenger traffic (+13 %). The implementation of the proposed additional measures needs to be carried out in time (as proposed) in order to be effective in 2020. If this is indeed the case, an increase in passenger volumes of up to 31 % could be achieved. The effects of the additional measures to 2030 were calculated on the basis of 27 % more passengers than without the additional measures. The results of the demand model calculations (2012-2030) indicate another situation for railway freight traffic, where the calculated growth in the volume of freight will increase by 71 %. The effect of the additional measures for the same period was calculated to be 23 % higher than a situation without the proposed additional measures. In 2020, the calculated effect was +37 %.

Figure 6: SETA corridor: Railway freight volume 2010



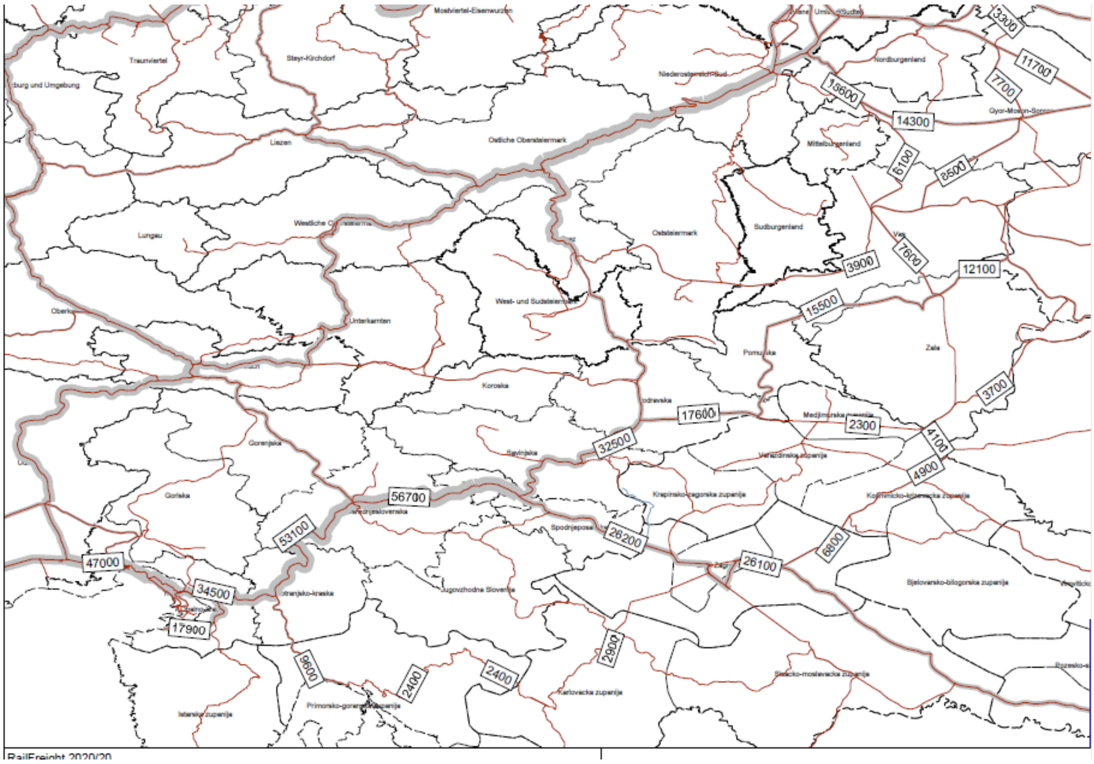
Source: IBV Fallast, 2013.

Figure 7: SETA corridor: Railway freight volume 2015



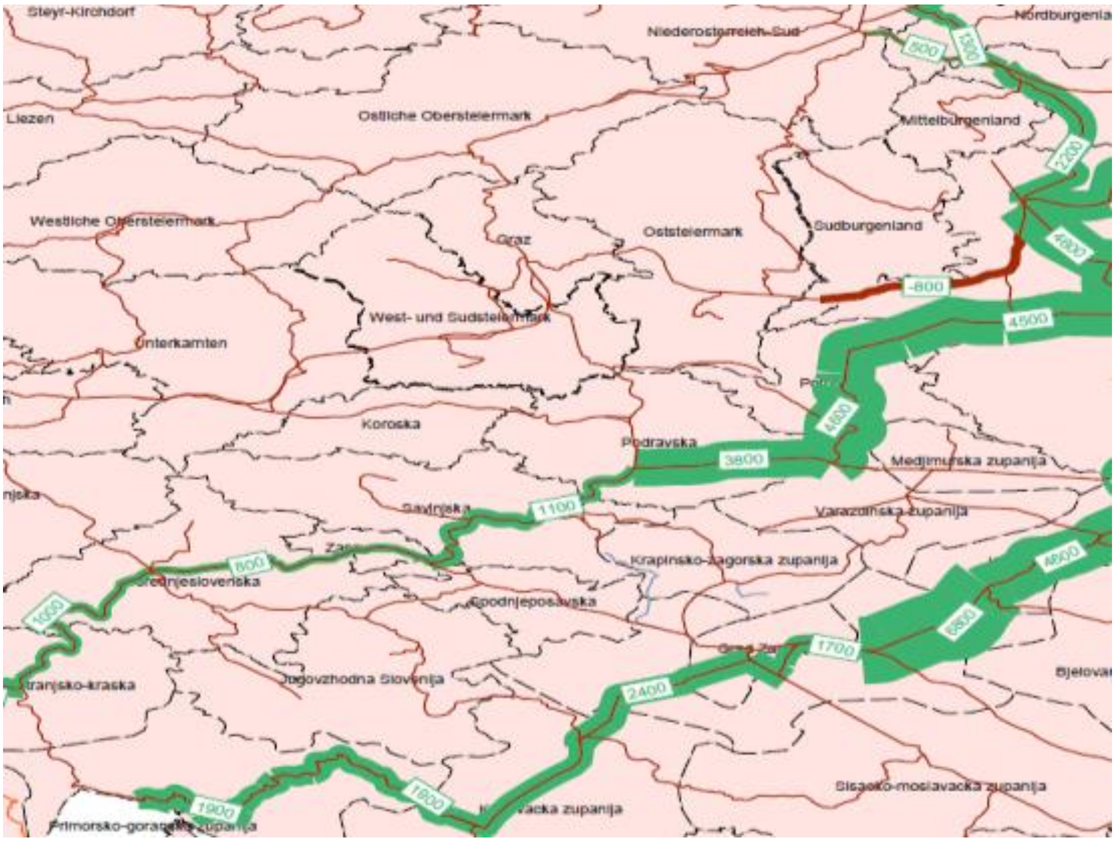
Source: IBV Fallast, 2013.

Figure 8: SETA corridor: Railway freight volume 2020



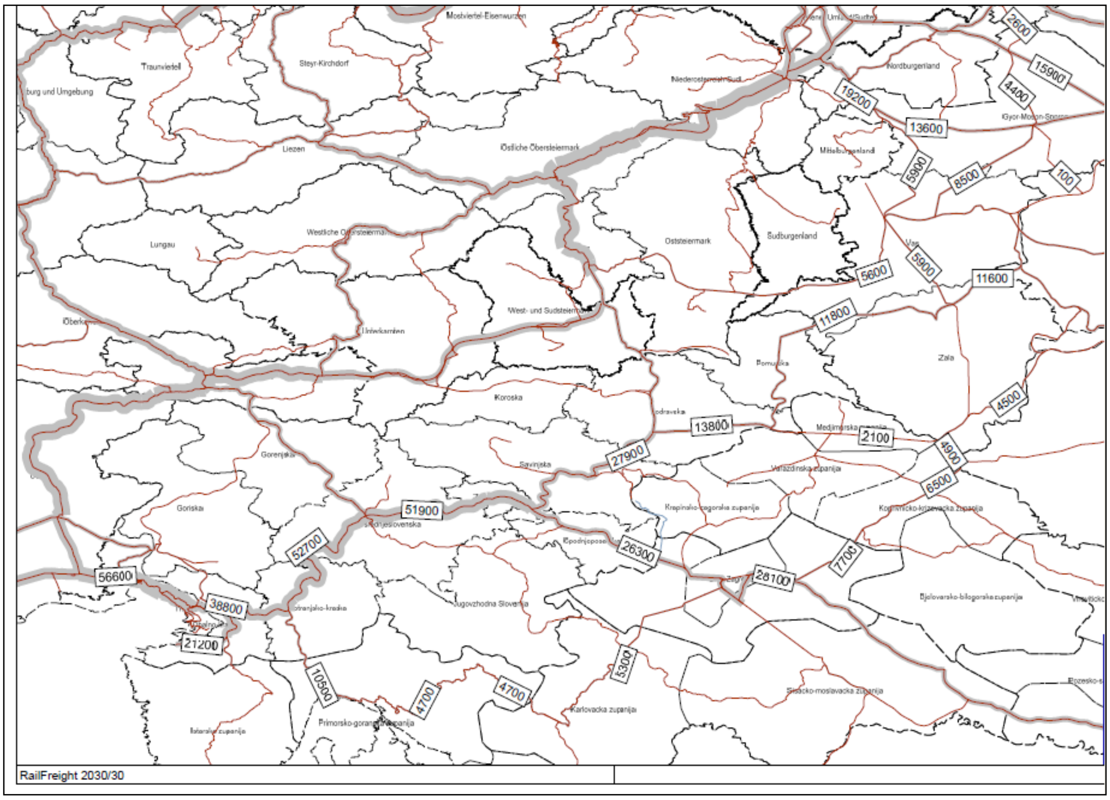
Source: IBV Fallast 2013.

Figure 9: SETA corridor: Railway freight volume – difference 2020 RC – 2020 AM



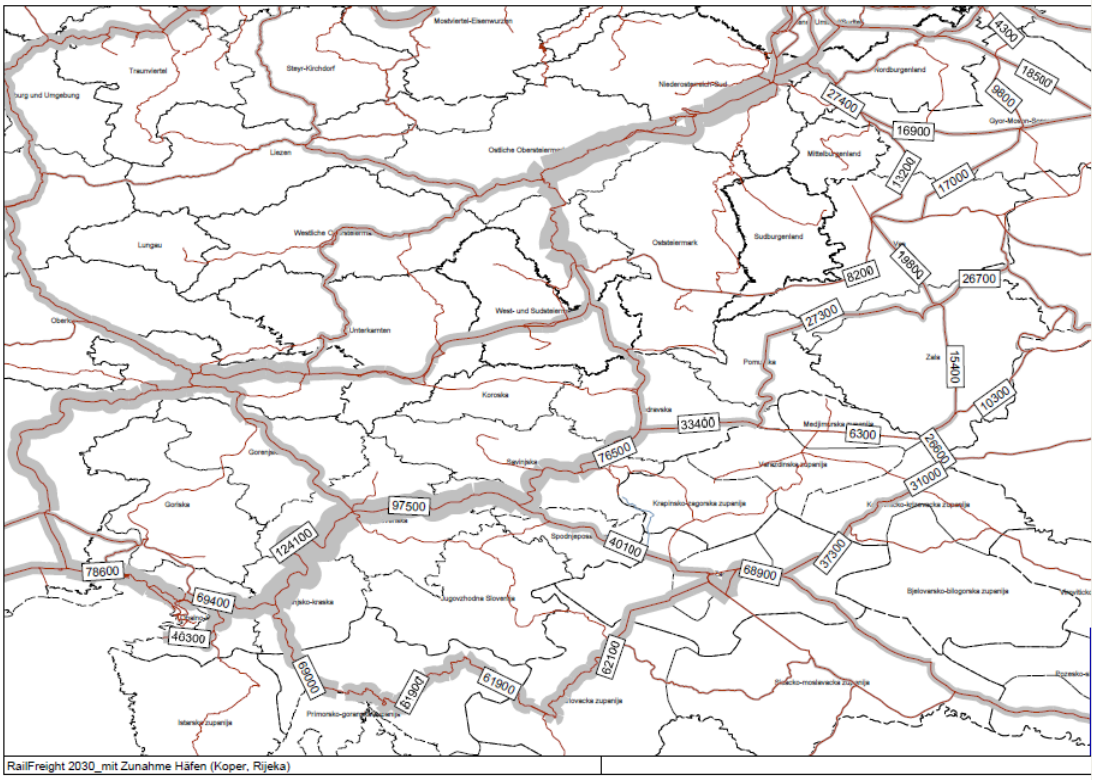
Source: IBV Fallast 2013.

Figure 10: SETA corridor: Railway freight volume 2030



Source: IBV Fallast, 2013.

Figure 11: SETA corridor: Railway freight volume 2030 (max)



Source: IBV Fallast, 2013.

4.2 The calculation model in the financial analysis

The methodology used for the financial analysis follows the recommendations contained in the "Guide to cost benefit analysis of investment projects"[10], where the basic financial analysis tool is the discounted cash flow table in which only cash inflows and outflows are considered (depreciation, reserves and other accounting items which do not correspond to actual flows are disregarded) and fulfils the following specifications:

- the determination of the project cash flows is based on the incremental approach, i.e. on the basis of the differences in the costs and benefits between the scenario with the project (do-something alternative) and the counterfactual scenario without the project (BAU scenario)
- the aggregation of cash flows occurring during different years requires the adoption of an appropriate financial discount rate in order to calculate the present value of the future cash flows

The financial discount rate reflects the opportunity cost of capital, defined as 'the expected return forgone by bypassing other potential investment activities for a given capital' (EC Working document No 4: Guidance on the methodology for carrying out cost-benefit analysis).

The main output of the financial analysis is

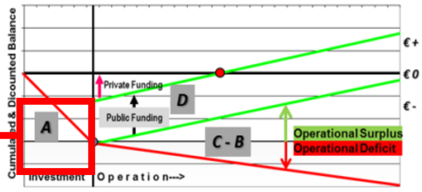
- the NPV (net present value) and
- the FIRR (financial rate of return).

The tables and figures shown below illustrate the procedure and give reference to the necessary indicators.

[10] European Commission (2008)

4.2.1 4.2.1 Indicator: Investment costs

Figure 12: Data requirement - indicator investment costs



A

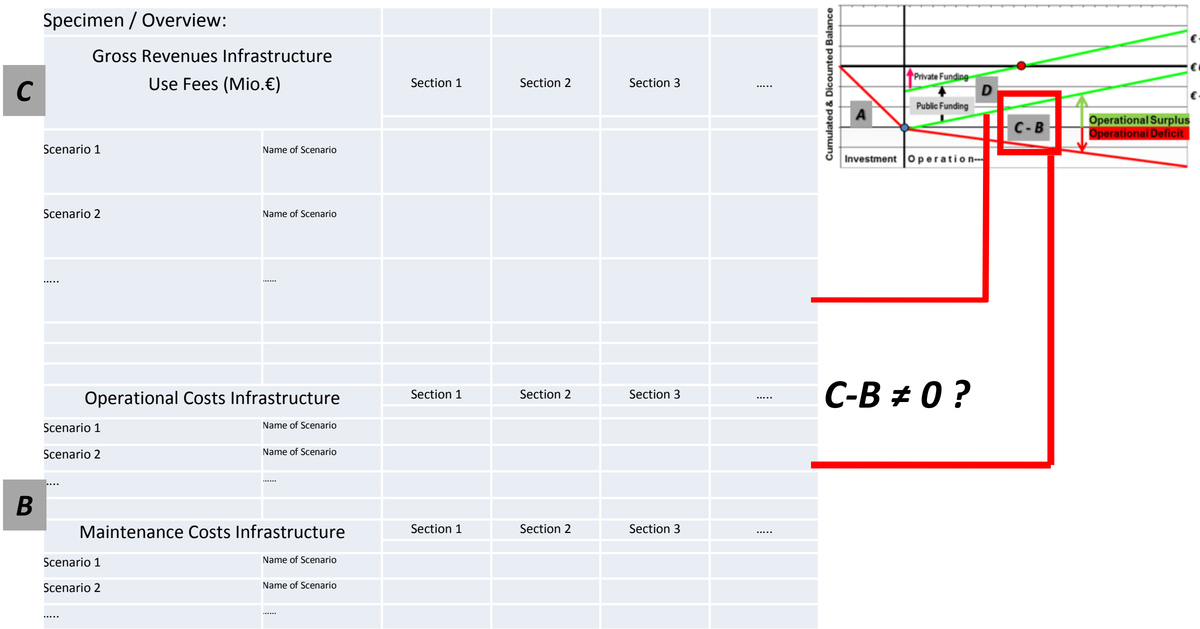
	Investments	Total Length	Costs Minimum	Cost Average	Cost Max	Average Costs Per KM
Scenario / Option		km	5%		95%	Mio. € / km
Option 1	Section 1A					
	Total land purchase					
	Total substructures, tunnels & bridges					
	Total rail infrastructure incl. electrification,					
	Total structural engineering					
	Total planning					
	.....					
	Total Construction					
Option 2	Section 2A					
Option 3	Section 3A					
......	....					

Source: TMC, 2013.

The investment costs were determined in conjunction with the involved railway companies or were supplied by the national development plans. They concern the costs published in the framework of national development policies. For the additional measures, the investment costs had to be estimated in conjunction with the train operating companies. Both costs were recorded during the forecast period in appropriate time pay-out locations for each scenario.

4.2.2 Indicator: Maintenance costs and operation costs

Figure 13: Data requirement - O&M costs / infrastructure use fees (access charges)



Source: TMC, 2013.

These costs were estimated by taking into account the cost per km for maintaining the track infrastructure and the rateable values of the maintenance costs of the stations.

The operating costs of the foreseen infrastructure investment were estimated on the basis of information supplied by the train operating companies. Operating and maintenance costs of additional infrastructure were calculated using the same ratio as between O+M costs and infrastructure investment for the foreseen measures. Since these results naturally show a relatively wide range of variation, they should be subjected to an appropriate sensitivity analysis.

4.2.3 Indicator: Infrastructure access charges

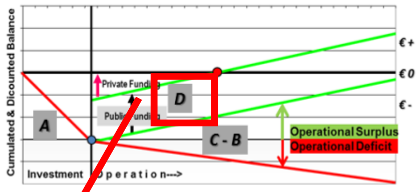
The calculation of the infrastructure access charges is based on the mathematic modelling of the passenger and freight volumes for rail transport for all scenarios from 2015-2030. Based on this information, the revenues for the infrastructure can be calculated via

- the number of trains for passenger and freight traffic, and
- the access charges (by taking into account the current access charges applied in AT, SK, HU, HR, SLO and I).

Infrastructure access charges are different in each country and can be separated into:

- access charges for fast and regional trains and
- access charges for freight traffic.

Figure 14: Sensitivity analysis: Calculation model



Investment Analysis		
	ASSUMPTIONS	
Discount Rate	5,00%	
Variation Investment Costs	100%	
Variation O&M Costs	100%	
Variation Revenues	100%	
Increase Revenues p.a.	2,0%	
Funding / finance		
	ASSUMPTIONS	
Equity	0,00%	
Return on Equity	1,50%	
Loans	100,00%	
Interest on Loans	5,00%	
EURIBOR	1,00%	
Spread on EURIBOR	0,50%	
Inflation	3,00%	

Source: TMC, 2013.

The procedure used for the financial analysis includes a sensitivity analysis, which serves as a tool for verifying the stability of the financial model versus alterations in the main input variables. Using an integrated Excel spreadsheet, the main input variables in the investment analysis are linked to calculation cells within the spreadsheet, providing the opportunity to change the input variable's base values by a certain percentage (with 100 % as the base value) and simultaneously observe the respective changes in the results (NPV, FIRR, discounted and cumulated cash flow graphs). An optional funding/financing section can also be added to the investment analysis: Provided that the results of the investment analysis produce viable figures (positive NPV, FIRR > 0 %), the financial model allows the calculation of the required annual cash flows including interest payments on loans and (if applicable) the cash flows needed to cover the requirements for a return on equity for the investor. This exercise is required to estimate the development of real cash flows and should be performed after a basic decision on the realisation of the measures has been taken.

4.3 Basic Requirements

A detailed description of the assessment procedure was provided in 4.2 and discussed in terms of overall results for the SETA corridor with all project partners (beyond the information previously given) with the aims of adapting the process to all parts of the SETA corridor and specifying the active participation required by the project partners. For this purpose, a binding list of requirements was drawn up in conjunction with all project partners. This list includes the following:

- the regional delineation of sections within each project area (as well as the mileage of the entire road network within the section)
- the infrastructure investment costs for the planned national infrastructure measures and for the additional measures
- the infrastructure maintenance and operation costs
- the infrastructure revenues (railway access charge)

The infrastructure measures per section always include the foreseen measures within the whole transportation network (WP 4.2), so that queries about the status of each planned infrastructure at specific points in time and the corresponding travel times for the entire corridor are possible. Furthermore, the results of the travel demand model were also taken into consideration, since this is where the network rerouting from one railway section to another (due to the better transport conditions) is calculated. Beside the infrastructure measures infrastructural operation measures also have to be considered. The economic break-even is determined by comparing the investment and maintenance costs of SETA-measures with the access charge (depending on the number of trains). Expanded by other regional and environmental effects, measures are selected to guarantee the fastest achievement of the economic break even.

4.3.1 Infrastructure investment costs

Investment figures for the railway infrastructure in the survey area have been collected and verified for RC 2020 (with investments between 2012 and 2020), RC 2030 (with investments between 2020 and 2030) and for the additional measures (AM), as proposed by the SETA project and which form part of the investment analysis.

The investment costs for the reference cases have been provided by the respective infrastructure operators in accordance with their respective national investment schedules (2015 (RC), 2020(RC), 2030(RC)) It should be noted here that binding investment plans could only be provided for the period from 2012 to 2020. For the period from 2020 to 2030, investment figures could only be obtained for measures in Croatia (Botovo-Zagreb, Zagreb-Rijeka) and Slovenia (Divaca-Koper).

Table 6: SETA corridor: RC investment measures and investment costs 2015-2030; Source: National development plans

	RC INFRASTRUCTURE MEASURES (national development plans)			
country	SETA - RAILWAY SECTION	TYPE OF MEASURES	INVESTMENT COSTS (MEUR)	YEAR OF REALISATION
AT	Wien-Meidling - Wien Blumental	2nd track, upgrading of stations and alignment	0,7	2018
	Wien-Blumental - Wampersdorf	2nd track	583,9	2020/2023
	Mosonszolnok - Porpac	Electrification	42,4	2015
	Szombathely - Zalaszentivan	Electrification	26,4	2015
HR	Koprvinica -Krizevci	2nd track, upgrading of stations and alignement, clearance gauge, axle load 22,5 t	237,8	2019
	Krizevci - Dugo Selo	2nd track, upgrading of stations and alignement, clearance gauge, axle load 22,5 t	175,9	2017
	Dugo Selo - Zagreb GK (Zapresic)	2nd track, upgrading of stations and alignement, freight train bypass, axle load 22,5 t	798,2	2022
	Zagreb GK - Karlovac	new double track line Leskovac-Karlovac, axle load 22,5 t	341,6	2018
	Karlovac - Ostarije	new double track line	202,2	2020
	Ostarije - Moravice	reconstruction of the existing railway line	376,8	2025
	Moravice - Skrljevo	reconstruction of the existing railway line, axle load, 20 t, double track n sections	1.244,7	2024
SLO	Koper - Divaca	alignment of a double track raillway line	1.197,4	2030
Total	Investment costs (MEUR)		**5.228,0**	
	Source: Austrian Federal Railways: Rahmenplan 2013-2018			

Source: TMC, 2013.

In total, the costs of the foreseen measures amount to 1.027 million EUR (2012-2020) and 4.201 million EUR (2020-2030).

Table 7: SETA corridor: RC planned investment cost (national development plans)

		Investment costs (in million €)							Year of disbursement of investment costs (in million €)														
		Total land purchase	Total structural engineering	Total substructure (tunnels, bridgess, e.g.)	Total Rail infrastructure and manufactured goods (electrification, safety, e.g.)	Total planning	Re-Investment costs	TOTAL INVESTMENT COSTS	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
2020 RC - **1.610** **Mio.€**																							
Austria	Burgenland																						
	Niederösterreich	0	0	0	0	0	0	584	76	86	99	77	65	85	53	32	11	0	0	0	0	0	0
	Wien																						
Slowakia	Bratislavský kraj																						
Hungary	Nyugat-Dunántúl	0	0	28	28	4	9	69	0	9	17	17	13	13	0	0	0	0	0	0	0	0	0
	Dél-Dunántúl																						
Slowenia	Vzhodna Slovenija																						
	Zahodna Slovenija																						
Croatia	Sjeverozapadna Hrvatska	31	138	195	49	0	0	414	123	53	71	95	71	0	0	0	0	0	0	0	0	0	0
	Jadranska Hrvatska	63	128	278	75	0	0	544	102	137	102	61	81	61	0	0	0	0	0	0	0	0	0
Italy	Friuli Venetia Giulia																						
2030 RC - **3.617** **Mio.€**																							
Austria	Burgenland																						
	Niederösterreich																						
	Wien																						
Slowakia	Bratislavský kraj																						
Hungary	Nyugat-Dunántúl																						
	Dél-Dunántúl																						
Slowenia	Vzhodna Slovenija																						
	Zahodna Slovenija	11	734	67	73	128	0	1.197	0	0	0	0	0	0	0	0	0	60	96	120	180	299	419
Croatia	Sjeverozapadna Hrvatska	112	376	152	159	0	0	798	0	0	0	0	0	239	319	239	0	0	0	0	0	0	0
	Jadranska Hrvatska	94	232	1.206	90	0	0	1.621	0	0	0	0	0	0	311	311	424	462	113	0	0	0	0
Italy	Friuli Venetia Giulia																						

Source: TMC, 2013.

The definition and estimation of the costs of the additional measures (AM) was carried out in close cooperation with the respective railway operators. It has been assumed that the additional measures will be effective by 2020 and that there will be no additional measures beyond 2020. The total costs of the proposed additional measures are as follows:

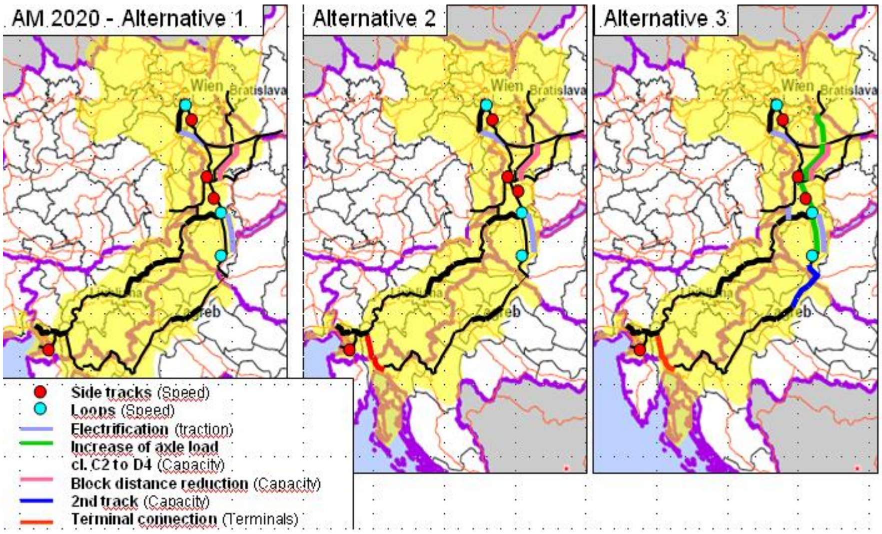
- 2012-2015: 3.73 million EUR
- 2015-2020 (2020 AM, Alternative 3, all projects): 690.3 million EUR

It cannot be expected and does not appear very realistic that the additional traffic generated by these measures will suffice to cover the additional investment costs. In an effort to identify the most effective and economic additional measures, three alternative AM options were developed:

- 2020 AM, Alternative 1: Totalling up to 150.2 million EUR and comprising all measures required to establish complete electrification.
- 2020 AM, Alternative 2: Totalling up to 339,3 million EUR (medium alternative) and comprising all measures in Alternative 1 as well as the additional measures required for the rehabilitation of the Skrljevo-Rijeka line in order to increase its capacity to the required level and facilitate cargo transport.
- 2020 AM, Alternative 3: Totalling up to 694,0 million EUR and comprising all

measures in Alternative 2

Figure 15: SETA corridor: Additional infrastructural measures 2013-2020



Source: TMC, 2013.

The tables on the following pages provide a detailed overview of the SETA investment measures.

Table 8: SETA corridor: Additional (AM) investment measures and investment costs

country	ADDITIONAL MEASURES (SETA MEASURES)	Investment costs million EUR 2020		
		Alternative 1	Alternative 2	Alternative 3
AT	Side tracks Neudörfl, Sauerbrunn, Mattersburg	2.8	2.8	2.8
	Electrification Wr.Neustadt - Sopron	28.4	28.4	28.4
	Loop Ebenfurth	44.8	44.8	44.8
	Side track "Steinbrunn"	13.0	13.0	13.0
HU	Bősárkány & Csorna reduction of block distance	0.7	0.7	0.7
	Hegyeshalom-Csorna increasing the loading class*			33.9
	Szombathely reduction of block distance+reconstruction of	7.5	7.5	7.5
	Csorna-Porpác increasing the loading class*			47.9
	Nagycenk & Lövő electrification of third side track	0.3	0.3	0.3
	Upgrading of Körmend-Zalalövö line (and electrification)			22.1
	Vasvar & Egervár lengthening of side tracks	0.6	0.6	0.6
	Increasing axle loading class Szombathely - Zalaszentivan*			44.4
	Electrification Zalaszentivan - Nagykanizsa	31.0	31.0	31.0
	Zalaszentiván loop	6.0	6.0	6.0
	Increasing axle loading class Zalaszentivan - Nagykanizsa*			44.5
	Nagykanizsa lenghten side track	2.4	2.4	2.4
	Loop Gyekenyes/Zarkany	6.0	6.0	6.0
HR	Second track Koprvinica-Kotoriba			161.9
	Dry port connection Skrljevo-Rijeka-Miklavje		189.1	189.1
SLO	Three side tracks Koper - Divaca	6.8	6.8	6.8
Total	Investment costs (MEUR)	**150.2**	**339.3**	**694.0**

* preliminary estimation

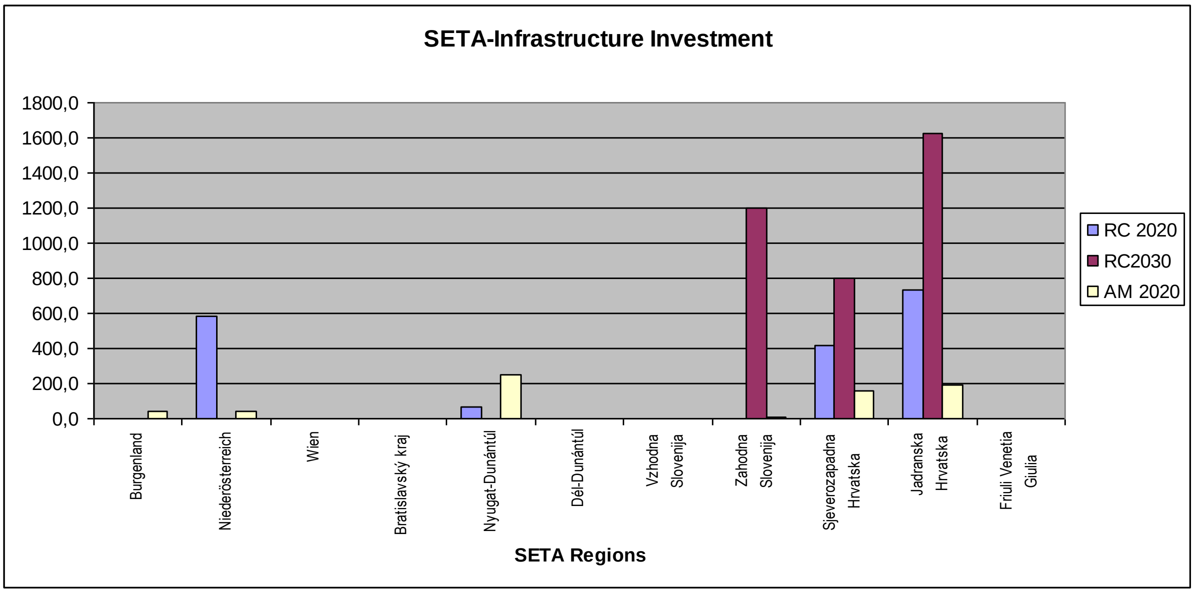
Source: TMC, 2013.

Table 9: Additional (AM) infrastructure investment per railway section

		Investment costs (in million EUR)							Year of disbursement of investment costs (in million EUR)															
Countries	NUT-S 2 Regions	Total land purchase	Total structural engineering	Total substructure (tunnels, bridgess, e.g.)	Total Rail Infrastructure and manufactured goods (electrification, safety, e.g.)	Total planning	Re-Investment costs	TOTAL INVESTMENT COSTS	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
2015 AM																								
Austria	Burgenland							3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Niederösterreich																							
	Wien																							
Slovakia	Bratislavský kraj																							
Hungary	Nyugat-Dunántúl	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dél-Dunántúl																							
Slovenia	Vzhodna Slovenija																							
	Zahodna Slovenija																							
Croatia	Sjeverozapadna Hrvatska																							
	Jadranska Hrvatska																							
Italy	Friuli Venetia Giulia																							
2020 AM Alternative 1																								
Austria	Burgenland	1	1	15	18	1	0	41	0	0	13	0	28	0	0	0	0	0	0	0	0	0	0	0
	Niederösterreich	1	0	4	34	6	0	45	0	0	5	10	30	0	0	0	0	0	0	0	0	0	0	0
	Wien																							
Slovakia	Bratislavský kraj																							
Hungary	Nyugat-Dunántúl	0	0	226	9	8	3	53	1	0	41	41	80	84	0	0	0	0	0	0	0	0	0	0
	Dél-Dunántúl																							
Slovenia	Vzhodna Slovenija																							
	Zahodna Slovenija	0	0	0	0	0	0	7	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0
Croatia	Sjeverozapadna Hrvatska	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jadranska Hrvatska	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Italy	Friuli Venetia Giulia																							
2020 AM Alternative 2																								
Austria	Burgenland	1	1	15	18	1	0	41	0	0	13	0	28	0	0	0	0	0	0	0	0	0	0	0
	Niederösterreich	1	0	4	34	6	0	45	0	0	5	10	30	0	0	0	0	0	0	0	0	0	0	0
	Wien																							
Slovakia	Bratislavský kraj																							
Hungary	Nyugat-Dunántúl	0	0	226	9	8	3	53	1	0	41	41	80	84	0	0	0	0	0	0	0	0	0	0
	Dél-Dunántúl																							
Slovenia	Vzhodna Slovenija																							
	Zahodna Slovenija	0	0	0	0	0	0	7	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0
Croatia	Sjeverozapadna Hrvatska	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jadranska Hrvatska	15	37	119	19	0	0	189	0	57	76	57	0	0	0	0	0	0	0	0	0	0	0	0
Italy	Friuli Venetia Giulia																							
2020 AM Alternative 3																								
Austria	Burgenland	1	1	15	18	1	0	41	0	0	13	0	28	0	0	0	0	0	0	0	0	0	0	0
	Niederösterreich	1	0	4	34	6	0	45	0	0	5	10	30	0	0	0	0	0	0	0	0	0	0	0
	Wien																							
Slowakia	Bratislavský kraj																							
Hungary	Nyugat-Dunántúl	0	0	226	9	8	3	246	1	0	41	41	80	84	0	0	0	0	0	0	0	0	0	0
	Dél-Dunántúl																							
Slovenia	Vzhodna Slovenija																							
	Zahodna Slovenija	0	0	0	0	0	0	7	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0
Croatia	Sjeverozapadna Hrvatska	10	79	59	15	0	0	162	0	0	0	40	81	0	0	0	0	0	0	0	0	0	0	0
	Jadranska Hrvatska	15	37	119	19	0	0	189	0	57	76	57	0	0	0	0	0	0	0	0	0	0	0	0
Italy	Friuli Venetia Giulia																							

Source: TMC, 2013.

Figure 16: Infrastructure investment (RC + AM) per railway section

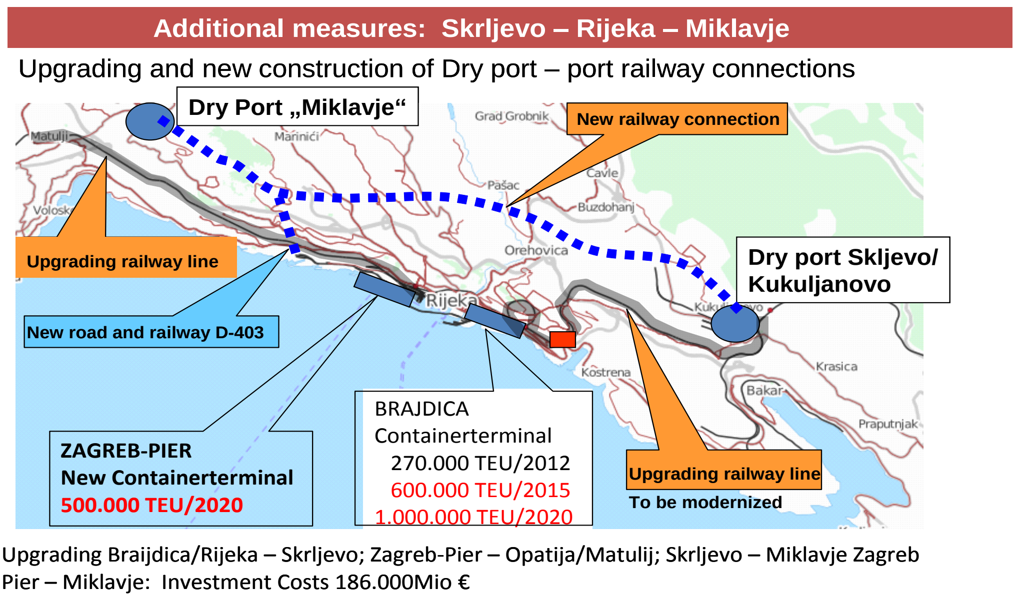


Source: TMC, 2013.

With the exception of Slovakia and Italy, all participating countries are affected by the additional measures. The majority of these measures involve minor infrastructural upgrades to increase the line capacity on single track lines and organisational measures to reduce travel times in both passenger and freight transport.

A major investment is foreseen primarily on the lines in Croatia, since about 50 % of the costs in Alternative 2 is accounted for by measures in Croatia. These measures are essential to ensure the planned capacity increase at the port of Rijeka. An additional prerequisite for handling the logistics of the cargo quantities foreseen for Rijeka is the realisation of inland ports/dry ports in the vicinity of the port.

Figure 17: Rijeka: Upgrading and new construction of dry port - port railway connections



4.3.2 Infrastructure maintenance and operating costs

The RC maintenance and operating costs for the different periods of time show the running costs of the existing infrastructure together with the additional costs for maintenance and operating of the planned infrastructure investments from 2015-2030.

Table 10: SETA corridor: RC operating and maintenance costs (in million EUR p.a.)

country	NUT-S 2 Regions	Operation costs RC, running costs p.a. (incl.measures RC) in million EUR		
		2015	2020	2030
Austria	Burgenland	8.37	9.46	10.54
	Niederösterreich	27.17	38.03	42.55
	Wien	1.95	2.24	2.58
Slovakia	Bratislavský kraj	1.28	1.28	1.28
Hungary	Nyugat-Dunántúl	19.32	25.36	28.42
	Dél-Dunántúl	0.00	0.00	0.00
Slovenia	Vzhodna Slovenija	18.53	23.61	25.97
	Zahodna Slovenija	16.61	17.06	29.78
Croatia	Sjeverozapadna Hrvatska	16.68	27.76	33.27
	Jadranska Hrvatska	26.91	50.57	69.85
Italy	Friuli Venetia Giulia	5.92	5.92	5.92
	Total	142.75	201.30	250.17

Source: TMC, 2013.

Based on the above, the maintenance costs for each of the additional measures had to be estimated in order to quantify the effect of the additional investment (AM) as proposed by the SETA project on O&M spending:

- Maintenance and operating costs for Alternative 1 were calculated at 2.14 million EUR (cost of proposed measures = 146.2 million EUR).
- Maintenance and operating costs of for Alternative 2 are expected to amount to 5.1 million EUR/p.a. (cost of proposed measures = 335.6 million EUR)
- Maintenance and operating costs for Alternative 3 amount to 10.5 million EUR (cost of proposed measures = 690.3 million EUR).

Table 11: O&M cost of additional measures 2015-2030

Operating costs for additional measures, Alternatives 1 - 3 in million EUR							
country	NUT-S 2 Regions	Operating costs AM, Alternative 1		Operating costs AM, Alternative 2		Operating costs AM, Alternative 3	
		2020	2030	2020	2030	2020	2030
Austria	Burgenland	1.07	1.07	1.07	1.07	1.07	1.07
	Niederösterreich	0.68	0.68	0.68	0.68	0.68	0.68
	Wien	0.00	0.00	0.00	0.00	0.00	0.00
Slovakia	Bratislavský kraj	0.00	0.00	0.00	0.00	0.00	0.00
Hungary	Nyugat-Dunántúl	0.19	0.19	0.19	0.19	1.87	1.87
	Dél-Dunántúl	0.00	0.00	0.00	0.00	0.00	0.00
Slovenia	Vzhodna Slovenija	0.00	0.00	0.00	0.00	0.00	0.00
	Zahodna Slovenija	0.20	0.20	0.20	0.20	0.20	0.20
Croatia	Sjeverozapadna Hrvat	0.00	0.00	0.00	0.00	3.73	3.73
	Jadranska Hrvatska	0.00	0.00	2.94	2.94	2.94	2.94
Italy	Friuli Venetia Giulia						
	Total	2.14	2.14	5.08	5.08	10.49	10.49

Source: TMC, 2013.

4.3.3 Infrastructure revenues (access charges)

The calculation of revenues derived from the train access charge is based on the currently applicable tariffs in the SETA-countries. Existing regional differences are not considered in the calculation:

$$IR = \sum ((Npt_{sec/c} \times Fp_c) + (Nft_{sec/c} \times Fc_c))$$

IR Infrastructure revenues
Npt Number of passenger trains
Nft Number of freight trains
C Country
Fp Fees for passenger trains
Fc Fees for cargo trains
Sec Railway section

Table 12: Access charges for use of infrastructure (2012)

		In Euro / Train-KM		
Country	*Length*	Fee Cargo Train	Fee Passenger Train Fast	Passenger Train (Regional)
AT	*90,00*	2,99	3,37	2,82
SK	*30,00*	2,03	1,31	2,03
HU	*403,80*	2,12	1,60	1,36
SI	*224,00*	0,93	0,56	0,37
HR	*306,90*	4,18	2,41	2,01
IT		-	-	-

Source: TMC, 2013.

The basis for the calculation of infrastructure access charges (access fees) in the forecast is the future number of trains, whereby a simplified procedure was chosen:

- The results of the transport demand model (number of passengers and tons/p.a. in cargo transport rail have been assigned to trains
- Consideration was given to
  - the maximum length of trains technically possible on the SETA corridor lines (currently 500 metres; 300 metres on certain sections of the line in Croatia)
  - the current technical specifications of cargo rolling stock
- The following assumptions were made
  - an empty wagon ratio of 20 %
  - an average net train payload of 450 tons/train
  - an average passenger capacity of 150 passengers/train

Table 13: Weights and measures of railway wagons

Weight and measures of railway wagons				
Railway Wagons	Total lenght in m	Net weight in t	max. payload in t	Tare in t (40`Container)
Regular railroad wagons.	10	13	20	
Container wagon	14	12.7	26	4.2
Lokomotives (Taurus)	19.3	86	0	
Trains	Length of train in m	Number of Wagons	Total Weight in t	Payload in t
500 m trains (regular)	500	41.4	1366	**828**
		38	1254	
300 m trains (regular)	300	21.4	706	**428**
500 m trains (container)	500	30	1144	**645**
300 m trains (container)	300	15	592	**333**
Container	Length in m	Net weight in t	max.payload in t	Total Weight in t
20 ft (TEU)	6.058	2.1	17.9	20
40 ft	12.192	4.2	25.8	30

Source: TMC, 2013.

Table 14: Calculation of revenues from access charges

freight trains: Calcualtion of revenues from access charges/Year/in M.Eur								
		Current	2015 RC	2015 RCAM	2020 RC	2020 RCAM	2030 RC	2030 RCAM
Austria	Burgenland	1,211	1,457	1,575	1,605	1,841	1,841	2,166
	Niederösterreich	3,012	3,012	3,012	3,936	4,139	4,139	5,132
	Wien							
Slowakia	Bratislavský kraj	0,091	0,131	0,140	0,149	0,235	0,190	0,240
Hungary	Nyugat-Dunántúl	3,051	4,825	4,982	5,687	8,065	7,555	8,532
	Dél-Dunántúl							
Slowenia	Vzhodna Slovenija	3,544	4,578	4,578	5,249	5,857	5,857	5,430
	Zahodna Slovenija	3,271	4,075	4,075	4,907	5,049	5,049	5,967
Croatia	Sjeverozapadna Hrvatska	2,149	2,433	2,664	4,340	5,613	5,613	6,269
	Jadranska Hrvatska	5,765	7,497	7,958	7,498	9,067	9,067	11,098
Italy		3,703	4,374	4,374	4,896	5,021	5,021	5,623
		25,797	**32,384**	**33,360**	**38,268**	**44,887**	**44,332**	**50,456**
passenger trains: Calcualtion of revenues from access charges/Year/in M.Eur								
		Current	2015 RC	2015 RCAM	2020 RC	2020 RCAM	2030 RC	2030 RCAM
Austria	Burgenland	0,839	0,900	0,994	0,982	1,230	1,360	1,696
	Niederösterreich	3,312	3,812	3,863	3,931	4,299	4,630	4,870
	Wien							
Slowakia	Bratislavský kraj	0,018	0,026	0,035	0,044	0,061	0,044	0,053
Hungary	Nyugat-Dunántúl	1,039	1,427	1,628	1,709	2,231	1,987	2,328
	Dél-Dunántúl							
Slowenia	Vzhodna Slovenija	1,119	1,151	1,151	1,116	1,137	1,116	1,116
	Zahodna Slovenija	0,589	0,604	0,621	0,593	0,562	0,578	0,578
Croatia	Sjeverozapadna Hrvatska	1,111	1,132	1,247	1,209	1,422	1,362	1,555
	Jadranska Hrvatska	2,572	2,572	2,774	2,572	3,140	4,362	4,580
Italy		0,893	0,863	0,863	0,918	0,883	0,921	0,921
		11,491	**12,487**	**13,176**	**13,075**	**14,965**	**16,359**	**17,696**
		37,289	44,871	46,536	51,343	59,852	60,691	68,152
all trains: Calcualtion of revenues from access charges/Year/in M.Eur								
		Current	2015 RC	2015 RCAM	2020 RC	2020 RCAM	2030 RC	2030 RCAM
Austria	Burgenland	2,050	2,357	2,569	2,587	3,072	3,201	3,862
	Niederösterreich	6,324	6,824	6,875	7,868	8,438	8,769	10,002
	Wien	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Slowakia	Bratislavský kraj	0,108	0,158	0,175	0,193	0,297	0,234	0,293
Hungary	Nyugat-Dunántúl	4,089	6,252	6,610	7,397	10,296	9,542	10,859
	Dél-Dunántúl	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Slowenia	Vzhodna Slovenija	4,663	5,729	5,729	6,365	6,994	6,973	6,546
	Zahodna Slovenija	3,860	4,680	4,696	5,500	5,611	5,627	6,545
Croatia	Sjeverozapadna Hrvatska	3,261	3,565	3,911	5,548	7,035	6,974	7,824
	Jadranska Hrvatska	8,337	10,069	10,732	10,070	12,207	13,429	15,678
Italy		4,596	5,237	5,237	5,815	5,904	5,942	6,543

Source: TMC, 2013.

4.4 Financial analysis - results

4.4.1 Calculated parameters

The calculated parameters are in line with the EU reference parameters for financial analysis:

- financial net present value FNPV(C), and
- financial rate of return FRR(C) on the total investment cost; measure the performance of the investment independently of the sources or methods of financing. The FNPV is calculated in accordance to the present value method and is expressed in monetary terms (EUR). Its value is also influenced by the assumption of the underlying discount rate.

The **financial internal rate of return** is defined as the discount rate that produces a zero FNPV:

$$FNPV = \Sigma\ [St\ /\ (1+FRR)t\ ] = 0$$

The calculation of the **financial return on investment** measures the capacity of the net revenues to remunerate the investment cost.

A rate of return which provides enough income to cover the opportunity cost(s) of the input is usually assumed to be necessary for an investment to be considered profitable. EU regulations designing the EU Cohesion/Structural Funds' interventions consider the level of profitability normally anticipated so that no over-financing occurs.

For a project to require an EU funding contribution, the net present value of the investment should usually be negative (and the financial rate of return lower than the applied discount rate). A very low or even negative financial rate of return does not necessarily mean that the project is not in keeping with the EU funding objectives, but only that it is not viable on the financial market.

Evaluators mainly use the FRR(C) to judge the future performance of an investment in comparison to other projects or to a benchmark required rate of return. This calculation also contributes to deciding if a project requires EU financial support: when the FRR(C) is lower than the applied discount rate (or the FNPV(C) is negative), then the revenues generated will not cover the costs, and the project needs EU funding assistance.

The financial net present value of capital, FNPV(K), is the sum of the net discounted cash flows that accrue to the project promoter due to the implementation of the investment project. The financial rate of return on capital, FRR (K), determines the return for the national beneficiaries (public and private sector combined).

When computing FNPV (K) and FRR (K), all sources of financing are taken into account, except for any EU contributions. These resources are taken as outflows (they are inflows in the financial sustainability account) instead of investment costs (as is the case in the calculation of the financial return on investment).

Even if the FRR (C) is expected to be very low or even negative for a public investment (especially for particular sectors, such as water), the FRR (K) will often be positive. As mentioned above, the EC standard financial discount rate is 5 % in real terms, and the return for the beneficiary should, in principle, be aligned with this benchmark. In fact, when a project expects a substantial positive FRR (K), this indicates that the grant from the EU would bring supra-normal profits to the national beneficiaries.

For the 2007-2013 programme period EU grants only finance part of the project 'funding gap', and the rest of the capital expenditure must be matched by other sources of finance, including loans and private contributions.

4.4.2 Financial analysis of SETA infrastructure investments - financial quick check

The SETA project partners assembled a series of infrastructural measures required to attract a maximum amount of future traffic flows to the rail system.

A sharp distinction has to be made between:

- infrastructure measures already proposed in the respective national investment plans (**RC**)
- additional measures (Alternative 3), as proposed by the SETA project partners (AM), and
- Alternatives 1 and 2 as selected additional measures which are a subset of all additional measures and result in the best cost-benefit ratio.

This document provides a "financial quick check". The results depicted herein are based on different expenditure and revenue data, as provided by the partners.

➔ The objectives of the financial quick check are to provide an initial insight into the financial viability of the measures and to establish a discussion basis for further elaboration.

A "static quick check" is a simple comparison of revenues vs. expenditures that ignores changes in values over time, inflation and – in particular – interest.

In the case of the data provided by the project partners, the investment costs for the additional measures are compared to the additional infrastructure access charges (→ calculation of a static amortisation period, i.e. the number of years required to cover expenditure through additional income.[11]

[11] Again without taking interest etc. into account and (in this case) also without taking O&M costs into account.

Table 15: Static quick check

	2015 AM	2020 RC	2020 AM 1	2030 RC
Investment (in million EUR)	3.7	1 940.8	146.2	4 169.7
Additional revenues (access charge)	1.7	6.8	8.5	9.3
Amortisation period	2.2	285.4	17.2	448.3

Source: TMC, 2013.

Calculations of infrastructure access charges are based on future train figures for the different scenarios.

4.4.3 Financial analysis of SETA infrastructure investments - dynamic investment analysis

Base financial scenario

From a methodological perspective, cash flow tables were calculated for the three scenarios for a 34-year period (i.e. from 2015–2049). These tables containing the following information for each year/scenario:

- **Investment costs**
- **O&M costs:** no assumptions on re-investment have been made by the project partners, which appears to be a sensible option given the high absolute level of operating and maintenance costs (O&M). For details on O&M, see the corresponding section in this document.
- **Revenues** from infrastructure usage fees.

A discount rate of 3 % was applied in the calculation of the financial indices (net present value [NPV], financial internal rate of return [FIRR]).

The dynamic investment analysis was performed for the reference case and was also carried out separately for the additional investments (selected SETA measures):

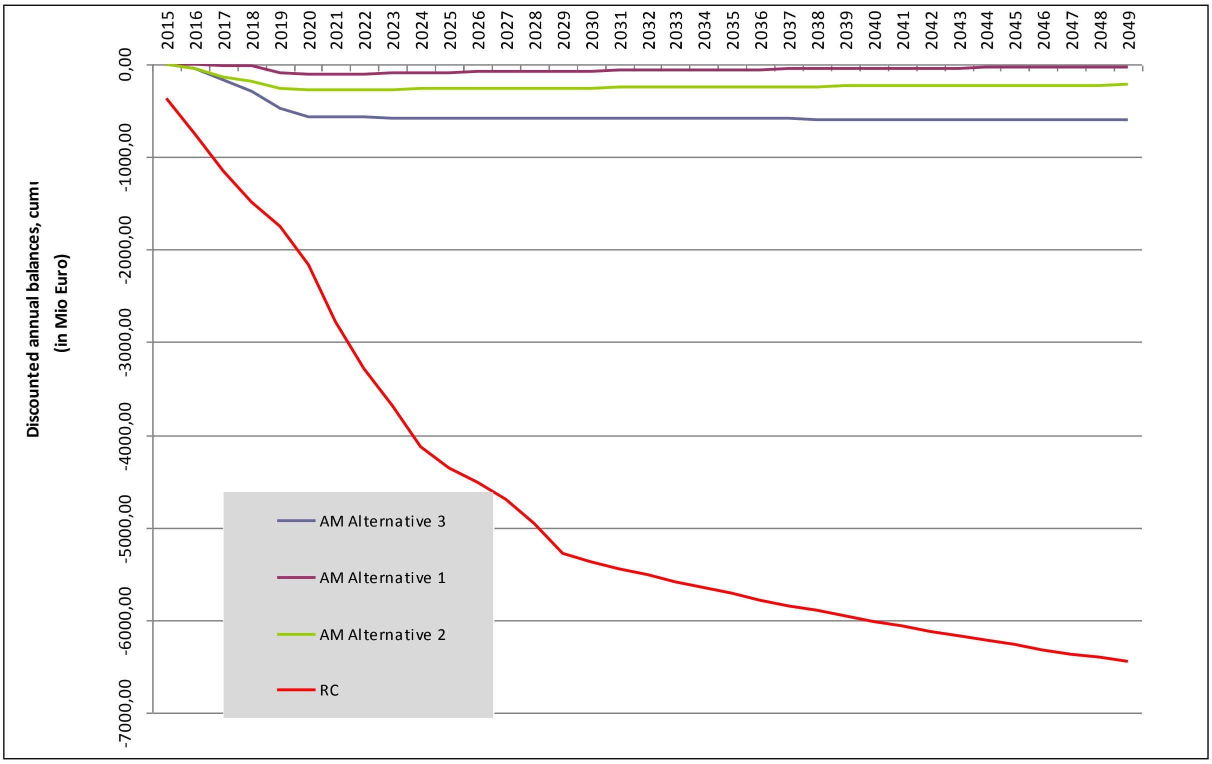
- RC: 5,228 million EUR, O&M 250.17 million EUR
- Alternative 1: 150.1 million EUR, O&M 2.09 million EUR
- Alternative 2: 339.2 million EUR, O&M 5.03 million EUR
- Alternative 3: 694.2 million EUR, O&M 10.44 million EUR

Revenues: The absolute income figures provided by the PPs were used in the analysis of the RC. In the case of the additional SETA measures, only additional revenues produced by these additional measures in comparison to the RC were introduced into the calculation.

Real discount rate: 3 %

The financial analysis includes a sensitivity analysis, which checks the stability of results when distinctive input parameters are changed. A **sensitivity analysis** was performed for the “critical” inputs, namely O&M and infrastructure fees.

Figure 18: Cumulated, discounted cash flows, SETA measures vs. RC



Source: TMC, 2013.

In the financial base scenario, none of the investment scenarios succeed in reaching a positive NPV (which is "normal" for railway infrastructure investments given the current financial market and production climates). The results of the financial base scenario analysis are as follows:

Table 16: Results of dynamic investment analysis, financial base scenario

	NPV	FIRR
RC	- 6.270,63	nn
AM ALTERNATIVE 3	- 598,40	nn
AM ALTERNATIVE 1	- 29,90	1%
AM ALTERNATIVE 2	- 221,88	nn

Source: TMC, 2013.

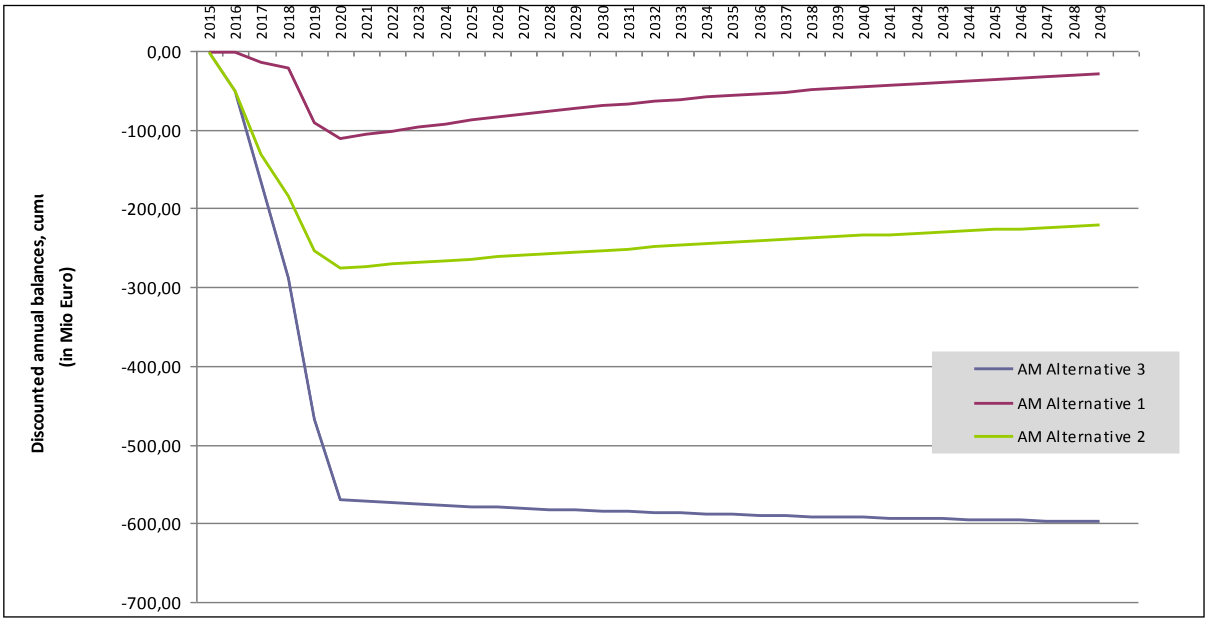
Nevertheless, Figure 18 clearly shows the excellent financial performance of the proposed SETA measures in comparison to the RC measures: whereas the cumulated and discounted annual income and expenditure totals show a sharp decline, the negative gradients of SETA Alternative 3 are significantly improving, with SETA Alternative 1 even showing a conversion to the x-axis, **still FIRR is positive (+1 %), whereas for all measures no FIRR could be calculated.**

This demonstrates that financial analysis alone cannot be selected as the most important issue for the infrastructure investment decision.

Based on the SETA Scenarios, Figure 19 shows a positive gradient only for Alternative 1 and 2, whereas for alternative 3 the gradient is negative.

The balance between O&M costs and infrastructure revenues is the main obstacle to financially successful railway investment and operations. It should be noted that with the exception of only a few financially viable operations, the railway infrastructure sector worldwide relies heavily on public spending.

Figure 19: Cumulated discounted cash flows, SETA measures only



Source: TMC, 2013.

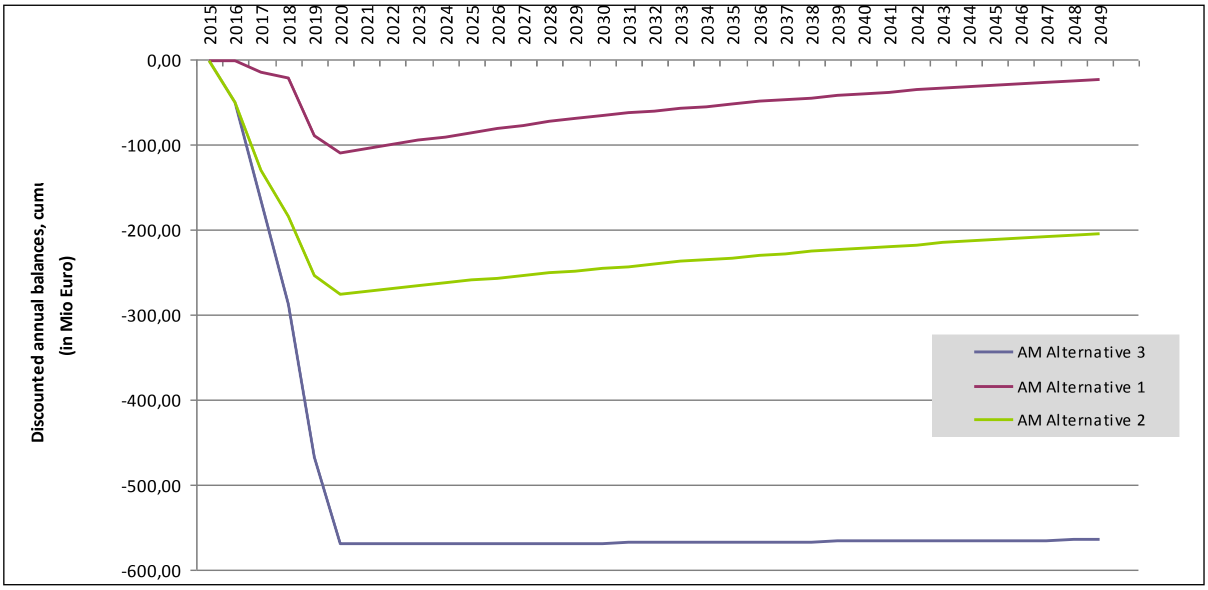
4.4.4 Sensitivity analysis

If we take a closer look at the balance between O&M figures and revenues as provided by the project partners (cost coverage of 20 %-30 %), it would appear that O&M costs (traditionally a “bottomless pit”) are over-estimated in the given context. For example, the Austrian railway infrastructure financing model, which was created in the 1990s by SCHIGmbH and has been applied since 2002 by ÖBB Infra, suggests a cost coverage level of 40 %.

In addition, the project partners share the opinion that the maintenance intensity of SETA measures is (comparatively) lower than investment in a completely new alignment.

The results of the dynamic investment analysis have therefore been re-calculated using reduced O&M costs for each SETA scenario. In more concrete terms, the O&M figures as used in the financial base scenario result in the following (assuming a reduction by 20 %):

Figure 20: Reduction in O&M costs by 20 %



Source: TMC, 2013.

Table 17: Results of dynamic investment analysis, O&M costs reduced by 20 %

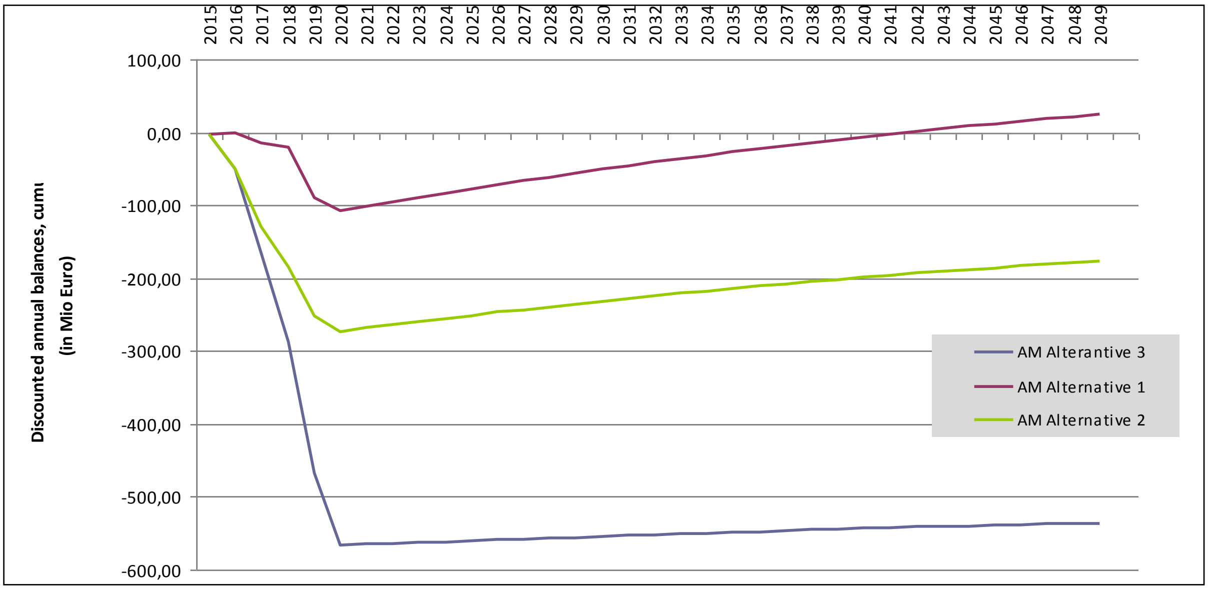
	NPV	FIRR
AM ALTERNATIVE 3	- 564,94	nn
AM ALTERNATIVE 1	- 23,03	1%
AM ALTERNATIVE 2	- 205,65	-5%

Source: TMC, 2013.

Given these assumptions, infrastructure scenario “AM Alternative 1” succeeds in producing a positive financial internal rate of return (FIRR) of 1 %, showing a “dynamic” break even (red line crosses x-axis) approximately in 2050.

Improving O&M efficiency in the railway sector will be a strategic policy in years to come, since otherwise European railways will never be able to deliver the modal split figures required by EU policy without being subject to heavy subsidisation. Accordingly, a decrease in O&M costs can be expected, as depicted above. In contrast, infrastructure usage fees will have to increase moderately in the years to come. Figure 21 shows the results of the addition of a 20 % increase in infrastructure revenues:

Figure 21: Reduction in O&M costs by 20 % and increase in infrastructure use fees by 20 %



Source: TMC, 2013.

Table 18: Results of dynamic investment analysis, O&M costs reduced by 20% and infrastructure access charge

	NPV	FIRR
ALTERNATIVE 3	- 535,87	nn
ALTERNATIVE 1	24,04	5%
ALTERNATIVE 2	- 176,58	-3%

Source: TMC, 2013.

Given this additional assumption, infrastructure scenario Alternative 1 results in a financial internal rate of return (FIRR) of 5 %, a positive NPV (24.04 million EUR) and a “dynamic” break even (red line crosses x-axis) in 2041.

Alternative 3 (all SETA measures) changes to a positive slope.

4.5 Results of the financial analysis

The (promising) results of the financial analysis are only one aspect of the decision on the realisation of the suggested measures in the SETA corridor. The results of the economic and environmental evaluations are an equally important factor in the recommendations. The main point here, however, is that the project's results clearly indicate the effectiveness of the proposed additional measures, which should therefore be integrated into the respective national investment plans.

From a financial perspective, the realisation of "Additional Measures, Alternative 1" is recommended given its comparatively favourable results:

- Positive results for "Additional Measures, Alternative 1", with a total investment of 160 million EUR (2012-2020)
- Partially positive results for "Additional Measures, Alternative 2", with a total investment of 339 million EUR
- Partially negative results for "All additional Measures, Alternative 3".

Alternative 1 includes the following measures:

Table 19: Recommended measures 1

country	ADDITIONAL MEASURES (SETA MEASURES)	Investment costs million EUR	
		2015	2020 Alternative 1
AT	Side tracks Neudörfl, Sauerbrunn, Mattersburg	2.8	
	Electrification Wr.Neustadt - Sopron		28.4
	Loop Ebenfurth		44.8
	Side track "Steinbrunn"		13
HU	Bősárkány & Csorna reduction of block distance	0.68	
	Szombathely reduction of block distance+reconstruction of station		7.5
	Nagycenk &Lövő electrification of third side track	0.25	
	Vasvar & Egervár lengthening of side tracks		0.55
	Electrification Zalaszentivan - Nagykanizsa		31
	Zalaszentiván loop		6
	Nagykanizsa lenghten side track		2.4
	Loop Gyekenyes/Zarkany		6
SLO	Three side tracks Koper - Divaca		6.8
Total	Investment costs 150,2 million EUR	**3.73**	**146.45**

Source: TMC, 2013.

Given the positive results of the economic and environmental evaluations, the realisation of AM/Alternative 2 can also be recommended. Further positive financial results can be achieved by cutting O&M costs for these additional measures by 20 %. In this context, it should be noted that increased efficiency and severe cost cuts are a major objective of all European railway infrastructure operators and will be crucial for the future development of the railway sector in Europe. While it is clear that there are (and will be) uncertainties, the discussions in the SETA project nonetheless offer strong indications that the general results can be qualified as realistic.

Consequently, the following measure has been included into the recommendation for realisation:

Table 20: Recommended measures 2

country	ADDITIONAL MEASURES (SETA MEASURES)	Investment costs million EUR	
		2015	2020 Alternative 2
HR	Dry port connection Skrljevo-Rijeka-Matulj		189.1
Total	Alternative 2 : Investment costs **339,3 million EUR**	**3.73**	**335.55**

Source: TMC, 2013.

No explicit evaluation was carried out with regard to the additional measures for 2015 (3.7 million EUR). Based on the results of the traffic model analysis, this investment would result directly in an annual increase in access fees of approx. 1 million EUR. Given the total investment of 3.7 million EUR, the (static) amortisation period is thus only four years. It is therefore recommended that these measures be realised as soon as possible.

All infrastructural measures must be accompanied by appropriate organisational measures, as summarised in the table below.

Table 21: SETA corridor: Organisational measures

country	ORGANISATIONAL MEASURES	
	SETA railway sections	Type of measures
AT	Wr.Neustadt -Sopron	new timetable considering new sidetracks (improve capacity)
SK	Rajka - Hegyeshalom	reduction of border crossing waiting time
		shortening bilateral authorization procedure for border crossing locomotives
		training of locomotive drivers for border crossing interoperability
HU/HR	Szombathely Station	acceleration of the dispatch of international trains
	Zalaegerszeg - Nagykanisza	Reduction of stops for international trains
	Gyekenyes-Botovo	customs clearance in the train (passenger trains)
		shortening bilateral authorization procedure for border crossing locomotives
		training of locomotive drivers for border crossing interoperability
SLO	Divaca-Koper	new operation program for optimal use of side tracks
SLO/HR	Pivka - Sapjane	shortening bilateral authorization procedure for border crossing locomotives
IT/SLO/HR	Monfalcone - Sezana - Rijeka	operation program for regular connection (Demotrain)

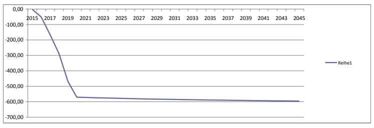
Source: TMC, 2013.

Table 22: SETA cash flow table (Alternative 3 – all measures)

SETA - Investment- and financial Analysis _ ALL MEASURES (20.9.2013)

Investment Analysis	
Discount Rate	3,00%
Variation Investment Costs	0,00%
Variation O&M	0,00%
Variation User Fee	0,00%
Financial Analysis	
Share of Equity of Total investment	
Expected Interest on Equity	
Share of Loans of total Investment	
Average effective InterestRate Loans	
EURIBOR	
Marge auf EURIBOR	
Inflation	0,00%
	0

Barwert: - 598,40
FIRR #ZAHL!



		0	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
INVESTMENT	**SELECTED MEASURES 1**	**Total**	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045				
Austria	Burgenland	41,40	-	-	13,00	-	28,40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	Niederösterreich	44,80	-	-	5,00	10,00	29,80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	Wien	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Slowakia	Bratislavský kraj	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Hungary	Nyugat-Dunántúl	250,15	4,24	-	40,96	40,96	79,87	84,12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	Dél-Dunántúl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Slowenia	Vzhodna Slovenija	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	Zahodna Slovenija	6,80	-	-	-	-	3,40	3,40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Croatia	Sjeverozapadna Hrvatska	161,96	-	-	-	40,49	80,98	40,49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	Jadranska Hrvatska	189,10	-	56,73	75,64	56,73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Italy		-																																			
	SUMME	694,21	4,24	56,73	134,60	148,18	222,45	128,01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				

OPERATION&MAINTENANCE		**Base Value**	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045				
Austria	Burgenland		0,029	0,029	0,029	0,029	0,029	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07
	Niederösterreich		-	-	-	-	-	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68
	Wien		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slowakia	Bratislavský kraj		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hungary	Nyugat-Dunántúl		0,019	0,019	0,019	0,019	0,019	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87	1,87
	Dél-Dunántúl		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slowenia	Vzhodna Slovenija		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Zahodna Slovenija		-	-	-	-	-	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Croatia	Sjeverozapadna Hrvatska		-	-	-	-	-	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73	3,73
	Jadranska Hrvatska		-	-	-	-	-	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94
Italy			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SUMME	0,000	0,05	0,05	0,05	0,05	0,05	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49	10,49

1

INFRASTRUCTURE USE FEES		**Base Value**	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045				
Austria	Burgenland		0,21	0,21	0,21	0,21	0,21	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66
	Niederösterreich		0,05	0,05	0,05	0,05	0,05	0,57	0,57	0,57	0,57	0,57	0,57	0,57	0,57	0,57	0,57	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23	1,23
	Wien		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slowakia	Bratislavský kraj		0,02	0,02	0,02	0,02	0,02	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06
Hungary	Nyugat-Dunántúl		0,36	0,36	0,36	0,36	0,36	2,90	2,90	2,90	2,90	2,90	2,90	2,90	2,90	2,90	2,90	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32	1,32
	Dél-Dunántúl		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slowenia	Vzhodna Slovenija		-	-	-	-	-	0,63	0,63	0,63	0,63	0,63	0,63	0,63	0,63	0,63	0,63	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43
	Zahodna Slovenija		0,02	0,02	0,02	0,02	0,02	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92
Croatia	Sjeverozapadna Hrvatska		0,35	0,35	0,35	0,35	0,35	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85
	Jadranska Hrvatska		0,66	0,66	0,66	0,66	0,66	2,14	2,14	2,14	2,14	2,14	2,14	2,14	2,14	2,14	2,14	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25	4,25
Italy																																					
	SUMME	0,000	1,66	1,66	1,66	1,66	1,66	8,42	8,42	8,42	8,42	8,42	8,42	8,42	8,42	8,42	8,42	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86	8,86

Annual Balance Expenditure / Revenues			2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045				
Austria	Burgenland		0,18	0,18	-12,82	0,18	-28,22	-0,59	-0,59	-0,59	-0,59	-0,59	-0,59	-0,59	-0,59	-0,59	-0,59	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41
	Niederösterreich		0,05	0,05	-4,95	-9,95	-29,75	-0,11	-0,11	-0,11	-0,11	-0,11	-0,11	-0,11	-0,11	-0,11	-0,11	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55
	Wien		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slowakia	Bratislavský kraj		0,02	0,02	0,02	0,02	0,02	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06
Hungary	Nyugat-Dunántúl		-3,90	0,34	-40,62	-40,62	-79,54	-83,09	1,03	1,03	1,03	1,03	1,03	1,03	1,03	1,03	1,03	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55	-0,55
	Dél-Dunántúl		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slowenia	Vzhodna Slovenija		-	-	-	-	-	0,63	0,63	0,63	0,63	0,63	0,63	0,63	0,63	0,63	0,63	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43	-0,43
	Zahodna Slovenija		0,02	0,02	0,02	0,02	-3,38	-3,49	-0,09	-0,09	-0,09	-0,09	-0,09	-0,09	-0,09	-0,09	-0,09	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72
Croatia	Sjeverozapadna Hrvatska		0,35	0,35	0,35	-40,14	-80,63	-42,73	-2,24	-2,24	-2,24	-2,24	-2,24	-2,24	-2,24	-2,24	-2,24	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88	-2,88
	Jadranska Hrvatska		0,66	-56,07	-74,98	-56,07	0,66	-0,80	-0,80	-0,80	-0,80	-0,80	-0,80	-0,80	-0,80	-0,80	-0,80	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31	1,31
Italy			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SUMME	-732,808	-2,62	-55,11	-132,98	-146,56	-220,84	-130,08	-2,07	-2,07	-2,07	-2,07	-2,07	-2,07	-2,07	-2,07	-2,07	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63	-1,63

Annual Balance Expenditure / Revenues - CUMULATED			2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045				
Austria	Burgenland		0,18	0,37	-12,45	-12,27	-40,48	-41,07	-41,66	-42,25	-42,84	-43,43	-44,02	-44,61	-45,20	-45,79	-46,38	-46,80	-47,21	-47,62	-48,04	-48,45	-48,86	-49,28	-49,69	-50,10	-50,52	-50,93	-51,34	-51,76	-52,17	-52,58	-52,99	-53,41	-53,82	-54,23	-54,65
	Niederösterreich		0,05	0,10	-4,85	-14,80	-44,55	-44,65	-44,76	-44,87	-44,98	-45,08	-45,19	-45,30	-45,41	-45,51	-45,62	-45,07	-44,51	-43,96	-43,40	-42,85	-42,29	-41,74	-41,18	-40,63	-40,07	-39,52	-38,97	-38,41	-37,86	-37,30	-36,75	-36,19	-35,64	-35,08	-34,53
	Wien		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slowakia	Bratislavský kraj		0,02	0,04	0,05	0,07	0,09	0,19	0,30	0,40	0,50	0,61	0,71	0,81	0,92	1,02	1,12	1,18	1,24	1,30	1,36	1,42	1,48	1,53	1,59	1,65	1,71	1,77	1,83	1,89	1,94	2,00	2,06	2,12	2,18	2,24	2,30
Hungary	Nyugat-Dunántúl		-3,90	-3,56	-44,18	-84,80	-164,34	-247,43	-246,40	-245,37	-244,34	-243,31	-242,28	-241,25	-240,22	-239,19	-238,16	-238,71	-239,26	-239,82	-240,37	-240,92	-241,47	-242,02	-242,57	-243,13	-243,68	-244,23	-244,78	-245,33	-245,88	-246,44	-246,99	-247,54	-248,09	-248,64	-249,19
	Dél-Dunántúl		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slowenia	Vzhodna Slovenija		-	-	-	-	-	0,63	1,26	1,89	2,52	3,15	3,78	4,40	5,03	5,66	6,29	5,87	5,44	5,01	4,58	4,16	3,73	3,30	2,88	2,45	2,02	1,60	1,17	0,74	0,32	-0,11	-0,54	-0,96	-1,39	-1,82	-2,24
	Zahodna Slovenija		0,02	0,03	0,05	0,07	-3,32	-6,81	-6,89	-6,98	-7,07	-7,15	-7,24	-7,33	-7,41	-7,50	-7,59	-6,87	-6,15	-5,43	-4,71	-3,99	-3,27	-2,55	-1,83	-1,11	-0,39	0,34	1,06	1,78	2,50	3,22	3,94	4,66	5,38	6,10	6,82
Croatia	Sjeverozapadna Hrvatska		0,35	0,69	1,04	-39,10	-119,74	-162,47	-164,71	-166,95	-169,20	-171,44	-173,68	-175,92	-178,17	-180,41	-182,65	-185,53	-188,41	-191,29	-194,17	-197,05	-199,93	-202,81	-205,68	-208,56	-211,44	-214,32	-217,20	-220,08	-222,96	-225,84	-228,72	-231,60	-234,48	-237,36	-240,24
	Jadranska Hrvatska		0,66	-55,40	-130,38	-186,45	-185,78	-186,59	-187,39	-188,19	-188,99	-189,79	-190,59	-191,39	-192,20	-193,00	-193,80	-192,49	-191,18	-189,87	-188,55	-187,24	-185,93	-184,62	-183,31	-182,00	-180,69	-179,38	-178,07	-176,76	-175,44	-174,13	-172,82	-171,51	-170,20	-168,89	-167,58
Italy			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SUMME	0,000	-2,62	-57,74	-190,72	-337,28	-558,12	-688,19	-690,26	-692,33	-694,39	-696,46	-698,52	-700,59	-702,66	-704,72	-706,79	-708,41	-710,04	-711,67	-713,29	-714,92	-716,55	-718,17	-719,80	-721,42	-723,05	-724,68	-726,30	-727,93	-729,56	-731,18	-732,81	-734,43	-736,06	-737,69	-739,31

Annual Balance Expenditure / Revenues - Discounted																																					
Austria	Burgenland		0,17	0,16	-11,06	0,15	-22,94	-0,47	-0,45	-0,44	-0,43	-0,41	-0,40	-0,39	-0,38	-0,37	-0,36	-0,24	-0,24	-0,23	-0,22	-0,22	-0,21	-0,20	-0,20	-0,19	-0,19	-0,18	-0,18	-0,17	-0,17	-0,16	-0,16	-0,15	-0,15	-0,14	-0,14
	Niederösterreich		0,05	0,05	-4,27	-8,33	-24,19	-0,08	-0,08	-0,08	-0,08	-0,08	-0,07	-0,07	-0,07	-0,07	-0,07	0,33	0,32	0,31	0,30	0,29	0,28	0,27	0,26	0,26	0,25	0,24	0,24	0,23	0,22	0,22	0,21	0,20	0,20	0,19	0,19
	Wien		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Slowakia	Bratislavský kraj		0,02	0,02	0,02	0,01	0,01	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,07	0,06	0,06	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Hungary	Nyugat-Dunántúl		-3,57	0,30	-35,04	-34,02	-64,67	-65,59	0,79	0,77	0,74	0,72	0,70	0,68	0,66	0,64	0,62	-0,32	-0,31	-0,31	-0,30	-0,29	-0,28	-0,27	-0,26	-0,26	-0,25	-0,24	-0,23	-0,23	-0,22	-0,21	-0,21	-0,20	-0,20	-0,19	-0,18
	Dél-Dunántúl		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Slowenia	Vzhodna Slovenija		0,00	0,00	0,00	0,00	0,00	0,50	0,48	0,47	0,45	0,44	0,43	0,42	0,40	0,39	0,38	-0,25	-0,24	-0,24	-0,23	-0,22	-0,22	-0,21	-0,20	-0,20	-0,19	-0,19	-0,18	-0,18	-0,17	-0,17	-0,16	-0,16	-0,15	-0,15	-0,14
	Zahodna Slovenija		0,01	0,01	0,01	0,01	-2,75	-2,75	-0,07	-0,06	-0,06	-0,06	-0,06	-0,06	-0,06	-0,05	-0,05	0,42	0,41	0,40	0,39	0,38	0,36	0,35	0,34	0,33	0,32	0,31	0,31	0,30	0,29	0,28	0,27	0,26	0,26	0,25	0,24
Croatia	Sjeverozapadna Hrvatska		0,32	0,31	0,30	-33,62	-65,56	-33,73	-1,72	-1,67	-1,62	-1,57	-1,53	-1,48	-1,44	-1,40	-1,36	-1,69	-1,64	-1,59	-1,55	-1,50	-1,46	-1,42	-1,38	-1,34	-1,30	-1,26	-1,22	-1,19	-1,15	-1,12	-1,09	-1,05	-1,02	-0,99	-0,96
	Jadranska Hrvatska		0,61	-49,81	-64,68	-46,96	0,54	-0,63	-0,61	-0,60	-0,58	-0,56	-0,55	-0,53	-0,51	-0,50	-0,48	0,77	0,75	0,73	0,70	0,68	0,66	0,64	0,63	0,61	0,59	0,57	0,56	0,54	0,52	0,51	0,49	0,48	0,47	0,45	0,44
Italy			0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	SUMME		-2,40	-48,97	-114,71	-122,74	-179,56	-102,68	-1,58	-1,54	-1,49	-1,45	-1,41	-1,37	-1,33	-1,29	-1,25	-0,96	-0,93	-0,90	-0,87	-0,85	-0,82	-0,80	-0,78	-0,75	-0,73	-0,71	-0,69	-0,67	-0,65	-0,63	-0,61	-0,60	-0,58	-0,56	-0,54

Annual Balance Expenditure / Revenues - Discounted Cumulated			2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2045	2045	2045	2045
Austria	Burgenland		0,17	0,33	-10,73	-10,57	-33,52	-33,98	-34,43	-34,87	-35,30	-35,71	-36,11	-36,50	-36,88	-37,25	-37,61	-37,85	-38,09	-38,31	-38,54	-38,75	-38,96	-39,16	-39,36	-39,55	-39,74	-39,92	-40,10	-40,27	-40,43	-40,59	-40,75	-40,90	-41,05	-41,19	-41,33
	Niederösterreich		0,05	0,09	-4,18	-12,51	-36,70	-36,78	-36,87	-36,95	-37,02	-37,10	-37,17	-37,24	-37,31	-37,38	-37,44	-37,12	-36,80	-36,50	-36,20	-35,91	-35,63	-35,35	-35,09	-34,83	-34,58	-34,34	-34,10	-33,88	-33,65	-33,44	-33,23	-33,03	-32,83	-32,64	-32,45
	Wien		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slowakia	Bratislavský kraj		0,02	0,03	0,05	0,06	0,08	0,16	0,24	0,32	0,39	0,46	0,53	0,60	0,67	0,73	0,80	0,83	0,86	0,90	0,93	0,96	0,99	1,02	1,04	1,07	1,10	1,12	1,15	1,17	1,20	1,22	1,24	1,26	1,28	1,30	1,32
Hungary	Nyugat-Dunántúl		-3,57	-3,27	-38,31	-72,33	-137,00	-202,59	-201,80	-201,03	-200,29	-199,57	-198,87	-198,19	-197,52	-196,88	-196,26	-196,58	-196,90	-197,20	-197,50	-197,79	-198,07	-198,34	-198,60	-198,86	-199,11	-199,35	-199,58	-199,81	-200,03	-200,24	-200,45	-200,65	-200,85	-201,04	-201,23
	Dél-Dunántúl		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slowenia	Vzhodna Slovenija		-	-	-	-	-	0,50	0,98	1,45	1,90	2,34	2,77	3,19	3,59	3,98	4,36	4,11	3,87	3,63	3,40	3,18	2,97	2,76	2,55	2,35	2,16	1,97	1,79	1,62	1,45	1,28	1,12	0,96	0,81	0,66	0,52
	Zahodna Slovenija		0,01	0,03	0,04	0,06	-2,69	-5,45	-5,51	-5,58	-5,64	-5,70	-5,76	-5,82	-5,87	-5,93	-5,98	-5,56	-5,15	-4,75	-4,36	-3,99	-3,62	-3,27	-2,92	-2,59	-2,26	-1,95	-1,64	-1,35	-1,06	-0,78	-0,51	-0,24	0,01	0,26	0,50
Croatia	Sjeverozapadna Hrvatska		0,32	0,62	0,92	-32,70	-98,26	-131,99	-133,71	-135,38	-137,00	-138,57	-140,10	-141,58	-143,02	-144,42	-145,77	-147,46	-149,11	-150,70	-152,25	-153,75	-155,21	-156,63	-158,00	-159,34	-160,63	-161,89	-163,11	-164,30	-165,45	-166,57	-167,65	-168,71	-169,73	-170,73	-171,69
	Jadranska Hrvatska		0,61	-49,21	-113,88	-160,84	-160,30	-160,93	-161,55	-162,14	-162,72	-163,28	-163,83	-164,36	-164,87	-165,37	-165,86	-165,09	-164,34	-163,61	-162,91	-162,23	-161,56	-160,92	-160,29	-159,68	-159,09	-158,52	-157,96	-157,42	-156,90	-156,39	-155,89	-155,41	-154,95	-154,50	-154,06
Italy			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SUMME	0,000	-2,40	-51,37	-166,08	-288,83	-468,38	-571,07	-572,65	-574,19	-575,68	-577,13	-578,54	-579,90	-581,23	-582,52	-583,77	-584,72	-585,65	-586,55	-587,42	-588,27	-589,10	-589,90	-590,67	-591,43	-592,16	-592,87	-593,56	-594,23	-594,88	-595,51	-596,12	-596,72	-597,30	-597,86	-598,40

Source: TMC, 2013.

5 Short-term economic effects (IHS)

5.1 Description of method

5.1.1 Multi-regional input-output model to assess the impact of construction and maintenance on regional development

An input-output analysis, among other methods, was used as an instrument to quantify the short- and medium-term economic effects of the SETA corridor. This analysis and the necessary input-output tables are explained in detail on the following pages. Since this method should be applied not only at the national level but also at the regional level, a (multi-)regionalisation of the existing national input-output tables – provided by the national statistics offices – was required.

5.1.2 Input-output analysis

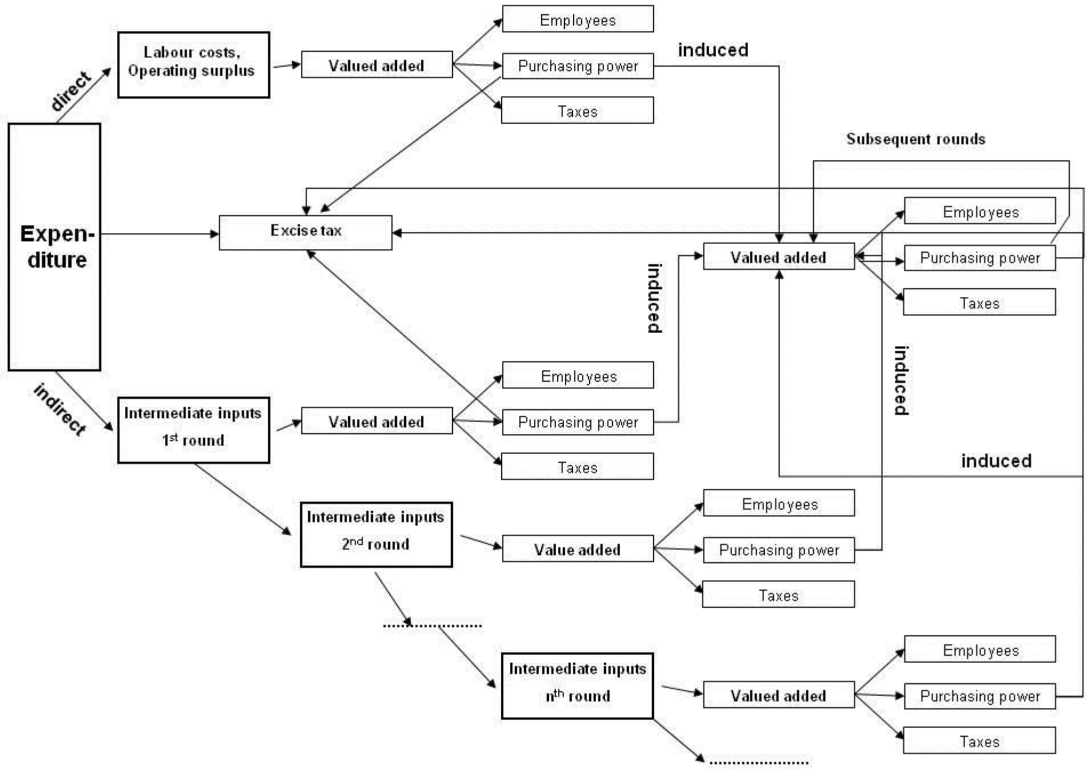
Input-output analysis was used as an instrument for the quantification of the economic implications of the SETA corridor.

The input-output analysis method is based on the work of Leontief (1936), who considered the overall economy as a system of sectors that absorb and render flows of services.[12] Leontief's central concept was that a regional primary demand induces further demands for intermediate inputs. These intermediate inputs are purchased from a specific geographical region, or a foreign country, and in turn generate regional intermediate input purchases, and so on. In an input-output table, these linkages are displayed in such a way that the respective demand and supply structures are related to specific sectors.

Input-output analysis allows for the computation of direct and indirect value creation effects, purchasing power effects and employment effects caused by demand for particular services (e.g. education or investment goods). It also allows the calculation of the effects on both overall economic tax revenues and social security contributions – separated by public authorities. A simplified structure of an input-output analysis is displayed schematically in Figure 22.

[12] The 1973 Nobel Prize in Economic Sciences was awarded to Wassily W. Leontief (1906-1999) for the development of the input-output-method and for its application to important economic problems (Nobel Media AB).

Figure 22: Illustration of value creation effects, employment effects, purchasing power effects, and fiscal effects.



Source: IHS – Institute for Advanced Studies, 2013.

Input-output analysis is based on very detailed (compared to standard macroeconomic models) input-output tables, which are compiled as a supplement to national accounts and show the linkages between individual production sectors of an economy as well as their contributions to value creation. Derived from the interdependencies between preceding services and from the input structure, value creation and employment multipliers can be calculated to depict the correlation between final demand and total production of goods.

The results show the cumulative effects of the construction and operation of the examined institutions on the economy.

These effects are enhanced multiplicatively through macroeconomic interdependencies in addition to so-called “first round effects”. The original expenses induce upstream effects in subsequent phases as well as multiplier effects, because every enterprise requires products and services as well as feedstock, additives, and working materials from other industries. In order to calculate such upstream effects drawing on first round effect values, multipliers derived from the input-output table are used. The extent of the multiplication effect depends primarily on the structure of the macroeconomic interdependencies between the most considerably stimulated industries and other industries, i.e. on the capital flows for labour and material costs, and how they are passed on to follow-up orders. It should also be considered that upstream services can be procured both on domestic and foreign markets. However, primary effects on a region are caused only by expenditures that do not flow abroad, i.e. expenditures that do not finance imports.

5.1.3 Regionalisation of the input-output tables

To achieve the objectives of this project, (multi-)regional input-output tables had to be generated from the existing national input-output tables provided by the national statistics offices. The national tables do not include regional data[13], and regional input-output tables are only available in very exceptional cases. However, an interest in economic analysis at the regional level makes it necessary to regionalise national input-output models so as to reflect specific regional problems. In formal terms, these regional input-output tables do not differ from those for the overall economy.

As a general rule for the smaller economic entities considered, dependence on trade with economic units located "outside" is larger – both as export markets for its own regional products as well as for suppliers of the necessary inputs for regional production. The amount of this leakage to the “outside” through imports from abroad or from other provinces has to be estimated.

The tables created for individual regions or provinces (regional input-output tables) depict their macroeconomic ties, but not in their totality, since multiplier effects from other regions in particular cannot be considered.

The multi-regional input-output table therefore represents a necessary enhancement of the regional input-output tables. It links all relevant regions and those to be considered in a single table, so that in addition to intra-regional (within a region) links, any inter-regional (between the individual regions) links can also be presented. Based on the multi-regional input-output table, economic effects triggered at the regional level as well as those induced in other regions and economic impulses from abroad can be calculated.

5.1.4 Types of classifications

In this report, two different types of classifications are used, one to classify companies, and the other to classify the production of goods.

The CPA[14] classification is used for the production of goods. The goods produced are classified by type (such as services in the accommodation sector or chemical products). In contrast, companies (such as accommodation companies or chemical companies) are classified according to NACE[15] codes. These two classifications correspond to each other, so that, in general, each type of product in the CPA has a corresponding type of company in NACE. Companies can offer products not only from their own sector but also those from other sectors (e.g. farms frequently also offer accommodation services, while accommodation companies often offer catering, retail or spa services). EUROSTAT therefore classifies companies according to their “most important” good.

If we consider, for example, economic performance, significantly different results can be achieved depending on the classification type. In the year 2005, added value in Slovenia in

[13] Regional data are aggregated before they advect into the national accounts or into the national input-output tables.
[14] Classification of Products by Activity.
[15] Nomenclature statistique des activités économiques dans la Communauté Européenne.

the "hotel and restaurant services" sector amounted to 622 million EUR (CPA).[16] In contrast, "hotels and restaurants" provided added value of up to 557 million EUR (NACE).[17]

An overview of the applicable sectors classified according to CPA or NACE (using the second level, two-digit classifications[18]) and including their full designations has been provided as an Appendix to this report (pp. 136).

In accordance with CPA 2008, the following hierarchical structure for the classification of goods with six levels, each identified with a specific code, is used:

Table 23: CPA 2008 goods classification

Level		CPA 2008	Δ CPA 2002	Designation (Code)
1)	First level:	21	+4	Segments (alphabetic code)
2)	Second level:	88	+ 26	Departments (two-digit numeric code)
3)	Third level:	261	+ 38	Groups (three-digit numeric code)
4)	Fourth level:	575	+ 73	Classes (four-digit numeric code)
5)	Fifth level:	1342	+ 196	Categories (five-digit numeric code)
6)	Sixth level:	3142	+ 534	Subcategories (six-digit numeric code)

N.B.: Δ CPA 2002 gives the change in the number of groups in each goods classification by the 2008 CPA revision.

Source: EUROSTAT, 2013.

5.1.5 Construction of the input-output tables

Input-output statistics are an essential part of national accounts, and their preparation is carried out mostly according to standardised international concepts and rules. The international standard is the "System of National Accounts" 1993 (SNA 93); its European counterpart is the "European System of National Accounts" (ESA 95). Symmetric input-output tables consolidate production and use of goods and services in a single table.

The national input-output table is built upon a goods x goods matrix. This means that the items are listed according to CPA classification in both the rows and columns. Intermediate demand can be read from this representation, which represents all goods inputs for the entire production of domestically produced goods. Analogously, the rows represent the added value of the corresponding amount of value added for the total production of a good. Additionally, final demand, or the amount demanded by the consumption of individual goods, can be read in the columns. Input-output tables can be divided into three sections, which are commonly referred to as quadrants:

1st Quadrant (intermediate demand):

The first quadrant (marked in yellow in Table 24) represents the actual core of the input-output table and covers supplies and procurement for the individual sectors (intermediate demand). All of the goods needed to meet intermediate demand, both those obtained from

[16] Slovenian input-output table 2005 (Statistics Office of the Republic of Slovenia).
[17] Slovenian use table 2005 (Statistics Office of the Republic of Slovenia).
[18] The goods and the economy will be divided respectively here in 88 sectors.

domestic (or regional) production and those obtained from imports, are shown here. It immediately becomes evident that the inputs in a given production area no longer correspond to the inputs in the corresponding economic sector (the use table[19]), but instead depict – both in absolute terms and in the structure of the goods - only those goods and services necessary to produce the goods that are characteristic of the production area.

2nd Quadrant (final demand):

The second quadrant (marked in blue in

Table 24) includes the individual components of the final demand. The use of those goods that directly meet final demand is divided here into consumption expenditures, gross investments, changes in inventories and exports. In addition, final demand is differentiated between domestic (or regional) and foreign production.

3rd Quadrant (added value/primary operating expense):

The third quadrant (marked in orange in

Table 24) depicts the added value in different production areas, divided into their individual components, or the primary production inputs for production in different sectors. For each production area, the matrix indicates how much of each value added component was used for the production of specific goods. Wages, depreciation, and operating surpluses are displayed in this quadrant.

The fourth quadrant shows the interdependence of primary operating expenditures and final demand (2nd and 3rd quadrants).[20]

[19] The symmetric input-output tables are derived from the supply and use tables.
[20] Not shown as a rule.

Table 24: Basic structure of an input-output table

	good 1	.....	**good n**	**final demand**	**sum**
good 1	z_{11}	......	z_{1n}	Y_1	Σ_1
⋮	⋮	......	⋮	⋮	⋮
good n	z_{n1}	.....	z_{nn}	Y_n	⋮
imports 1	m_{11}	.....	m_{1n}	my_1	⋮
⋮	⋮	.....	⋮	⋮	⋮
imports n	m_{n1}	.....	m_{nn}	my_n	Σ_n
added value	W_1	.....	W_n		
production	X_1	.....	X_n		

Source: IHS - Institute for Advanced Studies, 2013.

5.1.6 Construction of the use table

Intermediate demand by all economic sectors, along with the breakdown of intermediate goods used by all economic sectors for production, can be read from the use table. It is constructed schematically like the input-output table, but with a difference in the linkages. While the input-output table represents links between goods, the use table is a CPA x NACE matrix. Therefore, classes of goods are shown in the rows, while economic sectors (so-called “activities”) are listed in the columns. From the use table, the inputs required for the production of a manufacturing sector in the domestic economy can be read. In addition, the use of individual goods in the different economic sectors is represented. As in the input-output table, added value is also specified in one row, but in this case by economic sector. Again, the final demand is also shown. Any imports contained therein can be listed in separate rows.

The use table shows both basic prices and purchaser prices. The difference here lies in the (non-)consideration of trade and transport margins and goods taxes and the fewer subsidies for products. As with the input-output table, the use table is divided into quadrants. Here, too, the first quadrant represents the intermediate demand structure, with the use of goods in the various economic sectors. The second quadrant accounts for the final consumption of goods and exports in production, and the third quadrant gives the added value in the economic sectors.

The second quadrant accounts for the final consumption of goods and exports in production, and the third quadrant gives the added value in the economic sectors.

Table 25 shows the basic structure of a use table.

Table 25: Basic structure of a use table

	sector 1	.....	**sector** n	**final demand**	**sum**
good 1	z_{11}	......	z_{1n}	Y_1	Σ_1
⋮	⋮	......	⋮	⋮	⋮
good n	z_{n1}	.....	z_{nn}	Y_n	⋮
imports 1	m_{11}	.....	m_{1n}	my_1	⋮
⋮	⋮	.....	⋮	⋮	⋮
imports n	m_{n1}	.....	m_{nn}	my_n	Σ_n
added value	W_1	.....	W_n		
production	X_1	.....	X_n		

Source: IHS - Institute for Advanced Studies, 2013.

5.1.7 Construction of the supply table

In contrast to the use table, in which the intermediate demand and final demand for goods are specified according to economic classification, in the supply table the economic sectors that produce (domestic) goods are shown – again using a CPA x NACE matrix. The columns indicate individual economic sectors, while individual goods can be read row by row according to their manufacturing sectors. In addition to domestic supplies, imported goods (valued at CIF[21] prices) are also reported in the table. Overall, the supply table represents the production values for individual economic sectors and imports (quadrant I).

In the supply table, with the transition from basic prices to purchaser prices, the trade and transport margins, as well as the goods taxes less subsidies, are added. Table 26 shows the basic structure of a supply table.

[21] Cost, Insurance and Freight.

Table 26: Basic structure of the supply table

	sector 1	.....	sector n	imports	trade and transport margins	goods taxes less subsidies	sum
good 1	z_{11}	......	z_{1n}	m_1	H_1	S_1	Σ_1
⋮	⋮	......	⋮	⋮	⋮	⋮	⋮
good n	z_{n1}	.....	z_{nn}	m_n	⋮	⋮	⋮
goods supply	X_1	.....	X_n				

Source: IHS - Institute for Advanced Studies, 2013.

5.1.8 Methodology of the input-output analysis

As already mentioned, the input-output table represents the starting point for an input-output analysis. For a more detailed description of the methodology, see the information on the basic structure of an input-output table provided above (see Table 24).

The first quadrant, or *intermediate demand matrix*, describes the exchanges of products between sectors. These exchanges are also referred to as inter-sectoral flows. They are measured for a certain period of time (usually one calendar year) and are expressed in monetary units. If n represents the number of sectors, the first quadrant is basically a (2n x n) matrix: n sectors (in the columns) receive domestic intermediate demand from n sectors (rows) and from imports (also n sectors). The domestic intermediate demand from sector i to sector j is given as z_{ij}, and that of imported inputs as m_{ij} (i, j = 1, ..., n).

Final demand (quadrant II) refers to the demand for goods and services that are not used as inputs for the production process. Final demand is divided into five major areas:

- consumer expenditures by private households, C
- investments, V
- inventory changes, H
- government expenditures, G
- exports, E.

The first four components are often grouped under the term “domestic final demand”, while exports are also referred to as a “foreign final demand”. The final demand itself is abbreviated as Y and is defined as follows:

$$Y_i = C_i + V_i + H_i + G_i + E_i$$

This equation is valid for each sector i, i=1,..., n.

When read column by column, the added value matrix (quadrant III) shows the distribution of the value added components among economic sectors and, when read row by row, the composition of the added value in a particular sector. The individual components of the added value matrix are notably:

- labour costs, L, and
- other components, such as investment income, crop yields, profits and net goods taxes, which are combined and represented by N.

Added value itself is abbreviated as W, and is defined as follows:

$$W_i = L_i + N_i$$

By introducing all these elements together, the result is a table that defines the basic structure depicted in Table 24.

In abbreviated terms

z_{ij}	...	domestic intermediate demand (flows) from sector i to sector j;
m_{ij}	...	imported intermediate demand from sector i to sector j;
Y_i	...	total final demand for domestic goods of sector i;
my_i	...	total final demand for imported goods of sector i;
X_i	...	total domestic output from sector i;
mx_i	...	imported goods of sector i;
W_j	...	value added in sector j;
S_j	...	net goods taxes in sector j

For each sector n, the production equals demand:

$$\sum_{i=1}^{n} z_{ij} + \sum_{i=1}^{n} m_{ij} + S_j + W_i = X_i = \sum_{j=1}^{n} z_{ij} + Y_i \qquad i, j = 1, \ldots, n.$$

If the composition of consumption by domestic production in sector i, X_i, is considered,

$$X_i = \sum_{j=1}^{n} z_{ij} + Y_i \qquad i=1, \ldots, n$$

then this shows the distribution of the output of sector i to other sectors (intermediate demand used) and to the final demand Y in sector i. This equation can be used to represent each sector i = 1, ..., n.

For the purposes of further analysis, it is assumed that inter-industrial flows from i to j depend on the total output of sector j in a given period of time. Constant returns to scale are also assumed here, so that an increase in all inputs by a certain factor leads to an increase in output by exactly this factor. The ratio of domestic intermediate consumption of sector i to output j can therefore be defined as follows:

$$a_{ij} = \frac{z_{ij}}{X_j} = \frac{\text{Stream of inputs}}{\text{Output}}$$

These n x n ratios can be interpreted as domestic (or regional) customer-supplier relationships. The output of each sector X_j can be represented by means of these coefficients as a function of the input needs of all sectors from this output, so that:

$$X_j = \sum_{i=1}^{n} a_{ij} X_i + Y_j \qquad j = 1, \ldots, n.$$

As already mentioned, input-output analysis offers the possibility to quantify the outgoing added value and employment effects that result from a change in final demand (including private consumption, public consumption, investment and exports). In doing so, not only can the direct effects be determined, but through the use of an inverse Leontief matrix $(I-A)^{-1}$ as the core of an open static input-output model (Pischner and Stäglin (1976)), the indirect effects can also be determined due to linkages in intermediate demand.

With the final demand Y_i as well as the coefficients a_{ij} known, the values X_1 to X_n can be sought:

When all unknowns are placed on one side, we obtain the following linear system with n unknowns and n equations:

$$(1 - a_{11})X_1 - \sum_{j=1}^{n} a_{1j} X_j = Y_1,$$

$$\vdots$$

$$- \sum_{j=1}^{n} a_{nj} X_j + (1 - a_{nn})X_n = Y_n$$

respectively

$$(I - A)X = Y,$$

where

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix}, \quad X = \begin{bmatrix} X_1 \\ \vdots \\ X_n \end{bmatrix} \quad \text{and} \quad Y = \begin{bmatrix} Y_1 \\ \vdots \\ Y_n \end{bmatrix}.$$

Matrix A is the matrix of domestic (or regional) customer-supplier relationships. X and Y are column vectors of gross output and final demand. I is the identity matrix. (I-A) is referred to as the *Leontief Matrix*.

To determine the total effect of a change in final demand, we have to measure not only the direct but also the indirect effects of the required intermediate demand. To quantify such effects, gross output is represented as a function of final demand:

$$X = (I - A)^{-1} Y$$

$(I-A)^{-1}$ is also known as the *Leontief Inverse*. With the Leontief Inverse, *primary effects* (both direct and indirect) in the country (or region) being considered can be ascertained.

Their individual elements show how many monetary units of supply value from domestic production in the row vector are required for a monetary unit of final demand in the column vector (Richardson (1979)).

5.1.9 Determination of specified expenditures effects

Expenditures are divided primarily into two major groups: staff expenditures and operating expenditures. Staff expenditures and any surpluses belong to the *direct value added effects*.

Operating expenditures form the demand vector Y^s, which leads to immediate *indirect effects*. Take, for example, a demand vector Y^s. If the economic effects of specified expenditures or investments are to be quantified, any tax burdens for these expenditures (e.g. VAT) are deducted from the expenditure Y^s. Furthermore, expenses that are incurred abroad or imported by a dealer are also deducted in order to obtain the effective domestic net expenditure Y^h.

With the net operating expenditure Y^h, the requisite domestic production needs X^h can now be estimated:

$$X^h = (I - A)^{-1} Y^h$$

Based on production needs X^h, other economic variables can now be determined.

5.1.10 Added value effect, employment, wages and operating surplus

With the sectoral added value W_j and sectoral production value X_j from the input-output table, the value added coefficients can be calculated:

$$w_j = \frac{W_j}{X_j} \qquad j = 1, \ldots, n.$$

The value added coefficient w_j indicates the share of the added value from the production costs of economic sector j .

Multiplying this added value coefficient w_j by the corresponding production needs X^h gives us the entire value effect (direct and indirect) of the measure being examined:

$$W^h = \sum_{j=1}^{n} w_j X_j^h$$

Just as the added value can be determined from production needs, the direct and indirect effects on employment, wages and generated operating surpluses that are necessary for a measure can be calculated. For example, the employment coefficient b_j can be determined on the basis of the employment figures for sector j, B_j, and the corresponding added value:

$$b_j = \frac{B_j}{W_j} \qquad j = 1,\ldots, n.$$

The number of employees who can be connected with a particular measure, h, is then:

$$B^h = \sum_{j=1}^{n} b_j W_j^h .$$

The staff expenditures L^h and profits generated G^h can similarly be obtained:

$$l_j = \frac{L_j}{W_j}, \quad g_j \frac{G_j}{W_j}, j = 1,\ldots, n \quad L^h = \sum_{j=1}^{n} l_j W_j^h \quad G^h = \sum_{j=1}^{n} g_j W_j^h .$$

5.1.11 Purchasing power and employee charges

The determined staff expenditures L^h include gross wages and employer taxes. In order to obtain the disposable income, all public charges which burden the employees are deducted (primarily social security contributions and income taxes). These charges are divided by the various territorial authorities.

Subtracting savings from the disposable income gives us the *demand effective income* that is needed to calculate the consumption-induced effects described in the section below.

5.1.12 Consumption-induced effects

In addition to direct and indirect effects, induced effects can also be calculated. A change in final demand generates (if it is an increase) employment and, thus, wages and salaries. The resulting income induces (after deducting taxes, social security contributions and household savings) an increased demand for consumer goods in the amount of the demand effective income. The increase in final demand causes further economic effects, because this demand for consumer goods in turn triggers additional demand for goods, which are themselves then used (directly or indirectly) as inputs for the consumer goods demanded. Through this, production is stimulated in various sectors of the economy, and jobs are secured. The resulting wages and salaries (after deductions) have further effects on consumption - until a limit is reached. It should, however, be noted that some of the consumer-induced demand is satisfied directly by foreign goods or goods from other regions, so that only a part of the consumer-induced demand in the region under consideration is actually effective.

5.1.13 Summary of definitions of calculated effects

The following effects can be estimated:

Effects on gross production value

The gross production value corresponds to the total production. This includes sales of all products from in-house production, the value of specified products for internal company use and the value of any inventory changes.

Added value effects

The gross value added includes economic performance (production value minus intermediate demand) within a defined economic region, expressed in market prices, for each individual industry or the economy as a whole.

Employment effects

This means all jobs created through the measures considered and their linkages with other economic sectors. Employment effects are reported both in person-years (jobs) and in full-time equivalents (FTE). One FTE corresponds to a full-time job defined by a collective bargaining agreement.

Fiscal effects

The non-negligible tax reflux in the form of social security contributions and taxes is appended to the value added and employment effects mentioned above:

- social security contributions,
- income taxes,
- corporate taxes, and
- VAT.

Purchasing power effects

Additional consumption is induced by the net income generated by employees, which is subsequently demand effective. To quantify the direct effects of purchasing power, the demand effective net income is therefore required. This is calculated from personnel expenditures minus taxes and social security contributions. From this net income, savings and direct and indirect expenditures abroad are also deducted.

The economic effects can be classified as follows:

The *direct effects* are caused directly by the measure(s), which include primarily the following economic stimuli:

- personnel expenditures (direct income effect),
- the number of employees in the examined institutions themselves (direct employment effect),
- any profits of the institutions (direct operating surplus).

When combined with economic linkages (intermediate demand chain), the directly generated economic activities cause the *indirect effects*.

- As a rule, various services have to be purchased to achieve the implementation of various measures. These can include building operation services (e.g. power, water, sanitation, cleaning, etc.), advertising expenditures or investments in equipment. The purchase of these inputs in turn leads to employment and value added effects in the supplying company. The materials and services necessary for the provision of intermediate demand must also be purchased, and so on. The indirect effects form these interlinking chains in the economy.

The direct and indirect effects (i.e. the primary effects) affect changes in employment. These in turn lead to changes in income, purchasing power and consumption. This chain of effects triggers the (c*onsumption-)induced effects*.

<u>An illustrative example:</u>

The gross production value represents the sum of all production processes. Its significance is lower than that of the added value. For example, when a company divides its production across several subsidiaries, gross production increases because the production process no longer takes place entirely within the company itself, and several production steps are instead recorded in the national accounts. But the production of the upstream operation is, however, input for the next operation, so it also represents an expenditure for inputs. Only the difference in value is the actual *added value*. If the companies are integrated, gross production is reduced, but the added value remains the same.

<u>An illustrative example in the transport sector:</u>

A train station is built. The construction workers' wages represent a direct added value component, because their pay is an added value that results from the emerging railway station building. This is the *direct added value effect*, which is created directly through the client's use of construction services (usually a construction company). The power supply, the various materials and machines required, etc. are obtained as *intermediate demand* and thus represent the *indirect effects*. Their manufacture in turn constitutes intermediate demand: the processed metal for the tracks, the wood used for the railroad sleepers, the power used to produce them. Added value is also created: the tracks are produced by engineers and foundry workers from metal alloy. The manufacturer of the metal alloy in turn has obtained the pure metals as intermediate demand. The added value here arises from the work invested by technicians in creating alloys from the metals.

The value added at each stage is realised as wages, profits or taxes. With these income components, the workers, the business owners or the state can in turn consume additional services. This causes the *induced effects*.

In the following results tables, the gross production value of this operation would be: cost of construction services + cost of tracks, sleepers and power, etc. + cost of metal alloy, etc.

Since the contractor receives compensation for the costs of construction, including the cost of the rails, sleepers, etc., but also has to pay for the rails, etc., only the additional value of the services he has rendered is added value, i.e. the construction of the station building, which mainly represents the personnel costs for the construction staff. Any profit is, as a corporate earning, likewise an added value component.

5.1.14 Assumptions

Input-output analysis is an essential tool for measuring the effects of different investments and expenditures. When considering this method and interpreting its results and their significance, it should be noted that the analysis is based on some simplifying assumptions. We will now consider some of these assumptions in more detail:

Assumption 1: replacement investments and new investments must be treated as equal.

Capital investments can be divided into two categories:

- Replacement investments are the substitution of old or incompletely operative machinery, real estate and other assets to maintain production at a previous level.
- New investments result in expanded production, improvement in output quality, higher productivity or the launch of new production activities.

Pure replacement investments do not cause a change in capital stock – they only prevent a decrease - whereas new investments lead to increased capital stock. A rise in capital stock implies an increase in production and could also lead to higher productivity. This promotes competitiveness while stabilising existing jobs and could additionally induce increased demand for labour. Furthermore, pure replacement investments stabilise existing jobs but do not create new ones. Replacement investments which are not realised lead to a decrease in production capacity and, as a result, to a decrease in jobs.

In practice, pure replacement investments are unusual. Generally, the substitution of machinery, etc. is linked to some form of modernisation, either because the machinery to be replaced is no longer available in its original form, or because the company was planning to modernise anyway. Since replacement investments therefore often implicitly suggest new investments, these two categories of investment cannot be separated in any computation of their effects.

Assumption 2: Secured and newly created jobs must be treated as equivalents.

Realised investments and expenditures are related to jobs and, as a consequence, to value creation and tax revenue. In terms of jobs, it should be noted that investments and expenditures either imply a stabilisation of existing jobs or the creation of new ones, depending on the degree of capacity utilisation in the respective company. The full labour effect is revealed either only if capacities are utilised fully, i.e. to 100 %, or if there is an increase in capacity. In all other cases, there is a stabilising effect on existing jobs and full capacity utilisation. If labour demand is not permanent, there is often a tendency to satisfy it through overtime or extra shifts instead of hiring new employees.

In the present study, the questions of the extent to which employment is secured or whether new jobs are created are not answered. In fact, only total employment in relation to expenditures and investments is reported, irrespective of whether new jobs are created or there is any change in the deployment of existing ones.

Assumption 3: If due consideration is given to technological progress, inflation and increases in income, the input-output tables from 2007 or 2008 can be used.

Since all production linkages in an economy must be accounted for, data collection for the input-output tables is a very complex process. Thus, such tables are only available with a time lag of several years.

Experience shows that the input-output tables for 2007 or 2008 can be used for analysis in subsequent years if current information is included. Consideration must be given, in particular to technological progress (in the form of increased productivity), inflationary aspects (in the form of price changes) as well as rises in employee income levels. As a consequence, the later an expenditure is transacted, the lower its effects on employment (as a result of productivity growth and inflation).

5.1.15 Necessary data

To calculate the economic effects of the individual measures within the scenario network and the reference network, investment and operating data, which were provided in the scenarios (5.2), were considered necessary.

5.2 Results

5.2.1 Socio-economic effects – MRIOM - impacts of SETA measure expenses

The results of the multi-regional input-output model analysis will be presented for the six countries involved (Austria, Croatia, Hungary, Italy, Slovakia and Slovenia). The resulting economic effects, divided into value added, employment (in person years and FTEs) and taxes, will be included for each country. These results include both one-time effects (such as investments) and durable effects (such as maintenance and operating costs). In each case, the impact on the economies of the individual regions and the country itself is reported.

5.2.2 Economic effects of investments and maintenance and operating expenses

In the following chapter, the short-term effects of the investment expenses for the additional SETA measures as well as the effects of the SETA measure induced changes in maintenance and operating expenses are reported explicitly for each of the six countries and their respective regions.

Caution is required in the interpretation of the effects on labour, since several of the investments will be implemented over several years. Thus, “person-years” are calculated as the number of employed persons multiplied by the duration of employment.

The effects occur mainly in the investment phase as the expenses for investments and maintenance and operating do.

Table 27 to Table 30 show the results of the economic input-output analysis.

Table 27: Economic effects on value added in countries and regions for the three alternatives, in million EUR

Value added, in million EUR (base year 2012, present value)			
	Alternative 1	Alternative 2	Alternative 3
Burgenland	21.65	21.73	21.89
Niederösterreich	33.59	34.13	35.25
Wien	10.96	11.86	13.72
other regions	17.91	19.80	23.71
Austria	**84.11**	**87.51**	**94.57**
Zahodna	3.26	3.66	4.35
Vzhodna	2.76	3.03	3.50
Slovenia	**6.02**	**6.69**	**7.85**
Nyugat-Dunántúl	23.46	23.65	111.46
Dél-Dunántúl	0.77	0.89	3.63
other regions	9.98	11.55	47.17
Hungary	**34.22**	**36.09**	**162.26**
Jadranska	0.12	80.45	106.11
Sjeverozapadna	0.08	28.48	96.41
Panonska	0.06	14.03	29.02
Croatia	**0.26**	**122.96**	**231.55**
Friuli-Venezia Giulia	0.08	0.37	0.69
other regions	3.38	15.51	29.15
Italy	**3.46**	**15.87**	**29.83**
Bratislava	0.30	1.17	2.60
other regions	0.77	3.02	6.72
Slovakia	**1.07**	**4.19**	**9.32**
"SETA" countries	129.12	273.32	535.39
"EU 22"	33.04	68.09	143.11
EU 28	162.16	341.42	678.50
Rest of the world	21.15	65.97	135.39
World	183.31	407.39	813.89

Source: IHS - Institute for Advanced Studies, 2013.

Table 27 shows the value added for the three quantified alternatives for all six SETA countries and their regions as well as for the EU-22 countries (EU Member States excluding the SETA countries), the EU-28 countries and the rest of the world. The value added is calculated as the present value on the base prices of 2012 with a social discount rate (SDR) of 3.5 % for Member States which joined the EU before 2004 (Austria, Italy) and an SDR of 5.5 % for those who joined after 2004 (Croatia, Hungary, Slovakia, Slovenia). The effects presented show the results for investment, maintenance and operating expenses.

A comparison of the value added for the three alternatives shows that Alternative 3 yields the highest value added for all SETA countries, for the EU-28 countries and for the world as a whole. For Alternative 1, a comparison between SETA countries shows a highest value added for Austria, followed by Hungary.

An interesting effect can be observed from the comparison of the Alternatives within the individual SETA countries. Croatia shows the biggest difference between the Alternatives, with 231.55 million EUR value added for Alternative 3 in comparison to only 0.26 million EUR for Alternative 1. In contrast, Slovenia shows a 30 % difference between Alternative 1 (6.02 million EUR) and Alternative 3 (7.85 million EUR), whereas Austria has the smallest difference in value added between Alternative 1 (84.11 million EUR) and Alternative 3 (94.57 million EUR) at 12.4 %. Furthermore, the SETA regions as a whole could profit more from Alternative 3 than from Alternative 1. Similar results can be seen in general for the EU Member States and for the world.

Table 28 shows the economic effects on employment in person-years for the three quantified Alternatives for all six SETA countries and their regions as well as for the EU-22 countries (EU Member States without SETA-countries) and the EU-28 countries. The effects of investment, maintenance and operating expenses are all included in the results.

The structure of the results obtained for the employment in person-years indicator is the same as those obtained for value added. In general, Alternative 3 produces the highest employment rates in the SETA countries, the EU Member States and the world as a whole.

Employment effects are reported both in person-years (number of jobs) and in full-time equivalents (FTE). One FTE corresponds to a full-time job defined by a collective bargaining agreement.

Table 28: Economic effects on employment in person-years for the three alternatives on a country and regional basis

Employment in person-years (base year 2012)			
	Alternative 1	Alternative 2	Alternative 3
Burgenland	464	466	469
Niederösterreich	761	772	796
Wien	252	270	311
other regions	383	423	509
Austria	**1,860**	**1,931**	**2,085**
Zahodna	105	124	160
Vzhodna	189	202	226
Slovenia	**294**	**325**	**386**
Nyugat-Dunántúl	2,359	2,372	12,147
Dél-Dunántúl	46	54	223
other regions	592	698	2,899
Hungary	**2,997**	**3,123**	**15,270**
Jadranska	4	2,996	4,066
Sjeverozapadna	3	1,268	4,112
Panonska	2	551	1,162
Croatia	**9**	**4,815**	**9,340**
Friuli-Venezia Giulia	2	10	19
other regions	98	407	788
Italy	**101**	**416**	**806**
Bratislava	17	62	144
other regions	43	161	371
Slovakia	**60**	**223**	**515**
"SETA" countries	5,321	10,834	28,403
"EU 22"	1,054	2,043	4,353
EU 28	6,375	12,877	32,756

Source: IHS – Institute for Advanced Studies, 2013.

The economic effects on full-time employment are shown in Table 29. Over the whole period, the number of secured one-year full-time employees across all SETA countries totals 4,255 for Alternative 1, an effect that would double for Alternative 2 (8,131 FTEs), with the highest effects yielded by Alternative 3 (21,780 full-time employees).

If we break the results down to a country level, we can see that the highest full-time employment effects independent of the actual alternative chosen are achieved in Hungary, where about 80 % of these jobs are generated in the Nyugat-Dunántúl region. Here, the employment effects range from 1,955 FTEs for Alternative 1 to 10,070 FTEs for Alternative 3.

The second highest effects are achieved for Alternative 1 in Austria, where 1,455 full-time jobs could be secured. At a regional level, Lower Austria (Niederösterreich) contributes the highest employment effects, followed by Burgenland. Alternative 2 would generate aggregated employment effects of 1,511 FTEs for Austria, which is slightly below the value for Alternative 3 (1,632 FTEs).

In Slovenia, Alternative 1 generates 184 full-time jobs (66 in Zahodna and 118 in Vzhodna). Alternative 2 would secure 206 full-time positions, while Alternative 3 produces an even higher effects (248 employees). For all alternatives, around 60 % of these jobs would be created in the Vzhodna region.

For Croatia, the effects on full-time employment are fairly low for Alternative 1 (6 positions), a figure that would rise to 3,276 FTEs for Alternative 2 and would increase again by almost 91 % for Alternative 3. Within Croatia, the Jadranska region would profit most from the SETA measures, followed in second place by Sjeverozapadna.

In Italy, 81 full-time positions could be secured by Alternative 1, 378 by Alternative 2 and almost twice as many again by Alternative 3.

A total of 42 new jobs would be created in Slovakia by Alternative 1, a figure that would rise to 161 additional positions for Alternative 2 and 372 full-time positions with Alternative 3.

The total employment effects for the EU-28 countries as a whole would be as follows: 5,020 FTEs for Alternative 1, 9,764 for Alternative 2 and would reach their highest for Alternative 3 with the creation of 25,259 new jobs.

Table 29: Economic effects on employment in full-time equivalent employees for the three alternatives on a country and regional basis

Employment full-time equivalent employees (base year 2012)			
	Alternative 1	Alternative 2	Alternative 3
Burgenland	376	377	380
Niederösterreich	583	592	611
Wien	190	204	236
other regions	307	338	405
Austria	**1,455**	**1,511**	**1,632**
Zahodna	66	79	104
Vzhodna	118	127	144
Slovenia	**184**	**206**	**248**
Nyugat-Dunántúl	1,955	1,967	10,070
Dél-Dunántúl	38	45	177
other regions	493	588	2,300
Hungary	**2,487**	**2,600**	**12,548**
Jadranska	3	2,113	2,760
Sjeverozapadna	2	805	2,747
Panonska	1	357	745
Croatia	**6**	**3,276**	**6,253**
Friuli-Venezia Giulia	2	9	17
other regions	79	369	711
Italy	**81**	**378**	**728**
Bratislava	12	45	104
other regions	30	116	268
Slovakia	**42**	**161**	**372**
"SETA" countries	4,255	8,131	21,780
"EU 22"	766	1,633	3,478
EU 28	5,020	9,764	25,259

Source: IHS – Institute for Advanced Studies, 2013.

The fiscal effects induced by the SETA measures are shown in Table 30. Taxes are calculated as current value on the 2012 base prices with an SDR of 3.5 % for Member States which joined the EU before 2004 (Austria, Italy) and 5.5 % for those countries who became EU Member States after 2004 (Croatia, Hungary, Slovakia, Slovenia).

The Austrian government would receive additional taxes to the amount of 31.68 million EUR from Alternative 1, 32.97 million EUR from Alternative 2, with the highest fiscal effects generated by Alternative 3, which would result in 35.63 million EUR in additional public revenue. In Slovenia, the fiscal effects range from 2.34 million EUR (Alternative 1) to 3.06 million EUR (Alternative 3). The fiscal effects for Hungary total 14.68 million EUR for Alternative 1 and would be almost five times as high if Alternative 3 were chosen. For Alternative 1, the fiscal effects in Croatia would amount to only 0.07 million EUR, yet the

Croatian government could earn additional taxes of 42.63 million EUR or 80.75 million EUR with Alternatives 2 and 3 respectively. The tax effects in Italy would range from 1.10 million EUR for Alternative 1 to 9.07 million EUR for Alternative 3. The lowest fiscal effects of all the SETA countries would be achieved in Slovakia, where additional public revenue of 0.37 million EUR would be generated with Alternative 1, 1.13 million EUR with Alternative 2 and 2.9 million EUR with Alternative 3.

If the fiscal effects were totalled up for all six SETA countries, Alternative 1 would lead to additional taxes of 50.33 million EUR, while Alternative 2 would produce fiscal effects that were twice as high as Alternative 2, and Alternative 3 would generate 200.61 million EUR, thereby again doubling the fiscal effects of Alternative 2.

Table 30: Fiscal effects at national level for the three alternatives, in million EUR

Taxes in million EUR (base year 2012, base value)			
	Alternative 1	Alternative 2	Alternative 3
Austria	31.68	32.97	35.64
Slovenia	2.34	2.61	3.06
Hungary	14.68	15.48	69.20
Croatia	0.07	42.63	80.75
Italy	1.19	4.28	9.07
Slovakia	0.37	1.13	2.90
"SETA" countries	50.33	99.09	200.61

Source: IHS – Institute for Advanced Studies, 2013.

5.2.3 Effects of investments – national results

The tables below (Table 31 to Table 33) show the investments and the relative resulting values added for the six SETA countries. These tables explain the effects of the country's investments (in contrast to Table 34 to Table 36, which have to be read from the viewpoint of the profiting countries).

Each of the following tables shows the results for one particular Alternative. The tables show the countries in which investment occurred in columns and display the relative share of value added for the SETA countries in rows. Accordingly, they have to be read in the following manner: 'Investments in the countries… (columns) yield relative value added in countries… (rows)'. Hence, each column illustrates the relative distribution of value added for each country, an indicator which is affected by the investing nation.

The effects for the investments for Alternative 1 are shown in Table 31. For example, Austria's investment (column) has the greatest effect in Austria itself, where 70.59 % of the generated additional value remains (row). But the other countries also benefit. In Slovenia, the Austrian investment creates value added of 0.21 % of the generated value added; the corresponding figures for the other countries/regions are as follows: Hungary 0.49 %; Croatia 0.11 %; Italy 1.92 %; Slovakia 0.35 %; EU-22 17.43 % and the rest of the world 8.89 %. Table 32 and Table 33 show these results for Alternatives 2 and 3 respectively.

Table 31: National effects of investments, investing countries, Alternative 1

Alternative 1		Investment in…			
		Austria	Slovenia	Hungary	Croatia
…resulting value added in…	Austria	70.59%	5.22%	2.50%	0.00%
	Slovenia	0.21%	47.20%	0.40%	0.00%
	Hungary	0.49%	1.14%	58.59%	0.00%
	Croatia	0.11%	1.37%	0.13%	0.00%
	Italy	1.92%	8.32%	1.81%	0.00%
	Slovakia	0.35%	0.43%	1.59%	0.00%
	EU-22	17.43%	29.35%	21.93%	0.00%
	Rest of the world	8.89%	6.97%	13.05%	0.00%
		100.00%	100.00%	100.00%	0.00%

Source: IHS – Institute for Advanced Studies, 2013.

Table 32: National effects of investments, investing countries, Alternative 2

Alternative 2		Investment in…			
		Austria	Slovenia	Hungary	Croatia
…resulting value added in…	Austria	70.59%	5.22%	2.50%	2.13%
	Slovenia	0.21%	47.20%	0.40%	0.46%
	Hungary	0.49%	1.14%	58.59%	1.23%
	Croatia	0.11%	1.37%	0.13%	50.06%
	Italy	1.92%	8.32%	1.81%	7.88%
	Slovakia	0.35%	0.43%	1.59%	2.01%
	EU-22	17.43%	29.35%	21.93%	16.67%
	Rest of the world	8.89%	6.97%	13.05%	19.56%
		100.00%	100.00%	100.00%	100.00%

Source: IHS – Institute for Advanced Studies, 2013.

Table 33: National effects of investments, investing countries, Alternative 3

Alternative 3		Investment in…			
		Austria	Slovenia	Hungary	Croatia
…resulting value added in…	Austria	70.59%	5.22%	2.50%	2.20%
	Slovenia	0.21%	47.20%	0.40%	0.47%
	Hungary	0.49%	1.14%	58.51%	0.95%
	Croatia	0.11%	1.37%	0.13%	49.64%
	Italy	1.92%	8.32%	1.82%	7.78%
	Slovakia	0.35%	0.43%	1.59%	2.04%
	EU-22	17.43%	29.35%	21.97%	17.06%
	Rest of the world	8.89%	6.97%	13.08%	19.85%
		100.00%	100.00%	100.00%	100.00%

Source: IHS – Institute for Advanced Studies, 2013.

The following tables have to be read in a similar, but slightly different manner. Table 34-Table 36 explain how the SETA countries profit from a country's investments. The message is the same, but the viewpoint is different. The next three tables can be read as follows: 'Country X (row) profits from investments in country Y (column)'. This situation arises as a result of international economic linkages. Accordingly, the row values illustrate how a country's relative share of economic effects induced by SETA measures is distributed among the investing nations.

Table 34 shows the results for Alternative 1. It shows, for example, that Slovenia profits to 4.12 % from investments in Austria, to 90.76 % from investments in its own country and to 5.12 % from investments in Hungary. Croatian investments do not cause any effects in Slovenia. Table 35 and Table 36 show these results for Alternatives 2 and 3 respectively.

Table 34: National effects of investments, profiting countries, Alternative 1

Alternative 1		Investment in…				
		Austria	Slovenia	Hungary	Croatia	
…profiting country…	Austria	97.12%	0.69%	2.19%	0.00%	100.00%
	Slovenia	4.12%	90.76%	5.12%	0.00%	100.00%
	Hungary	1.29%	0.29%	98.42%	0.00%	100.00%
	Croatia	33.32%	40.98%	25.70%	0.00%	100.00%
	Italy	49.60%	20.58%	29.83%	0.00%	100.00%
	Slovakia	25.11%	2.95%	71.93%	0.00%	100.00%
	EU-22	50.91%	8.23%	40.86%	0.00%	100.00%
	Rest of the world	49.71%	3.74%	46.55%	0.00%	100.00%

Source: IHS - Institute for Advanced Studies, 2013.

Table 35: National effects of investments, profiting countries, Alternative 2

Alternative 2		Investment in…				
		Austria	Slovenia	Hungary	Croatia	
…profiting country…	Austria	91.36%	0.65%	2.06%	5.93%	100.00%
	Slovenia	3.43%	75.63%	4.27%	16.66%	100.00%
	Hungary	1.21%	0.27%	92.03%	6.49%	100.00%
	Croatia	0.10%	0.12%	0.08%	99.70%	100.00%
	Italy	9.24%	3.84%	5.56%	81.36%	100.00%
	Slovakia	6.18%	0.73%	17.70%	75.39%	100.00%
	EU-22	24.88%	4.02%	19.97%	51.14%	100.00%
	Rest of the world	14.84%	1.12%	13.89%	70.15%	100.00%

Source: IHS - Institute for Advanced Studies, 2013.

Table 36: National effects of investments, profiting countries, Alternative 3

Alternative 3		Investment in…				
		Austria	Slovenia	Hungary	Croatia	
…profiting country…	Austria	82.76%	0.59%	6.86%	9.80%	100.00%
	Slovenia	2.75%	60.70%	12.59%	23.96%	100.00%
	Hungary	0.35%	0.08%	97.01%	2.56%	100.00%
	Croatia	0.06%	0.07%	0.16%	99.71%	100.00%
	Italy	5.27%	2.19%	11.63%	80.91%	100.00%
	Slovakia	2.99%	0.35%	31.43%	65.24%	100.00%
	EU-22	12.78%	2.06%	37.68%	47.47%	100.00%
	Rest of the world	7.70%	0.58%	26.50%	65.22%	100.00%

Source: IHS - Institute for Advanced Studies, 2013.

5.2.4 Effects of investments – regional results

In this section, the effects of investments at a regional level will be illustrated. The information contained in the corresponding tables can be interpreted in the same manner as the national results (Table 31 to Table 36).

Table 37 to Table 39 show the results for the investments required for Alternatives 1, 2 and 3 on a regional basis. In these tables, the affected additional relative values added of a region's investment are shown. Each column displays the relative share of value added resulting from another region's investment.

Table 37: Regional effects of investments, investing regions, Alternative 1

Alternative 1			Investment in…					
			Austria		Slovenia	Hungary	Croatia	
			Burgen-land	Nieder-österreich	Zahodna	Nyugat-Dunántúl	Jadranska	Sjeveroza-padna
…resulting value added in…	AT	Burgenland	40.18%	0.53%	0.12%	0.06%	0.00%	0.00%
		Niederösterreich	5.33%	48.26%	0.83%	0.40%	0.00%	0.00%
		Wien	8.86%	6.08%	1.38%	0.66%	0.00%	0.00%
		other regions	19.18%	12.78%	2.90%	1.38%	0.00%	0.00%
	SI	Zahodna	0.19%	0.06%	31.13%	0.24%	0.00%	0.00%
		Vzhodna	0.13%	0.03%	16.07%	0.16%	0.00%	0.00%
	HU	Nyugat-Dunántúl	0.04%	0.05%	0.11%	40.43%	0.00%	0.00%
		Dél-Dunántúl	0.03%	0.03%	0.07%	1.30%	0.00%	0.00%
		other regions	0.37%	0.45%	0.95%	16.86%	0.00%	0.00%
	HR	Jadranska	0.05%	0.06%	0.65%	0.06%	0.00%	0.00%
		Sjeverozapadna	0.03%	0.03%	0.40%	0.04%	0.00%	0.00%
		Panonska	0.02%	0.03%	0.32%	0.03%	0.00%	0.00%
	IT	Friuli-Venezia Giulia	0.04%	0.05%	0.19%	0.04%	0.00%	0.00%
		other regions	1.68%	2.08%	8.12%	1.77%	0.00%	0.00%
	SK	Bratislava	0.08%	0.12%	0.12%	0.44%	0.00%	0.00%
		other regions	0.21%	0.30%	0.31%	1.15%	0.00%	0.00%
	EU-22		15.61%	19.25%	29.35%	21.93%	0.00%	0.00%
	Rest of the world		7.98%	9.81%	6.97%	13.05%	0.00%	0.00%
			100.00%	100.00%	100.00%	100.00%	0.00%	0.00%

Source: IHS – Institute for Advanced Studies, 2013.

Table 38: Regional effects of investments, investing regions, Alternative 2

Alternative 2			Investment in…					
			Austria		Slovenia	Hungary	Croatia	
			Burgen-land	Nieder-österreich	Zahodna	Nyugat-Dunántúl	Jadranska	Sjeveroza-padna
…resulting value added in…	AT	Burgenland	40.18%	0.53%	0.12%	0.06%	0.05%	0.00%
		Niederösterreich	5.33%	48.26%	0.83%	0.40%	0.34%	0.00%
		Wien	8.86%	6.08%	1.38%	0.66%	0.56%	0.00%
		other regions	19.18%	12.78%	2.90%	1.38%	1.18%	0.00%
	SI	Zahodna	0.19%	0.06%	31.13%	0.24%	0.28%	0.00%
		Vzhodna	0.13%	0.03%	16.07%	0.16%	0.19%	0.00%
	HU	Nyugat-Dunántúl	0.04%	0.05%	0.11%	40.43%	0.12%	0.00%
		Dél-Dunántúl	0.03%	0.03%	0.07%	1.30%	0.08%	0.00%
		other regions	0.37%	0.45%	0.95%	16.86%	1.03%	0.00%
	HR	Jadranska	0.05%	0.06%	0.65%	0.06%	36.39%	0.00%
		Sjeverozapadna	0.03%	0.03%	0.40%	0.04%	9.18%	0.00%
		Panonska	0.02%	0.03%	0.32%	0.03%	4.50%	0.00%
	IT	Friuli-Venezia Giulia	0.04%	0.05%	0.19%	0.04%	0.18%	0.00%
		other regions	1.68%	2.08%	8.12%	1.77%	7.69%	0.00%
	SK	Bratislava	0.08%	0.12%	0.12%	0.44%	0.56%	0.00%
		other regions	0.21%	0.30%	0.31%	1.15%	1.45%	0.00%
	EU-22		15.61%	19.25%	29.35%	21.93%	16.67%	0.00%
	Rest of the world		7.98%	9.81%	6.97%	13.05%	19.56%	0.00%
			100.00%	100.00%	100.00%	100.00%	100.00%	0.00%

Source: IHS – Institute for Advanced Studies, 2013.

Table 39: Regional effects of investments, investing regions, Alternative 3

Alternative 3			Investment in…					
			Austria		Slovenia	Hungary	Croatia	
			Burgen-land	Nieder-österreich	Zahodna	Nyugat-Dunántúl	Jadranska	Sjeveroza-padna
…resulting value added in…	AT	Burgenland	40.18%	0.53%	0.12%	0.06%	0.05%	0.05%
		Niederösterreich	5.33%	48.26%	0.83%	0.40%	0.34%	0.36%
		Wien	8.86%	6.08%	1.38%	0.66%	0.56%	0.60%
		other regions	19.18%	12.78%	2.90%	1.39%	1.18%	1.27%
	SI	Zahodna	0.19%	0.06%	31.13%	0.24%	0.28%	0.28%
		Vzhodna	0.13%	0.03%	16.07%	0.16%	0.19%	0.20%
	HU	Nyugat-Dunántúl	0.04%	0.05%	0.11%	40.39%	0.12%	0.06%
		Dél-Dunántúl	0.03%	0.03%	0.07%	1.30%	0.08%	0.04%
		other regions	0.37%	0.45%	0.95%	16.82%	1.03%	0.50%
	HR	Jadranska	0.05%	0.06%	0.65%	0.06%	36.39%	5.84%
		Sjeverozapadna	0.03%	0.03%	0.40%	0.04%	9.18%	38.20%
		Panonska	0.02%	0.03%	0.32%	0.03%	4.50%	5.05%
	IT	Friuli-Venezia Giulia	0.04%	0.05%	0.19%	0.04%	0.18%	0.18%
		other regions	1.68%	2.08%	8.12%	1.77%	7.69%	7.49%
	SK	Bratislava	0.08%	0.12%	0.12%	0.44%	0.56%	0.58%
		other regions	0.21%	0.30%	0.31%	1.15%	1.45%	1.50%
	EU-22		15.61%	19.25%	29.35%	21.97%	16.67%	17.57%
	Rest of the world		7.98%	9.81%	6.97%	13.08%	19.56%	20.22%
			100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: IHS – Institute for Advanced Studies, 2013

Table 40 to Table 42 explain how the SETA regions profit from investments on a regional level. The values in the rows display the relative share of regional effects across the investing countries.

Table 40: Regional effects of investments, profiting regions, Alternative 1

Alternative 1			Investment in…						
			Austria		Slovenia	Hungary	Croatia		
			Burgen-land	Nieder-österreich	Zahodna	Nyugat-Dunántúl	Jadranska	Sjeveroza-padna	
…profiting region/country…	AT	Burgenland	98.46%	1.30%	0.06%	0.18%	0.00%	0.00%	100.00%
		Niederösterreich	9.84%	88.93%	0.29%	0.93%	0.00%	0.00%	100.00%
		Wien	55.27%	37.85%	1.65%	5.24%	0.00%	0.00%	100.00%
		other regions	56.00%	37.23%	1.62%	5.15%	0.00%	0.00%	100.00%
	SI	Zahodna	2.89%	0.86%	91.61%	4.65%	0.00%	0.00%	100.00%
		Vzhodna	3.83%	1.00%	89.15%	6.02%	0.00%	0.00%	100.00%
	HU	Nyugat-Dunántúl	0.08%	0.10%	0.04%	99.77%	0.00%	0.00%	100.00%
		Dél-Dunántúl	1.64%	2.01%	0.81%	95.55%	0.00%	0.00%	100.00%
		other regions	1.64%	2.01%	0.81%	95.55%	0.00%	0.00%	100.00%
	HR	Jadranska	14.97%	18.35%	40.98%	25.70%	0.00%	0.00%	100.00%
		Sjeverozapadna	14.97%	18.35%	40.98%	25.70%	0.00%	0.00%	100.00%
		Panonska	14.97%	18.35%	40.98%	25.70%	0.00%	0.00%	100.00%
	IT	Friuli-Venezia Giulia	22.19%	27.40%	20.58%	29.83%	0.00%	0.00%	100.00%
		other regions	22.19%	27.40%	20.58%	29.83%	0.00%	0.00%	100.00%
	SK	Bratislava	10.31%	14.81%	2.95%	71.93%	0.00%	0.00%	100.00%
		other regions	10.31%	14.81%	2.95%	71.93%	0.00%	0.00%	100.00%
	EU-22		22.83%	28.09%	8.23%	40.86%	0.00%	0.00%	100.00%
	Rest of the world		22.33%	27.38%	3.74%	46.55%	0.00%	0.00%	100.00%

Source: IHS – Institute for Advanced Studies, 2013

Table 41: Regional effects of investments, profiting regions, Alternative 2

Alternative 2			Investment in…						
			Austria		Slovenia	Hungary	Croatia		
			Burgen-land	Nieder-österreich	Zahodna	Nyugat-Dunántúl	Jadranska	Sjeveroza-padna	
…profiting region/country…	AT	Burgenland	97.95%	1.29%	0.06%	0.18%	0.52%	0.00%	100.00%
		Niederösterreich	9.58%	86.61%	0.29%	0.91%	2.61%	0.00%	100.00%
		Wien	48.03%	32.89%	1.43%	4.55%	13.10%	0.00%	100.00%
		other regions	48.76%	32.42%	1.41%	4.49%	12.92%	0.00%	100.00%
	SI	Zahodna	2.44%	0.72%	77.55%	3.93%	15.35%	0.00%	100.00%
		Vzhodna	3.10%	0.81%	72.18%	4.88%	19.03%	0.00%	100.00%
	HU	Nyugat-Dunántúl	0.08%	0.10%	0.04%	98.77%	1.01%	0.00%	100.00%
		Dél-Dunántúl	1.37%	1.68%	0.68%	79.90%	16.38%	0.00%	100.00%
		other regions	1.37%	1.68%	0.68%	79.90%	16.38%	0.00%	100.00%
	HR	Jadranska	0.03%	0.04%	0.08%	0.05%	99.81%	0.00%	100.00%
		Sjeverozapadna	0.07%	0.09%	0.19%	0.12%	99.52%	0.00%	100.00%
		Panonska	0.11%	0.14%	0.31%	0.20%	99.24%	0.00%	100.00%
	IT	Friuli-Venezia Giulia	4.14%	5.11%	3.84%	5.56%	81.36%	0.00%	100.00%
		other regions	4.14%	5.11%	3.84%	5.56%	81.36%	0.00%	100.00%
	SK	Bratislava	2.54%	3.64%	0.73%	17.70%	75.39%	0.00%	100.00%
		other regions	2.54%	3.64%	0.73%	17.70%	75.39%	0.00%	100.00%
	EU-22		11.15%	13.72%	4.02%	19.97%	51.14%	0.00%	100.00%
	Rest of the world		6.67%	8.17%	1.12%	13.89%	70.15%	0.00%	100.00%

Source: IHS – Institute for Advanced Studies, 2013

Table 42: Regional effects of investments, profiting regions, Alternative 3

Alternative 3		Investment in…						
		Austria		Slovenia	Hungary	Croatia		
		Burgen-land	Nieder-österreich	Zahodna	Nyugat-Dunántúl	Jadranska	Sjeveroza-padna	
…profiting region/country… AT	Burgenland	97.08%	1.28%	0.06%	0.65%	0.51%	0.42%	100.00%
AT	Niederösterreich	9.16%	82.82%	0.27%	3.19%	2.50%	2.06%	100.00%
AT	Wien	39.07%	26.75%	1.16%	13.60%	10.66%	8.76%	100.00%
AT	other regions	39.77%	26.44%	1.15%	13.44%	10.53%	8.66%	100.00%
SI	Zahodna	1.99%	0.59%	63.21%	11.78%	12.51%	9.90%	100.00%
SI	Vzhodna	2.42%	0.63%	56.35%	13.99%	14.86%	11.76%	100.00%
HU	Nyugat-Dunántúl	0.02%	0.03%	0.01%	99.56%	0.28%	0.10%	100.00%
HU	Dél-Dunántúl	0.43%	0.53%	0.21%	91.78%	5.14%	1.91%	100.00%
HU	other regions	0.43%	0.53%	0.21%	91.78%	5.14%	1.91%	100.00%
HR	Jadranska	0.03%	0.03%	0.07%	0.16%	88.79%	10.91%	100.00%
HR	Sjeverozapadna	0.02%	0.02%	0.05%	0.11%	23.85%	75.96%	100.00%
HR	Panonska	0.06%	0.08%	0.17%	0.39%	53.43%	45.87%	100.00%
IT	Friuli-Venezia Giulia	2.36%	2.91%	2.19%	11.63%	46.37%	34.54%	100.00%
IT	other regions	2.36%	2.91%	2.19%	11.63%	46.37%	34.54%	100.00%
SK	Bratislava	1.23%	1.76%	0.35%	31.43%	36.42%	28.82%	100.00%
SK	other regions	1.23%	1.76%	0.35%	31.43%	36.42%	28.82%	100.00%
	EU-22	5.73%	7.05%	2.06%	37.68%	26.28%	21.20%	100.00%
	Rest of the world	3.46%	4.24%	0.58%	26.50%	36.41%	28.81%	100.00%

Source: IHS – Institute for Advanced Studies, 2013

5.3 Summary

This section summarises the most important results of the short-term economic evaluation conducted via the multi-regional input-output analysis. For more detailed results, please refer to **the Regional Fact Sheets** provided in **Appendix 2**.

The highest value added effects for Alternative 1 are produced in Austria (84.11 million EUR), followed by Hungary (34.22 million EUR) and Slovenia (6.02 million EUR). However, Hungary in turn ranks first in terms of employment effects with 2,487 full-time employees. Austria assumes second place here with 1,455 secured full-time positions for one year, followed by Italy in third place. At the regional level, Niederösterreich generates the highest value added effect with Alternative 1 (33.59 million EUR), while the highest employment effects, 1,955 FTEs, are generated in the Hungarian region of Nyugat-Dunántúl. The total value added for all SETA countries produces an effect worth 129.12 million EUR; for the rest of the world, this figure amounts to 183.31 million EUR. The full-time employment effects across all SETA countries amount to 4,255 FTEs for Alternative 1.

Alternative 2 would generate 122.96 million EUR in value added and 3,276 full-time employees in Croatia, roughly two-thirds of which near the coast in the Jadranska region. The second highest economic outcome would be achieved in Austria, with totals of 87.51 million EUR and 1,511 full-time employees, followed by Hungary with 36.09 million EUR in value added effects and 2,600 secured full-time positions. On a EU level, the generated value added with Alternative 2 would total 407.39 million EUR and 5,020 full-time equivalents in the EU-28 region.

Alternative 3 would generate the highest effects, namely 813.89 million EUR for the whole world and 535.39 million EUR for the SETA countries. Of the SETA countries, Croatia profits most from Alternative 3 with a share of over 43 % of total value added effects, followed by Hungary (162.26 million EUR; around 69 % of which in the Nyugat-Dunántúl region. In Alternative 3 terms, Austria ranks third with a share of approx. 18 % of the total SETA value added effects. As far as the employment effects for Alternative 3 are concerned, these are highest for Hungary (12,548 FTEs), where the Nyugat-Dunántúl region again profits most (10,070 FTEs).The second highest employment effects are produced in Croatia with 6,253 FTEs, while Austria ranks in third place with 1,632 secured full-time positions. Alternative 3 would reach aggregated full-time employment effects of 21,780 positions across all SETA regions and 25,259 FTEs for the EU-28 region as a whole.

With regard to how investment in one region generates value added effects in the whole of the SETA area and beyond, the highest effects always remain in the actual region itself, followed by other regions in the same country and in the “EU-22” countries (i.e. the EU Member States without the SETA countries). However, economic spill-over effects with other SETA countries are fairly small.

6 Long-term economic effects (IHS)

6.1 Theoretical background: economic effects of transport infrastructure

Investments in transport infrastructure are cost-intensive and, at times, not lucrative for a single provider. But since economic studies have identified substantial positive external effects, which often exceed individual benefits on a societal level and can lead to overall positive returns, it might nonetheless be beneficial for society to implement them.

In order to evaluate these external economic benefits, the Vienna-based Institute for Advanced Studies (IHS) has developed an accessibility-dependent regional model (*Erreichbarkeitsabhängiges Regionalmodell*, or EAR) which follows a spatial econometric approach and has already been used to evaluate a variety of Austrian infrastructure projects.

The main goal of this model is to determine whether, and if so to what extent, infrastructure improvements will also lead to improvements in economic performance. In order to test this in the SETA project's case, we used an econometric approach in which improved accessibility, reflecting improvements in transportation, is linked to gross value added (GVA) and employment measures. This approach can be considered especially useful, since accessibility is assumed to be one of the main drivers of economic activity, both on a national and on a regional level (Schürmann and Talaat 2000).

The theoretical concepts used in the model, which stem from economics as well as transportation science, are explained below. While the general descriptions provided are intended to give an insight into the workings of the EAR 2.0 model, we would also like to point out that constraints relating to the availability of specific data required us to slightly adapt the model in most cases to suit the project's specific needs.

6.1.1 Evaluation of effects in the construction phase

When evaluating new transport infrastructure project, a distinction is traditionally made between those effects that occur during the construction phase and those that are achieved during the operating phase. The installation of new transport infrastructure causes an increase in demand for the construction sector, which can lead directly to an increase in value added, a higher demand for intermediate inputs and services, as well as higher employment. The demand for intermediate inputs may lead to further demand for other inputs and is dependent on the specific network and the structure of the sector. At the same time, households have higher disposable incomes (due to the additional jobs), which can lead to an increase in consumer expenditure. Both these effects in turn lead to an increase in demand for industrial and consumption goods and, consequently, to better economic performance. The evaluation of the effects in the construction phase is usually carried out by means of an input-output analysis and is described in Chapter 5.

6.1.2 Evaluation of effects during the operating phase

When evaluating the economic use of new transport infrastructure, the *generalised costs* of transport concept (Nagl, Schwarzbauer and Sellner, 2010) is crucial: traffic between two locations is influenced by the monetary costs of transport (such as tolls and fuel costs) on the one hand and by time costs on the other. In case of the latter, the utility of both present and potential users can be increased significantly if the construction of new infrastructure leads to savings in travel time. These individual utilities are then monetised according to certain assumptions (e.g. that time spent on business trips and commuting is more valuable than leisure time) and totalled. The total economic benefit therefore equals the sum of all individual benefits.

While this approach follows an easy principle and is straightforward to apply, it also has a fundamental disadvantage: the benefits calculated via the time use concept cannot be directly compared with the project's costs as they are merely theoretical. In addition to this, the concept focuses only on one segment of the economic effects of new infrastructure. However, infrastructure investments can produce economic benefits via several other channels.

As transport infrastructure is improved, sinking costs of transportation can lead to increased trade between regions and economies. Firms now have larger potential market areas, which in turn can induce increased corporate specialisation and higher regional productivity. In addition, more trade between regions results in technology and knowledge transfers and spill-overs. Furthermore, consumers profit from the larger variety of products on offer (Lakshmanan 2011, Anderson and Lakshamanan 2004).

Better infrastructure results in increased attractiveness as potential markets become closer (=easier to reach), logistics costs decrease and agglomeration advantages come into effect (Graham, 2007). Vickerman (2007) emphasises the role of transportation costs for a firm's locational decision processes and suggests that, in many cases, firms also reconsider their decisions when the infrastructure improve (see also Rietveld, 1989). In addition, companies and individuals profit from the increased range of the potential labour force, which means better access to human capital and better job matching. Infrastructure improvements thus strengthen the regional locational factor and, in turn, increase the region's chances of successfully competing in global markets.

New economic geography models explicitly focus on the role of geography and networks by using transport infrastructure to explain the spatial distribution of economic activity (Fujita, Krugman and Venables, 2001). They divide the main factors driving this distribution into two categories: centripetal forces that lead to agglomeration (such as higher product variety and a thicker – i.e. richer – labour market) and centrifugal forces (immobile factors such as land and natural resources, land rents). However, due to their formal complexity, such models are only of limited use when it comes to quantifying an improvement in the transport infrastructure. This is why most empirical studies take a production function approach, which in its core describes an economy's output through the labour, capital and infrastructure factors.

Current approaches therefore tend towards using accessibility concepts in their models as these value infrastructure investments only according to the qualitative improvements they entail. The IHS EAR 2.0 model described below is also based on this methodological concept, which can be found in Wegener and Bökemann (1998), Schürmann and Talaat (2000) and Spiekermann and Wegener (2007).

6.2 Method description: regional accessibility-dependent model (EAR[22])

6.2.1 The IHS model (EAR 2.0) for assessing the operating phase

The methodological framework behind the EAR model adopts the principle of generalized costs within a spatial interaction context in order to display the externalities resulting from infrastructure improvements due to its specific network topology. In addition, the increased production possibilities open to firms as a result of the improved location (such as lower transport costs and better external connections) are also considered.

6.2.2 Accessibility

Since the concept of accessibility lies at the core of the EAR model, we will first discuss some basic concepts of accessibility in order to then differentiate the approach chosen in the IHS EAR model.

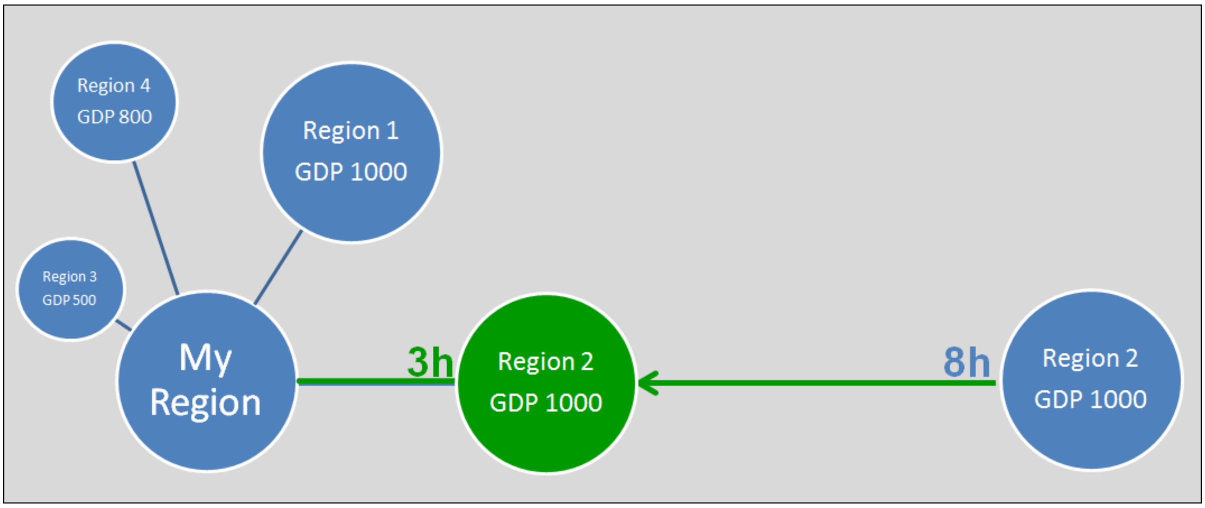
Accessibility can be seen as the main 'product' of a transport system as it determines the locational advantage of a region in relation to all other regions. There are various definitions of accessibility: Hansen (1959) and Martellato et al. (1998) define it as the potential of spatial interaction, whereas others interpret it as the ease with which spatial interaction can take place, the possibility to interact with contacts and providers of intermediate products or the attractiveness of nodal points in relation to other nodes (see Rietveld, 1994).

Indicators of accessibility measure the benefits generated for households and firms due to the existence and use of transport infrastructure in a region. They can be designed to include both the transport infrastructure within a given region and the infrastructure outside the region which nonetheless affects it.

While simple accessibility indicators only reflect intraregional transport infrastructure using measures such as the number of railway stations or travel time to close nodes on interregional networks, more sophisticated concepts also identify the inherent network character of transport infrastructure which links both areas within regions as well as regions with each other. It is therefore important to consider both the network itself and the 'activities' (e.g. work or leisure) and 'opportunities' (such as employment or markets) that can be reached. Accordingly, it is also useful to apply an index that is dependent on two functions, one of which representing the activities or opportunities that can be reached and the other representing the effort, time, distance or cost needed to reach them (Schürmann and Talaat 2000).

[22] EAR is the German abbreviation for *Erreichbarkeitsabhängiges Regionalmodell*, which translates as regional accessibility-dependent model.

Figure 23: Schematic depiction of factors influencing the accessibility indicator



Source: IHS - Institute for Advanced Studies, 2013

Following this approach, the EAR model uses an indicator to define accessibility (*Accessibility Indicator; AI*), in which the accessibility of region *i* is defined as follows (see also Spiekermann and Neubauer, 2002): the larger the GDP of a neighbouring region to "My Region", the larger the *AI*. Distance to the other region is the second factor that influences accessibility, and low travel times again lead to a high *AI*. The basic idea behind the *AI* is shown in Figure 23: Schematic depiction of factors influencing the accessibility indicator for one particular case. In this example, the *AI* of region 1 is calculated by taking the sum of all AIs between it and regions 2, 3, 4 and 5. The same is done for all regions in the SETA area.

The calculation of the AI in Table 43 shows that the AI increases as a result of the assumed improvement through the additional SETA measures, which brings region 2 closer to "My Region" for example by five hours.

The formal description of the AI used in EAR 2.0 is as follows:

$$AI_i = \sum_j g(W_j)\, f(c_{ij}), \qquad (1)$$

The function $g(W_j)$ defines the accessibility of activities *W* in other regions *j* (≠*i*). The second term $f(c_{ij})$ is the so-called impedance function (as it has a function similar to impedance in an electric circuit), which contains the generalised costs of interaction between regions *i* and *j*.

The activity function describes how an activity W_j in region *j* can be reached from region *i*. The activity can be measured, for example, via population, GDP or the average income in a region. The larger W_j is, the higher the value of the AI under the *ceteris paribus* assumption (given that all other factors influencing accessibility stay constant).

The impedance function describes the spatial resistance, or friction, that must be overcome in order to reach the activity in region *j* from region *i*. This resistance term contains not only the costs of a transport medium but also the travel time costs that are needed to reach region j.

Table 43: Calculation of AI

Evalutaion	GDP	Minutes of Travel Time	AI of region XY		Value without SETA	Value with SETA
Region 1	1000	120	431.7		432	432
Region 2	1000	540	22.8		23	
Region 2 (SETA)	1000	180	283.7			284
Region 3	500	60	328.5		329	329
Region 4	800	180	226.9		227	227
Accessibility Indicator is the SUM of all single relations:					1010	1271
AI decreases with increasing distance measured in minutes	1000	60	657.0			
	1000	120	431.7			
	1000	180	283.7			
	1000	240	186.4			
	1000	300	122.5			
	1000	360	80.5			
	1000	420	52.9			
	1000	480	34.7			
	1000	540	22.8			
	1000	600	15.0			
	1000	660	9.9			
	1000	720	6.5			
	1000	780	4.3			
	1000	840	2.8			

Source: IHS - Institute for Advanced Studies, 2013.

A region that is easily accessible – e.g. due to its central location or good infrastructure - will have low generalized costs, which signify a comparatively high AI. If W_j is set to the population of a region, and c_{ij} contains the travel times between regions i and j, a high AI_i indicates that the population in region j can be reached in comparatively little time from region i.

In the EAR model, the following equations are used to describe the AI for goods (*GV*) and passenger transport (*PV*):

$$AI_i^{GV} = \sum_j GDP_j \exp\left(-\beta t_{ij}^{GV}\right), \qquad (2)$$

$$AI_i^{PV} = \sum_j POP_j \exp\left(-\beta t_{ij}^{PV}\right) \qquad (3)$$

where $BIP_j(POP_j)$ stands for the gross domestic product (population) of region j. The impedance function is given by $f(c_{ij}) = \exp(-\beta c_{ij})$, with $c_{ij} = t_{ij}^{GV}$ standing for travel times in goods transport and $c_{ij} = t_{ij}^{PV}$ for travel times in passenger transport. The parameter β

determines how strongly regions that are farther away are weighted. The higher this parameter, the lower the weighting attributed to faraway regions.

By means of the above described AIs, two effects of accessibility on economic growth can be portrayed. First, an improvement in transport connections leads to lower costs of transportation, which in turn means a faster and cheaper carriage of products used as intermediate inputs. This effect is reflected in the indicator that weights regional GDP by travel times in freight traffic. The second effect is represented in the population that can be reached via personal transport, as this can be seen as an indicator for market size or sales potential. The larger the population of a region, the easier it is for companies to increase their turnover and achieve economies of scale.

In the EAR model, transport time generally consists of a modal split-weighted average of travel time on roads and rail (both for passenger and goods transport):

$$t_{ij} = m_{nat}^{(str)} t_{ij}^{(str)} + \left(1 - m_{nat}^{(str)}\right) t_{ij}^{(tr)}, \quad (4)$$

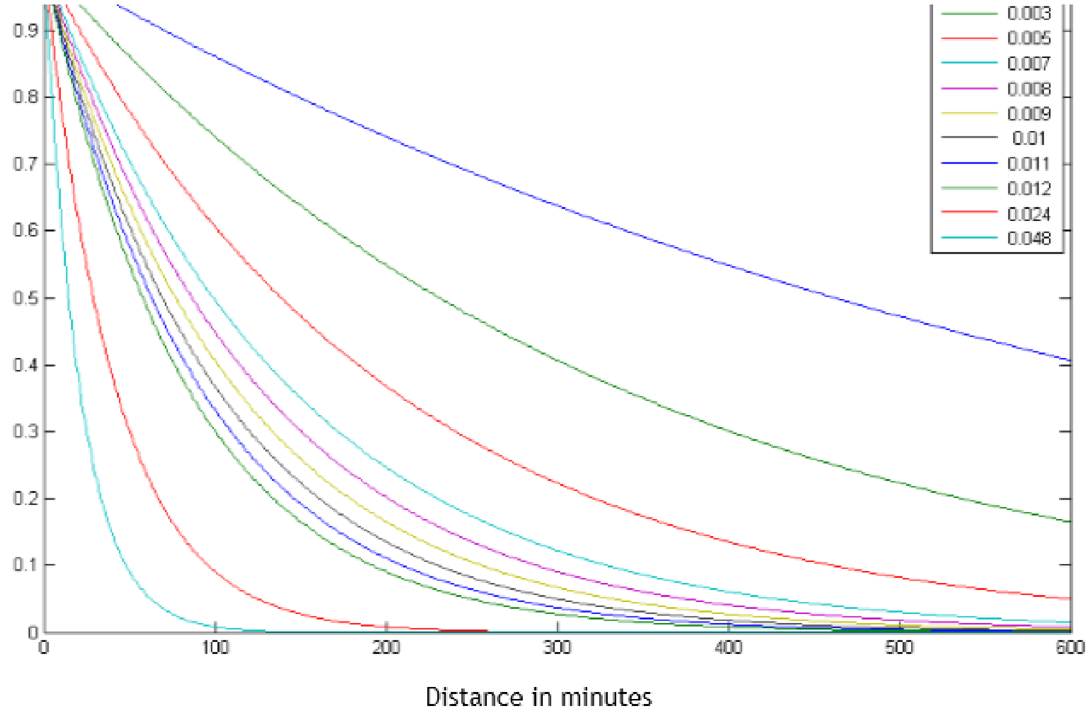
where $m_{nat}^{(str)}$ is the portion of traffic allotted to roads. By weighting travel times according to modal split shares between two regions, we can ensure that improvements in one mode of transport are not attributed too much significance, as these are weighted according to the carrier's historical usage.

Since a transport infrastructure consists of a network of nodal points (such as train stations, towns, cities, transport junctions) and links (roads, railways, waterways), investments in certain nodes have an effect on the network as a whole. It can be assumed that this effect is stronger for those parts of the network that are close to the measure implemented and that its influence drops with increasing distance to it. In order to be able to capture the impacts of investments in transport infrastructure on traffic as well as the economy, the first step that has to be taken is to define the regions for which the impact of the investment is to be examined. Here, the range of the geographic area has to be decided and an aggregation level that is both adequate and empirically feasible needs to be found.

The spatial weight parameter β is estimated by comparing information gained from the calibration in equation (3) with values used in regional economic literature as preliminary information.

Figure 24 illustrates the weighting of economic activity attributed to various AIs between two regions over an increasing distance. The lower the value of β, the higher the weighting given to faraway regions. A value of 0.0015 would, for example, mean that a region 10 hours away is still given a weighting of 40% of that region's GDP. In contrast, a smaller β of 0.048 would attribute weighting of practically zero to any region that is more than 100 minutes of travel time away. These two examples of course represent the extremes, and both existing literature and our own assessment experience have shown the parameter to lie between 0.003 and 0.007 depending on the mode and purpose (goods or passengers, respectively) of transport (see Schürmann and Talaat 2000).

Figure 24: Economic activity weighted according to travel times, comparison of various ß coefficients.



Source: IHS - Institute for Advanced Studies, 2013.

6.2.3 Regional production function

Within the EAR model, regional value creation is described using a modified Cobb-Douglas production function (see Barro and Sala-i-Martin, 2003). Accessibility (represented by the *AI*) is one of three factors of production. In general, regional production Y_i is described as a function of the level of technology (A), the physical capital stock $\left(K_{i,s}\right)$, the number of people employed $\left(L_{i,s}\right)$, the stock of human capital $\left(H_i\ \right)$, the AI $\left(AI_i\ \right)$ and a stochastic shock $\left(\varepsilon_{i,s}\right)$:

$$Y_{i,s} = AK_{i,s}^{\alpha_s} L_{i,s}^{\beta_{1,s}} H_i^{\beta_{2,s}} AI_i^{\phi_s} \varepsilon_{i,s}, \qquad (5)$$

where $Y_i = \sum_s Y_{i,s}$,

The parameters α_s, $\beta_{1,s}$, $\beta_{2,s}$ and ϕ_s will then be estimated using a Bayesian estimation of this spatial econometric model. If data for all the necessary regions is available, a separate estimation will be made for each economic sector. In this case, the subscript *s* stands for the specific economic sector (agriculture and forestry, manufacturing and services). It is assumed that an increase in each of the factors of production leads to higher production in the region and therefore increases its economic performance.

6.2.4 Estimating the factor elasticities of output

The decision on a level of aggregation is especially important as the EAR model combines the concept of accessibility, used in transportation science, with a model of regional economic growth. Whereas transport models used to calculate travel times usually work on a highly disaggregated level (the TRANSTOOLS model, for example, operates on a NUTS3 level), economic data is frequently only available for larger regions (such as provinces). An adequate choice of scale is therefore crucial, as it has to satisfy the demand for a combination of the complexity inherent in transport models and the availability of essential economic information. Under these two premises, namely data availability and detailedness of the data, different regional levels of aggregations were chosen in cooperation with the project partners.

Information on passenger and goods transport was supplied by the project partners. In an ideal case, the additional data available will include physical capital stocks, gross value added, employment and human capital stocks on both the regional and the sectoral levels.

In order to estimate factor elasticities, it is common to log-linearize equation (5). The result is shown in equation (6):

$$lnY_{i,s} = lnA + \alpha_s lnK_{i,s} + \beta_{1,s} lnL_{i,s} + \beta_{2,s} lnH_i \quad + \phi_s lnAI_i \quad + ln\varepsilon_{i,s}. \qquad (6)$$

As equation (4) contains regional cross-sectional data, and it must therefore be assumed that observations of neighbouring regions are not fully independent, various econometric tests for spatial correlation are performed to correct for any resulting error of estimation (LeSage and Pace, 2009). In addition to this general issue of contiguity, it can also be assumed that the new EU Member States may follow a different pattern of economic growth than the 'old' Member States. In order to control for this heterogeneity, equation (6) might need to be expanded to include regional dummy variables for each country in addition to choosing a heteroskedasticity-robust Bayesian approach (see LeSage and Pace, 2009).

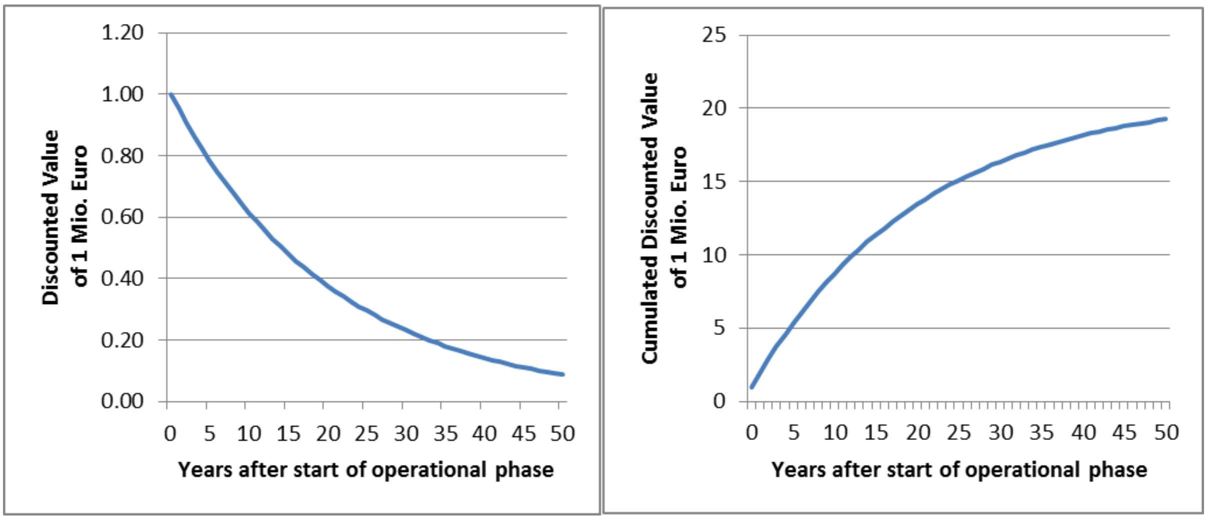
The coefficients estimated can then be used to simulate the effects of certain infrastructure measures:

$$\Delta lnY_{i,s} = \phi_s \Delta lnAI_i^{GV} \qquad (7)$$

For instance, equation (5) depicts the calculation of how a change in accessibility for the transportation of goods ($\Delta lnAI_i^{GV}$) affects value creation in region i ($\Delta lnY_{i,s}$). The change in accessibility of goods transport is calculated by taking the difference between the accessibility before and after infrastructure measurements.

$$\Delta lnAI_i^{GV} = lnAI_i^{GV,measure} - lnAI_i^{GV,no\ measure}$$

Figure 25: Schematic effects of an infrastructure project over time



Source: IHS - Institute for Advanced Studies, 2013.

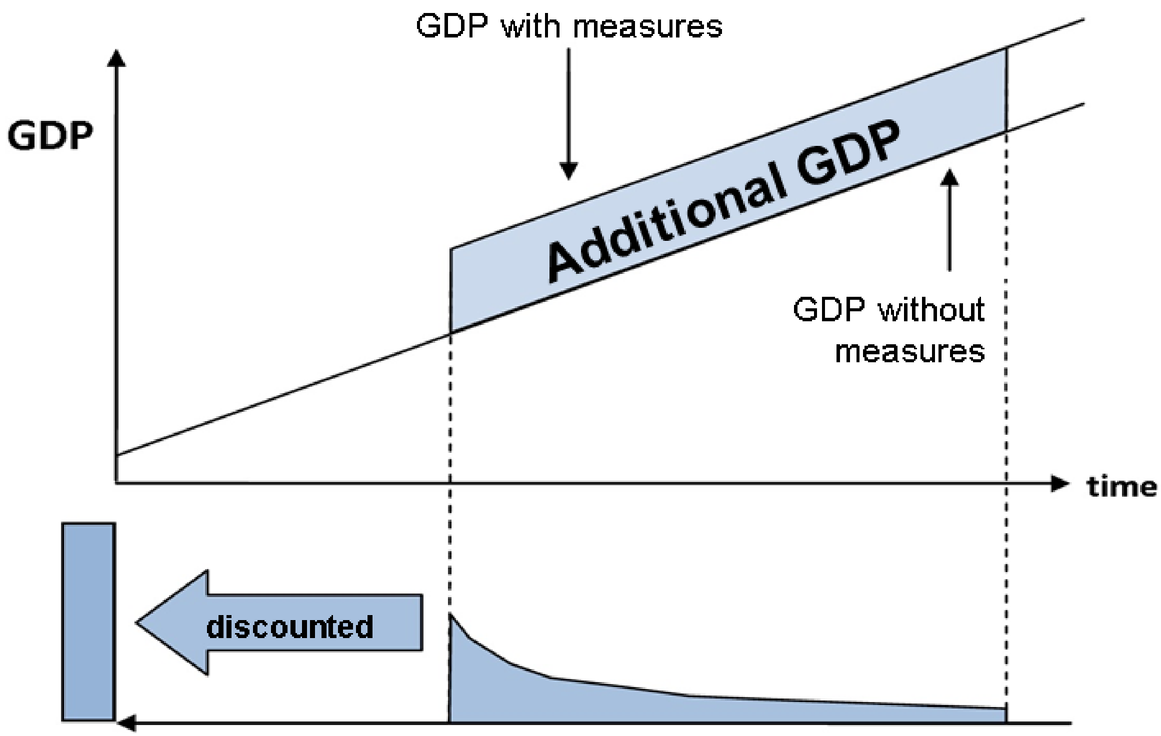
The IHS EAR 2.0 model delivers projections for the development of additional GDP and employment due to infrastructure investments in their operational phase. These effects can then be illustrated on various levels of aggregation. While the economic effect of the measure is large at the beginning of the operational phase, it starts to decay faster and faster until it (almost) ends. This decay in additional economic value is due to the effect of the *time value of money* since it is generally accepted that having 1 million EUR today is better than having 1 million EUR tomorrow.

The general considerations presented here are the basis for further calculations and describe the fundamental principles applied to SETA.

The left panel in

Figure 25 shows the discounted value of 1 million EUR over the first 50 years assuming a discount rate of 5 %. The right panel shows the cumulative effects. Figure 26 summarizes all value streams schematically. The proposed additional SETA measures constitute an additional level effect. But since today's value of a future cash flow strongly depends on the time of the flow, these streams have to be made comparable by using the present value method. Thus, the GDP effects of the proposed SETA measures over time will first be discounted and then cumulatively presented for a specific base year (in this case, the base year is 2012).

Figure 26: GDP effects over time - present value method



Source: Illustration by IHS - Institute for Advanced Studies, 2013.

6.3 SETA and the EAR 2.0 Model

6.3.1 Objectives of the economic analysis

The main question examined by this research question is: How does improved accessibility due to SETA measures affect South Eastern European regions and states? Or more precisely, what are the expected economic growth effects of these measures?

6.3.2 Data and statistical methods

Data on physical capital stocks, gross value added (GVA) and employment on both the regional and the sectoral levels has been obtained from the *Cambridge Econometrics Database*. Data on human capital stems from EUROSTAT and is defined as the share of people who have completed tertiary education in a defined population. Information on passenger and goods transport has been supplied by our project partners. The estimation of the EAR 2.0 model refers to the year in which all relevant data from the different regions are available.

Statistical tests for spatial error correlation are assumed to show that the error term $\ln(\varepsilon_{i,s})$ follows a spatial autocorrelation, in which case several options that correct for this correlation need to be tested. Previous experience has shown that the error term follows a first order (=affecting immediate neighbouring regions) spatial autoregressive process in many cases:

$$ln\varepsilon_{i,s} = \rho M \ln(\varepsilon_{i,s}) + u_{i,s},$$

where $u_{i,s}$ is independent and identically distributed. M represents a matrix with $m_{ij} = 1$ if region i and j share a geographical border and $m_{ij} = 0$ if they do not. For statistical reasons, this matrix is then transformed so that the sums of all rows equal 1. The parameter ρ states the spatial correlation in the error term.

In addition to this general issue of contiguity, it can be assumed that the new EU Member States may follow a different pattern of economic growth than the “old” Member States. In order to control for this heterogeneity, equation (4) has been expanded to include regional dummy variables for each country and a heteroskedasticity-robust Bayesian approach may be applied (see LeSage and Pace, 2009).

6.3.3 Estimating factor elasticities of output using a Bayesian spatial econometrical approach

The basic production function (as described in 6.2.3) is provided in equation 6. A table containing the estimated parameters α_s, $\beta_{1,s}$, $\beta_{2,s}$ und ϕ_s resulting from the IHS EAR regression will be displayed and used as a basis for subsequent analysis. Assuming data availability, this table will showcase the resulting parameters for the three economic sectors agriculture and forestry, industry, and services separately. Each production factor’s coefficient will be subsequently discussed and interpreted in its sectoral context and discussed within the context of both expected outcomes in economic theory and comparable studies. The relevant parameters are reported in Table 44.

6.3.4 Description of parameters:

Parameters for Capital (α) and Labour Force (β1): According to standard economic growth literature, the capital output elasticity will be around 0.33 for all three sectors, while the output elasticity of the labour force should equal 0.66 (Barro et al. 2003). This would imply that an increase in the productive capital by 1 % leads to an increase in output of 0.33 %. For the labour force, a value of 0.66 represents a 0.66 % increase in a region’s output if employment in that region rises by 1%.

Parameter for Human Capital (β2): Human capital, which is especially important for industry and services, will be approximated by the share of people with tertiary education within a region’s population.

Parameter for Accessibility in Goods Transport (Φ): We then address the influence of the parameter ϕ, which represents accessibility, on regional growth. After having controlled for the important economic influences of labour, capital and human capital, this coefficient indicates *ceteris paribus* (all other factors being held constant) the effect of a 1 % increase in the AI on a region’s economic performance.

Table 44: Example of estimated parameters of the production function in case of sectorial model specification and an aggregate specification (based on experience in the past).

Dependent variable: Gross value added						
	AF[a)]		Ind.[b)]		Serv.[c)]	
	range		range		range	
α - Capital	0.32	0.36	0.22	0.37	0.28	0.38
β_1 - Labour force	0.60	0.70	0.59	0.70	0.51	0.66
β_2 -Human capital	*insignificant*		0.08	0.15	0.14	0.22
Φ - Accessibility in goods transport	0.05	0.10	0.08	0.15	0.07	0.15
Ndraws	50,000		50,000		50,000	
Nomit	12,500		12,500		12,500	
Observations	77		77		77	
R^2	0.83		0.83		0.83	

Comments: [a)] Agriculture and Forestry [b)] Industry, [c)] Services;
Estimation method: Bayesian heteroskedastic spatial error model.
Source: IHS - Institute for Advanced Studies, 2013.

Several conclusions can be drawn from the comparison of the production factors' coefficients. Previous infrastructure studies conducted using the IHS EAR model have, for example, shown that classical factors such as labour and capital still play an important role as drivers of regional development. But, at the same time, they clearly indicate that interconnectedness with other regions is an important factor that affects the development of European regions, with a coefficient as high as human capital in the industry sector.

6.4 Results of the IHS-EAR 2.0 model simulation

This chapter identifies the additional economic effect which was generated through the measures along the SETA corridor. The financial analysis provided three sets of measures: Alternative 3, which comprises all suggested measures (with costs of 690.5 million EUR); Alternative 1 (with costs of 146.4 million EUR) is a subset of Alternative 3 and includes only those measures which result in a reduction in travel-time (which was taken as a model input proxy for a reduction in generalised costs); Alternative 2 (with costs of 335.5 million EUR) includes the measures in Alternative 1 plus the removal of severe capacity constraints in Croatia. The following analysis is based on Alternative 2. With this in mind the change in the AI due to the SETA measures can be calculated. This task is best summarized using the following formula, which is derived from equations (2), (4) and (5) for the case of goods transport:

$$\Delta lnY_{i,s} = \phi_s \Delta \left\{ \sum_j GVA_j \exp\left[-\beta \left(m_{nat}^{(rail)} t_{ij}^{(rail)} + \left(1 - m_{nat}^{(rail)}\right) t_{ij}^{(road)} \right) \right] \right\}$$

6.4.1 Data inputs and assumptions

In this section, all necessary variables for identifying the overall economic effect are explained and referenced.

Travel time matrices $t_{ij}^{(rail)}$ and $t_{ij}^{(road)}$

In order to quantify the additional economic effect, different datasets have to be gathered and prepared for processing. The most important of these are the travel time matrices for three different points in time (2015, 2020, 2030), which provide information about the time needed to travel from a certain region of origin to a certain region of destination (the so-called O/D matrices). In our case, the travel times for a reference scenario have to be compared with the reduced travel times in the SETA scenario (which includes the SETA measures) for each of the three years of major change in infrastructure. The respective datasets were provided by the project partner IBV Fallast. Unlike in the financial analysis and the short- and medium-term economic analyses, there is no need to differentiate here between the three different spending variants.

Figure 27 provides a graphical summary of the relative travel time savings in the year 2015 due to SETA measures in selected regions and nations. This visualisation of the travel time savings matrix reveals those regions or nations which profit most. The relative savings in travel time for selected origin-destination connections (links) are coloured according to the region of origin. For instance, Croatia (light green) has travel time savings to other regions or nations (these connections or links are also coloured light green). Travel time savings from another point of origin to Croatia are shown in the colour of the region of origin. Since, in general, the travel time reductions are symmetric (i.e. in both directions), the outbound travel time savings equal the inbound travel time savings.

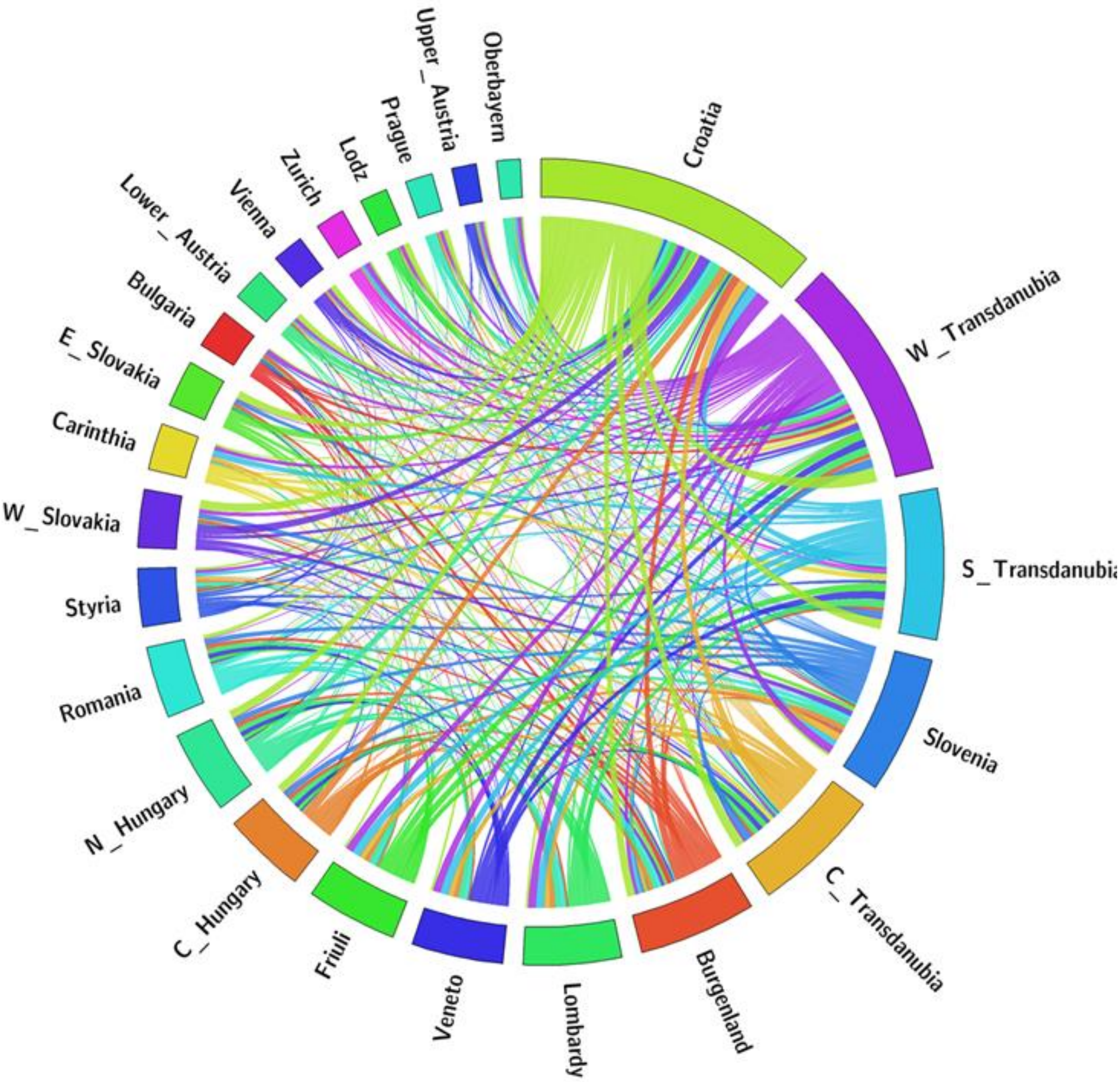
Due to data limitations in the transport demand model, it was not possible to keep the NUTS2 standard for all regions in the observation area. Accordingly, Croatia, Slovenia, Bulgaria and Romania were included on a NUTS0 basis, while the NUTS2 standard was kept for all other regions.

In the example of Western Transdanubia, outbound travel time savings are shown in violet, whereas inbound travel time savings are coloured according to the region of origin. The thickness of the lines reflects the relative amount of travel time saved. In general, travel time savings between regions should be roughly equal regardless of the direction of travel, and in the example of the savings in travel times between Western Transdanubia and Slovenia savings can indeed be seen in both directions (green and blue lines connecting the two regions), which means that travelling from Western Transdanubia to Slovenia and vice versa is now faster.

Modal split $m_{nat}^{(rail)}$

The information about the modal split was taken from EUROSTAT. In the cases of countries with inland waterways, the percentage shares for rail and road were re-weighted so as to sum up to one. Due to the lack of data, the modal split was kept unchanged in all calculations. This imperfection leads to a downward bias and, therefore, to an underestimation of the additional economic effect. Simulations revealed that the underestimation might be up to 10 % of the regional present value. Further analysis would be needed to specify the underestimation more precisely.

Figure 27: Graphical summary of the travel time matrices: Relative savings in travel time for 2015. Relative savings in travel time for selected origin-destination connections (links) are coloured according to the region of origin.



Source: IHS - Institute for Advanced Studies, 2013. Software: Krzywinski, M. et al. Circos: An Information Aesthetic for Comparative Genomics. Genome Res (2009) 19:1639-1645

Spatial weight parameter β

As described in Section 6.2.2 above, the spatial weight parameter β is taken from literature on spatial economics and our own previous estimations. In accordance with Schürmann and Talaat (2000), a spatial weight parameter of 0.003 in the case of goods transport and 0.007 in the case of passenger transport is implemented.

Gross value added (GVA)

GVA was obtained from the *Cambridge Econometrics Database*. On a regional level (NUTS2), GVA was available until 2010; these values were then inflated to match the base year of this study (2012). In order to forecast regional GVAs, GDP forecasts were taken from long-term baseline projections by the OECD (Economic Outlook No 93 from June 2013), providing real GDP growth rates until the year 2060. These growth rates were then applied to forecast GVA, as GVA is defined as GDP – taxes + subsidies. It was thus implicitly assumed that the tax ratio will stay the same over the entire period of consideration (2015 – 2049).

Accessibility elasticity of output ϕ_s
The accessibility elasticity of output was generated by estimating the above described accessibility-dependent regional model (IHS-EAR model 2.0). Depending on the exact specification robust estimates of elasticities for the industrial sector that are statistically significant for goods transport range from 0.08 – 0.12. Unfortunately, estimates for passenger transport turned out to be statistically insignificant, with the consequence that the model was only applied to goods transport. The probable reason for this is that in the case of passenger transport NUTS2 regions might still be a level of analysis that is not detailed enough for an adequate analysis . For the economic evaluation of SETA measures described here, an elasticity of 0.08 was applied. Thus, the value of 0.08 reflects a rather conservative estimate of the accessibility elasticity. However, recent research in a parallel project shows that if the elasticity for passenger transport becomes statistically significant, the value of the elasticity for goods transport reduces. A possible explanation for this is that due to their high correlation the passenger and goods transport elasticities are multicollinear.

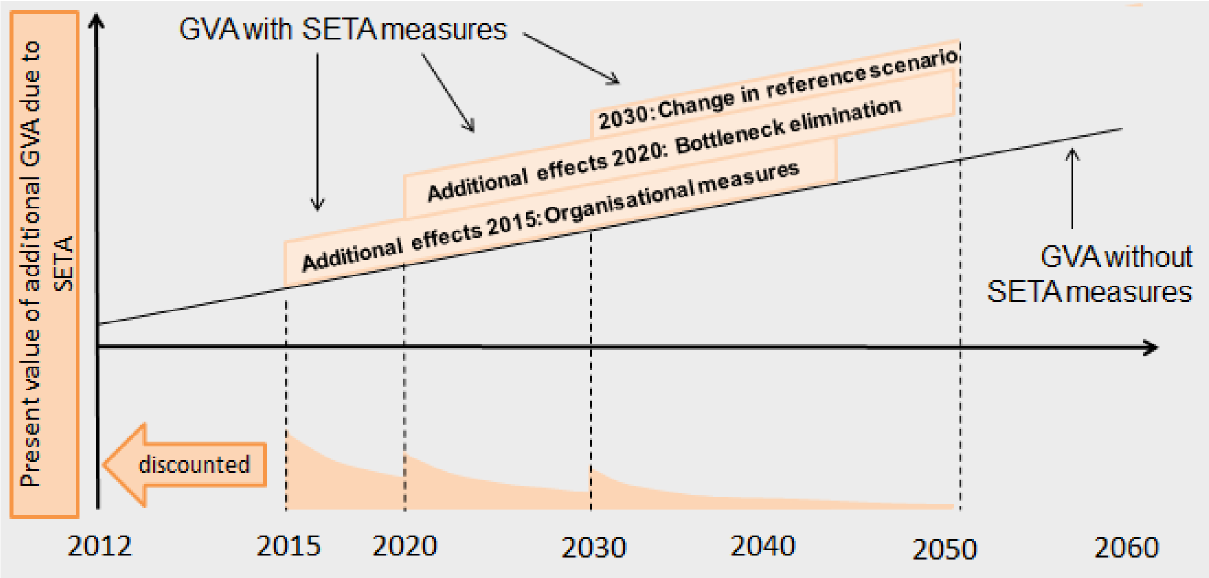
As specified above, the data for the model estimation on physical capital stocks, GVA and employment on both the regional and the sectoral levels was obtained from the *Cambridge Econometrics Database*. Data on human capital stems from EUROSTAT, and is defined as the share of people who have completed tertiary education in a defined population.

Social discount rate (SDR)
The SDR rate was taken in accordance with the EU's guide to the cost benefit analysis of investment projects. The following SDR values were used: 5.5 % for cohesion countries (Slovakia, Hungary, Slovenia and Croatia) and 3.5 % for the remaining countries (Austria and Italy). The SDR is needed to properly discount future flows of values and to summarize them to a comparable present value (in accordance with the present value method).

6.4.2 Simulation of economic effects

Based on the model described above, additional GVA effects of the SETA measures over time (2015, 2020, and 2030) were estimated and then discounted and totalled. Figure 28 shows the IHS approach and depicts schematically how the SETA measures (2015 and 2020) will affect GVA per year in comparison to a baseline scenario. From 2030, the SETA measures were re-evaluated to reflect severe (assumed) changes in the reference scenario (caused mainly by the finalization of the Koralm tunnel and the Semmering tunnel). The underlying assumption is that each SETA measure will have an effect for a 30-year period. The additionally generated GDP per year from all SETA scenarios then needs to be discounted in order to compute the present value of all SETA measures in relation to long-term GDP growth. A shaded, downward sloping area in the lower area of the chart represents the cumulative effects of all scenarios over time valued at 2012 prices. In a final step, these effects are then totalled in order to obtain the effects' present value in 2012.

Figure 28: SETA measures - GDP effects over time



Source: IHS - Institute for Advanced Studies, 2013.

6.5 Results

Following the approach described above, the final present values (discounted and then aggregated additional effects) are shown in Table 45:

Table 45: Overall economic effects due to SETA measures, present values

Country	Present value in 2012 (in 2012 million EUR)
Austria	595
Croatia	564
Hungary	912
Italy	422
Slovenia	143
Slovakia	104
SETA Countries	**2,739**
EU-28 + EFTA	3,954

Source: IHS - Institute for Advanced Studies, 2013.

The overall present value for all SETA countries in 2012 equals 2,739 million EUR, and nearly 4 billion EUR for the EU-28 and EFTA[23] countries. This value represents the sum of all discounted future streams of monetised economic benefits due to the reduction of generalised costs (approximated travel time savings) by SETA measures in the period from 2015-2049.

[23] EFTA countries: Switzerland, Liechtenstein, Norway and Iceland.

As expected, Hungary benefits the most from travel time savings with a present value of 912 million EUR, since it is situated in the centre of the SETA corridor. Next come Austria and Croatia, with 595 million EUR and 564 million EUR, respectively. As the accessibility elasticity of output generates an additional effect, the basis to start from is the level of current national or regional GVA. This plays a large role: countries might have the same elasticity, but in absolute terms the benefit for countries with higher initial GVA is greater than for those with lower GVA.

Italy follows next with a present value of 422 million EUR, while Slovenia and Slovakia benefit with 143 million EUR and 104 million EUR, respectively. A comparison of the effect on SETA countries with the present value for all countries included in the evaluation (EU-28 + EFTA) shows how far-reaching the benefits derived from the SETA measures are.

The GDP effects resulting from accessibility improvements through SETA measures for each country are calculated (Table 46), and regional GVA increases are mapped (Figure 29) on the following pages.

In order to approximate the additional employment generated through the implementation of the SETA measures, average GVA for the years 2000–2006 divided by the average employment in the same period was calculated. This ratio was then multiplied by the additional GVA generated by the SETA measures. Since GVA is generated through either capital, labour or technological advance, the resulting values were then multiplied with the labour share. The 2000-2006 period was chosen as a comparable period of time since it is assumed that the inclusion of later years would bias the result due to the economic boom in 2007 and 2008 and the subsequent crises in the years thereafter.

Table 46: Average additional employment during operational phase

Country	Average additional employment during operational phase
Austria	300
Croatia	1550
Hungary	2080
Italy	300
Slovenia	165
Slovakia	230
SETA Countries	**4,625**

Source: IHS - Institute for Advanced Studies, 2013.

With respect to additional employment, Croatia and Hungary benefit even more than they do in GVA terms. One reason for this might be that these countries are characterized by lower labour costs. On average, additional employment amounts to 1,550 persons in Croatia and 2,080 persons in Hungary. The SETA effects for the remaining countries are as followed: Austria 300, Italy 300, Slovenia 165 and Slovakia 230. Detailed data on employment can be found in the **regional fact sheets** in the Appendix 2 to this report.

The following approach was chosen with regard to additional tax revenue. A national tax ratio (in relation to GVA) was derived from the input-output tables. This tax ratio was simply multiplied with the additional GVA generated by the SETA measures. This is fairly straightforward at the national level, but it is far more complicated at the regional level, since the tax regimes vary substantially between SETA countries and regions (from a more federal system to a more centralised system). Thus, the tax revenues specified in the **regional fact sheets** (see Appendix 2) should be interpreted as tax revenue generated in the region but contributing to the overall public budget, and not as the tax revenue to, for example, a regional government. The results are shown in Table 47.

Table 47: Additional tax revenue

Country	Tax Revenue due to SETA measures (Present value in 2012 million EUR)
Austria	226
Croatia	190
Hungary	394
Italy	123
Slovenia	56
Slovakia	31
SETA Countries	**1,020**

Source: IHS - Institute for Advanced Studies, 2013.

Table 48 provides an overview of GVA in present values by country (in alphabetical order), including regional outcomes and the respective applied SDR. The present values are calculated for 2012 (i.e. present = 2012) and in 2012 prices.

As the first SETA measures come into effect in 2015, column 5 gives forecasted regional GVA values for this reference year in 2012 prices. Columns 6, 7 and 8 exemplify the discounted values of additional GVA in 2015, 2030 and 2049 due to the proposed SETA measures in 2012 prices. The table shows nicely the property of declining values due to social discounting.

Column 9 provides the overall sum of all annual present values in 2012 prices. This represents the sum of all discounted additional values (such as columns 6, 7 and 8, but only for all years from 2015-2049).

The last column indicates the percentage increase in GVA (which approximates a percentage increase in GDP). It shows which regions profit the most from the SETA measures in relative terms.

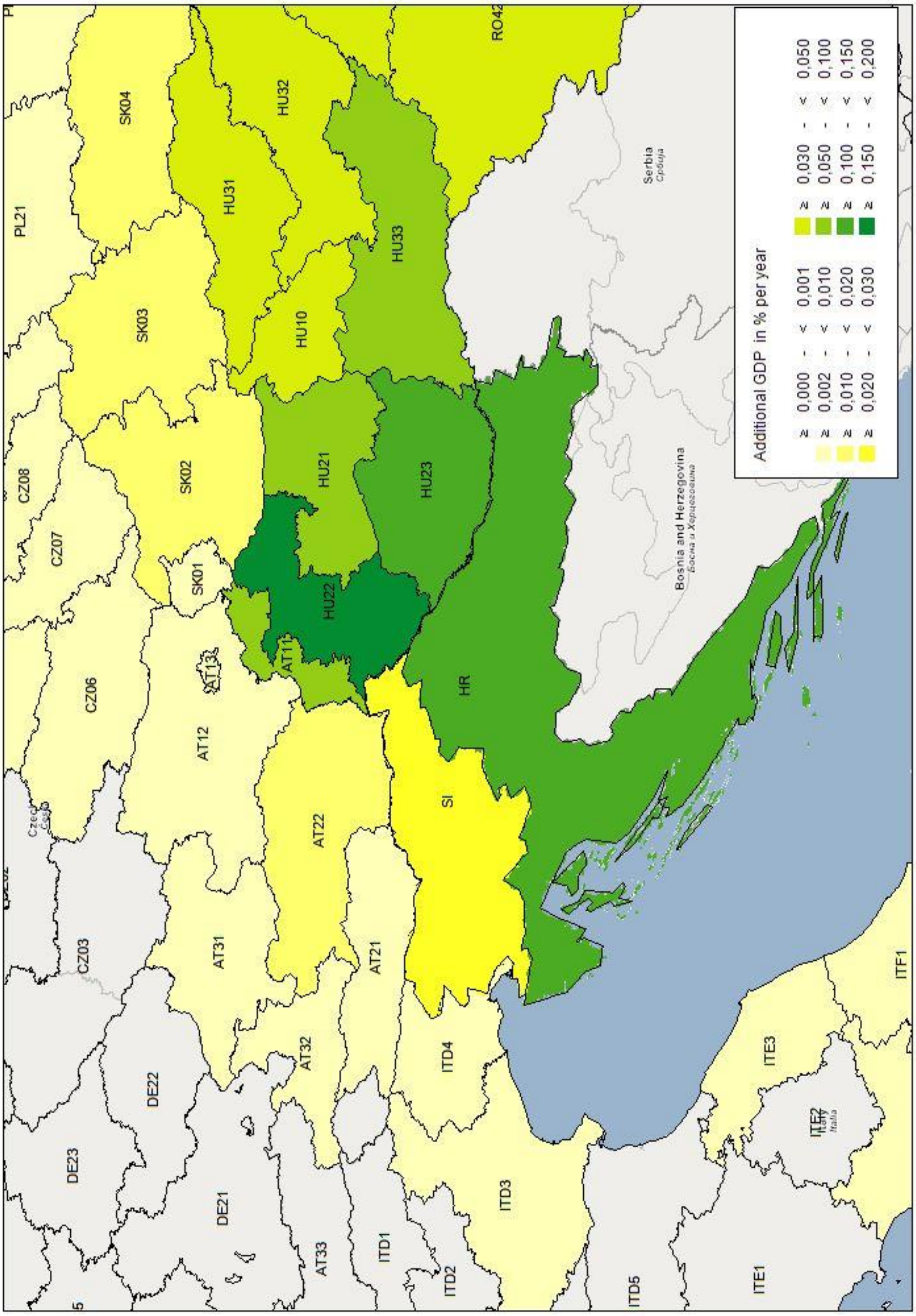
Figure 27 then maps how these annual additional effects on GVA (column 10 in Table 48) are distributed on a regional level. For instance, the additional effect on regional GVA in Western Transdanubia is 0.21 % in 2015.

Table 48: Final results of long-term economic analysis based on IHS-EAR 2.0 model simulation. (GVA = Gross Value Added)

Country	Region	NUTS2	SDR	Forecasted GVA in 2015	Present Value of additional GVA in 2015	...	Present Value of additional GVA in 2030	...	Present Value of additional GVA in 2049	∑ of present values 2015-2049	Additional GVA in 2015
			in %	in 2012 Mio Euro	in 2012 Mio Euro	...	in 2012 Mio Euro	...	in 2012 Mio Euro	in 2012 Mio Euro	in %
AUSTRIA	**TOTAL**	**AT**	**3.5%**	**292,495**	**23.2**	**...**	**19.6**	**...**	**13.1**	**595**	**0.009%**
	Burgenland	AT11	3.5%	6,499	4.7	...	3.3	...	2.2	110	0.081%
	Lower Austria	AT12	3.5%	46,339	3.0	...	2.7	...	1.8	77	0.007%
	Vienna	AT13	3.5%	78,102	5.5	...	4.8	...	3.2	139	0.008%
	Carinthia	AT21	3.5%	16,564	0.9	...	0.9	...	0.6	26	0.006%
	Styria	AT22	3.5%	36,461	6.5	...	5.6	...	3.7	176	0.020%
CROATIA	**TOTAL**	**HR**	**5.5%**	**38,658**	**44.6**	**...**	**16.3**	**...**	**7.6**	**564**	**0.135%**
HUNGARY	**TOTAL**	**HU**	**5.5%**	**88,124**	**53.2**	**...**	**20.6**	**...**	**10.8**	**912**	**0.071%**
	Central Transdanubia	HU21	5.5%	8,794	7.4	...	3.5	...	1.9	135	0.099%
	Western Transdanubia	HU22	5.5%	8,371	14.7	...	7.0	...	3.6	259	0.207%
	Southern Transdanubia	HU23	5.5%	5,485	6.4	...	3.8	...	2.0	126	0.137%
ITALY	**TOTAL**	**IT**	**3.5%**	**1,259,185**	**25.0**	**...**	**7.3**	**...**	**5.0**	**422**	**0.002%**
	Friuli-Venezia Giulia	ITD4	3.5%	32,341	1.1	...	0.6	...	0.4	25	0.004%
	Veneto	ITD3	3.5%	128,626	3.2	...	1.3	...	0.9	62	0.003%
	Emilia-Romagna	ITD5	3.5%	120,107	2.1	...	0.7	...	0.5	37	0.002%
	Marche	ITE3	3.5%	36,092	1.0	...	0.3	...	0.2	17	0.003%
SLOVAKIA	**TOTAL**	**SK**	**5.5%**	**67,988**	**5.7**	**...**	**2.8**	**...**	**1.2**	**104**	**0.010%**
SLOVENIA	**TOTAL**	**SI**	**5.5%**	**31,045**	**6.3**	**...**	**4.2**	**...**	**2.1**	**143**	**0.024%**

Source: IHS - Institute for Advanced Studies, 2013.

Figure 29: Additional GVA in % due to SETA measures – 2015 values



Source: IHS – Institute for Advanced Studies, 2013.

6.6 Results of Alternatives

As described at the beginning of Section 6.4, these calculations are based on the implementation of measures referred to as Alternative 2. In order to derive economic effects for Alternative 1 and Alternative 3, the following was assumed (due to a lack of data): since Alternative 1 does not remove the existing capacity constraints in Croatia, the overall present value for Croatia was reduced by half to reflect the development of the access charges for this alternative. Further, the present values for other countries were reduced slightly (by 10%), since the access to the Adriatic Sea via Rijeka was assumed to be capacity-constrained. In contrast, the economic long-term effects of Alternative 3 were kept equal to those of Alternative 2 because Alternative 3 (in comparison to Alternative 2) does indeed further improve capacity in the SETA corridor (e.g. through increases in axle loads). But since estimated traffic in Alternative 2 (unlike in Alternative 1) is not anymore capacity-constrained, further improvements in capacity have no effects (from an EAR 2.0 model point of view). As consequence, the EAR 2.0 model effects of Alternative 3 are the same as for Alternative 2. A comparison of all alternatives is undertaken in Chapter 8 (Consolidated Economic Analysis, p. 119).

6.7 Summary

The IHS EAR 2.0 model estimates the long-term economic effects by adding up all future additional increases in GVA for the years 2015-2049 which are generated through a reduction in generalised costs due to the implementation of SETA measures.

The overall present value of the additional GVA in 2012 for all SETA countries equals 2.7 billion EUR. Hungary benefits the most, with a present GVA value of 912 million EUR, as it is located in the centre of the SETA corridor. Next come Austria and Croatia, with 595 million EUR and 564 million EUR, respectively. Italy follows next with a present value of 422 million EUR, while Slovenia and Slovakia benefit with 143 million EUR and 104 million EUR, respectively.

The overall effect for all countries included in the evaluation i.e. all EU-28 plus the EFTA countries, generates a present value of nearly 4 billion EUR in additional GVA over a 35-year period (2015–2049). This shows how far-reaching the benefits derived from the SETA measures are. As described in the previous section, the values provided here reflect the implementation of the SETA measures included in Alternative 2. Alternative 1 is estimated to have an overall present value of 2.2 billion EUR for SETA countries and an overall present value of 3.3 billion EUR for all EU-28 and EFTA countries.

In relative terms, this means that the regions located in the heart of the SETA corridor benefit by an increase of up to 10-20 basis points in terms of annual GDP growth. This corresponds to an increase in the GDP growth rate of between 0.1 and 0.2 percentage points, which is remarkable on the one hand given the low investment costs (in relation to other infrastructure projects) yet obvious on the other since the SETA measures are primarily aimed at removing organisational and infrastructural bottlenecks.

In short, the effects of this project contribute to the implementation of the European Union’s regional policy. The “cohesion countries” mainly benefit from the implementation of the SETA measures (as can be seen in Figure 29). Several regions within the “cohesion countries" are put on a higher growth path. Thus, this project also contributes to the European Union's convergence objective.

7 Environmental and socio-economic evaluation (IHS)

7.1 Description of method

In economic theory, the prices of market goods depend on their respective supply and demand. Generally, in a market transaction two parties exchange goods or services which are characterized by their quantities and per unit prices, the latter reflecting the value given to the good. In the case of an economic evaluation based on a cost-benefit analysis, which takes the perspective of society as a whole, the market pricing of a good is not a good indicator of its true value to society as so-called **external effects** also play a significant role.

External effects (or externalities) are uncompensated impacts of economic decision-making on third persons which can be both positive and negative. They are not included in an item’s price in a market transaction and therefore not taken into account in individual decision-making. As this leads to the conclusion that individual decision-making does not lead to societally optimal decisions, this concept of externalities is crucial to justify public intervention in mainstream economic theory (Gwartney et al. 2011). The difficulty thus lies in the evaluation of these impacts, which can become manifest in social and/or ecological costs and/or benefits. Yet the valuation of these effects is crucial for economic analysis. In order to internalise these externalities, the external effects have to be identified, quantified and have a realistic monetary value assigned to them. The calculated value for externalities or non-market products is a so-called shadow price.

When utilizing a transport service, certain benefits (e.g. reaching a destination) and costs (e.g. the price of the ticket) are generated. Benefits and costs that do not solely affect the person demanding the service include, in our case, emissions and noise (also their reduction in the event that rail is chosen over road). These effects are usually very beneficial for railway operations as, for example, particulate matter emissions can be reduced significantly in comparison to road transportation.

The scientific literature identifies several external effects that should ideally be taken into account (see e.g. Maibach et al. 2008). Of these, the following are considered to be of possible critical importance for the SETA project: air pollution, climate change, accidents and noise.

The thorough inclusion of all relevant externalities is crucial as (especially in the railway case) an improvement of the modal split tend to reduce negative external effects. If not taken into account, these lead to an underestimation of societal benefits as all factors that are not monetized are by definition set to zero.

7.1.1 External effects included in the analysis

As discussed above, the estimation and monetisation of external effects is difficult and may introduce additional uncertainties as they can only be estimated and monetised roughly, if at all. For some factors there are also considerable ethical hurdles concerning their monetisation. The approach taken in this analysis was to identify and include those factors for which robust estimations regarding their change due to the operational phase of the SETA measures could be supplied by the project partners along with available estimations of costs.[24]

Global warming and air pollution caused by transport activities leads to different types of external costs. The most important regional external costs are health costs due to cardiovascular and respiratory diseases caused by air pollutants. Other external costs include building and material damages, crop losses and global impacts on biodiversity and ecosystems as well as long-term climate change impacts. The main climate change factors identified are the greenhouse gases CO_2 (carbon dioxide), nitrous oxide (N_2O) and methane (CH_4), whereas the most important transport related air pollutants are particulate matter (PM_{10}, $PM_{2.5}$), nitrogen oxide (NOx), sulphur dioxide (SO_2), volatile organic compounds (VOC) and ozone (O_3) as an indirect pollutant.

In the case of the IHS' consolidated economic analysis of SETA measures (which takes environmental and social external effects into account) the following relevant air polluters - identified in accordance with academic literature, consultations with SETA partners and EU guidelines - are monetized according to HEATCO standards (See Bickel et al. 2006):

Air pollution

- **NOx** (nitrogen oxide)
- **PM_{10}, $PM_{2.5}$** (particulate matter)
- **NMHC** (non-methane hydrocarbons, a VOC sub-group)
- **SO_2** (sulphur dioxide)

Global warming

- **CO_2** (carbon dioxide)
- **N_2O** (nitrous oxide)
- **CH_4** (methane)

To estimate the economic effects of these externalities, we used prices and methods proposed by the HEATCO study, which provides a consistent methodological framework for project appraisal including default values for the most non-marked goods.[25]

7.1.2 Air pollution

The monetary values for air pollution (NOx, PM10, PM2.5, NMHC and SO_2) have been taken from HEATCO, applied on a country level according to guidelines and adjusted to GDP.[26]

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[24] The effects of construction, which are likely to be negative, were not considered as they are hard to estimate. The effects calculated only refer to the operational phase and the effects of changes in modal split due to SETA measures.

[25] Unfortunately, HEATCO does not provide shadow prices for Croatia. Thus, these values necessarily had to be deduced from neighbouring areas (Slovenia) and adjusted to regional GDP values.

[26] For the emission of particulate matter, the monetary value assigned also depends on whether the area of emission is considered urban or rural. As the information supplied did not include the declaration of particulate matter by urban/non-urban area, an average of 50% each was applied.

With respect to air pollution, the HEATCO study suggests increasing the related values based on a default inter-temporal elasticity to GDP per capita growth of 1.0. This means that the future values for air polluting substances (for 2015-2049) would have to be adjusted every year according to the respective regional GDP per capita growth rate. HEATCO data are given in 2008 prices and were inflated into 20012 prices (EUR_{2012}) using the Harmonised Consumer Price Index (HCPI). In order to adjust for GDP per capita growth, GDP per capita forecasts could be taken from the OECD's most recent (June 2013) long-term baseline projections.[27]

7.1.3 Global warming

Climate change or global warming impacts of transport are caused mainly by emissions of the greenhouse gases carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4). The method of calculating costs due to the emission of greenhouse gases (usually expressed as CO_2 equivalents) basically involves multiplying the amount of CO_2 equivalents emitted by a cost factor. Due to the global scale of the damage caused, there is no difference how and where in Europe the emissions of greenhouse gases take place. For this reason, we have applied the same values in all countries.

The HEATCO study suggests that the CO_2 equivalent of a greenhouse gas is derived by multiplying the amount of the gas by the associated Global Warming Potential (GWP). The GWP for methane is 23, for nitrous oxide 296, and for CO_2 1.

With respect to global warming, the relevant HEATCO values were taken but not GDP per capita adjusted, since HEATCO and Watkiss (2005) argue against such an adjustment as the values they recommend are based on the 2K climate change goal[28], which is unrelated to changes in GDP. This means that the monetary estimates gained from the environmental analysis might be conservative with regard to air pollutants.

Table 49: Prices based on Watkiss et al. (2005) in EUR_{2002} (factor prices) per ton of CO_2 equivalent emitted

Year of emission	Central guidance	For sensitivity analysis	
		Lower central estimate	Upper central estimate
2000 - 2009	**22**	14	51
2010 - 2019	**26**	16	63
2020 - 2029	**32**	20	81
2030 - 2039	**40**	26	103
2040 - 2049	**55**	36	131

Source: HEATCO (Bickel et al.: 2006).

Since CO_2 is one of the main factors in the estimation of environmental benefits from SETA, it is considered separately in an additional sensitivity analysis in Chapter 7.2.3. As can be seen from Table 49 prices attributed to CO_2 increase over time. This is based on the assumption that in future emissions will have stronger total impacts than they do at

[27] See OECD (2013). Since the OECD does not provide values for Croatia, IHS estimates were used for the years 2013 and 2014, whereas the long-term growth rates had to bet set arbitrarily by approximating those for Slovakia in the period 2015-2030 and Slovenia in the period 2031-2049.
[28] The target of staying below a two degree Kelvin/Celsius increase in global temperature, which was a goal of the Kyoto Protocol and also supported in the Copenhagen Accord in 2009.

present.[29] Accordingly, the upper limit values recommended for a sensitivity analysis are rather high in comparison to the lower estimates.[30]

For the estimation of economic effects, the possibilities of greenhouse gas emissions due to the project (measured in tons) need to be multiplied by the CO_2 equivalents and the according cost factor.

7.1.4 External costs not included in this study

The following factors have not been included in the environmental analysis.

- Reduction in **accidents**: By enhancing a railway line, accidents can be reduced due to a change in modal split away from road transport to the more secure railway option. While estimates of the anticipated number of accidents could have been taken from the traffic demand model (Work Package 4.3), a discussion with the project partners led to the conclusion that the estimates would be based on the one hand on strong assumptions and over-generalisations regarding the reduction in the number of accidents. On the other hand, the monetisation of accidents or deaths also poses a strong ethical question, and although some studies do determine the value of both human lives and person-years lost, it was decided that only qualitative statements regarding the possible decrease in accidents and mortality could be made. However, this decision leads to an underestimation of the reduced social costs.
- Change in **noise:** A change in traffic volume of 10 % is estimated to change noise emissions by about 1 dB; any level below this volume cannot be measured if noise levels are not constant but vary (e.g. depending on intensity of use). In addition, noise emission is based on a variety of local factors (composition of vehicles, local speed limits, road surface, etc.) and is therefore subject to changes that cannot be estimated on the planning level applied in the traffic demand model. The evaluation of changes in noise emission due to measures along the SETA axis by project partners (IBV Fallast) was therefore only possible in classes of 5 dB for road sections. In order to be able to measure changes by traffic volume, they would have to be measurable (which would signify a change in traffic volume of at least 10 % or 1dB) and, even then, only a change in noise category (which is measured in intervals of 5 dB) would be significant and could be monetized. In addition to these hurdles, different monetary values are ascribed to noise changes depending on the current noise level and regional classifications.

7.2 Results

The expected development of greenhouse gas and air pollutant emissions scenarios with and without the upgraded network scenarios are were supplied by our project partners (IBV Fallast) and are depicted in Table 50.

[29] See Watkiss et al. 2005

[30] This assumption of growing values over time requires explicit and careful emission modelling over time. If this is not the case, the results may overestimate the benefits of a transport project, as it can be assumed that vehicle emissions will decrease considerably in future (see Watkiss et al. 2005).

Table 50: Overview of emissions reduced by SETA measures

Difference 2015 to 2019									
Country	SETA Regions	CO_2 [t/y]	NO_x [t/y]	PM10 [t/y]	PM2.5	NMHC	SO_2 [t/y]	N_2O [t/y]	CH_4 [t/y]
Austria	Burgenland	467.602	1.603	0.026	0.025	0.043	0.003	0.025	0.001
	Niederösterreich	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Wien	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slovakia	Bratislavský kraj	40.084	0.137	0.002	0.002	0.004	0.000	0.002	0.000
Hungary	Nyugat-Dunántúl	850.319	2.915	0.047	0.046	0.078	0.006	0.046	0.002
Slovenia	Vzhodna Slovenija	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Zahodna Slovenija	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Croatia	Sjeverozapadna Hrvatska	690.868	2.368	0.038	0.037	0.064	0.005	0.037	0.002
	Jadranska Hrvatska	1406.882	4.823	0.078	0.076	0.130	0.010	0.076	0.003
Italy	Friuli Venezia Giulia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total		**3455.754**	**11.847**	**0.191**	**0.187**	**0.319**	**0.024**	**0.187**	**0.008**

Difference 2020 to 2029									
Country	SETA Regions	CO_2 [t/y]	NO_x [t/y]	PM10 [t/y]	PM2.5	NMHC	SO_2 [t/y]	N_2O [t/y]	CH_4 [t/y]
Austria	Burgenland	903.870	1.362	0.020	0.020	0.047	0.006	0.054	0.001
	Niederösterreich	838.076	1.263	0.019	0.018	0.044	0.006	0.050	0.001
	Wien	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slovakia	Bratislavský kraj	368.036	0.555	0.008	0.008	0.019	0.003	0.022	0.000
Hungary	Nyugat-Dunántúl	9354.512	14.097	0.209	0.205	0.491	0.067	0.560	0.012
Slovenia	Vzhodna Slovenija	6496.517	9.790	0.145	0.142	0.341	0.047	0.389	0.008
	Zahodna Slovenija	1955.871	2.947	0.044	0.043	0.103	0.014	0.117	0.003
Croatia	Sjeverozapadna Hrvatska	3712.113	5.594	0.083	0.081	0.195	0.027	0.222	0.005
	Jadranska Hrvatska	4630.342	6.978	0.104	0.102	0.243	0.033	0.277	0.006
Italy	Friuli Venezia Giulia	365.043	0.550	0.008	0.008	0.019	0.003	0.022	0.000
Total		**28624.381**	**43.136**	**0.641**	**0.628**	**1.504**	**0.205**	**1.712**	**0.037**

Difference 2030 to 2049									
Country	SETA Regions	CO_2 [t/y]	NO_x [t/y]	PM10 [t/y]	PM2.5 [t/y]	NMHC [t/y]	SO_2 [t/y]	N_2O [t/y]	CH_4 [t/y]
Austria	Burgenland	1245.651	0.742	0.009	0.008	0.042	0.009	0.076	0.001
	Niederösterreich	4106.590	2.447	0.029	0.028	0.139	0.029	0.251	0.003
	Wien	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slovakia	Bratislavský kraj	213.559	0.127	0.001	0.001	0.007	0.002	0.013	0.000
Hungary	Nyugat-Dunántúl	7474.496	4.455	0.052	0.051	0.253	0.054	0.456	0.006
Slovenia	Vzhodna Slovenija	-2039.332	-1.215	-0.014	-0.014	-0.069	-0.015	-0.124	-0.002
	Zahodna Slovenija	3538.740	2.109	0.025	0.024	0.120	0.025	0.216	0.003
Croatia	Sjeverozapadna Hrvatska	1922.278	1.146	0.013	0.013	0.065	0.014	0.117	0.002
	Jadranska Hrvatska	5740.049	3.421	0.040	0.039	0.194	0.041	0.350	0.005
Italy	Friuli Venezia Giulia	1809.027	1.078	0.013	0.012	0.061	0.013	0.110	0.002
Total		**24011.058**	**14.310**	**0.167**	**0.163**	**0.812**	**0.172**	**1.465**	**0.020**

Source: IBV Fallast, illustration by *IHS, 2013.* [31]

Table 50 gives an overview of annual reductions in pollution by region for the given periods of time. Only those SETA regions affected by changes in emission due to SETA measures are included. The reductions were subsequently converted into monetary terms as described above.[32]

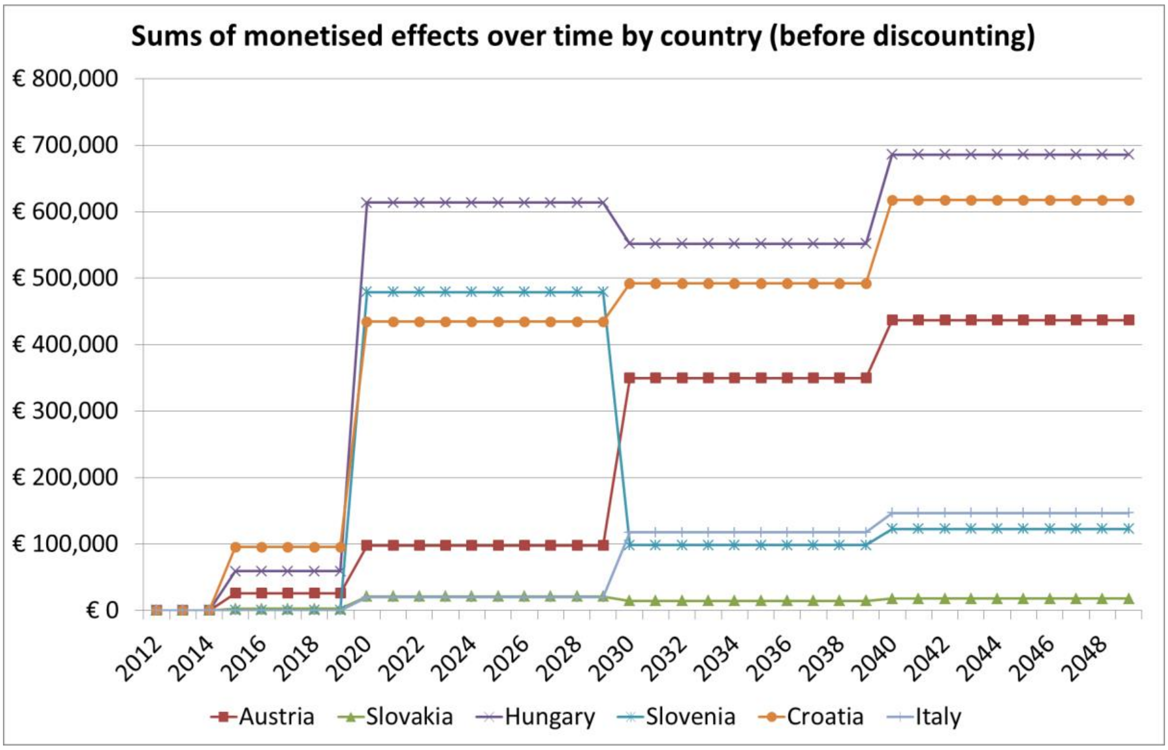
[31] Values for the period 2040-2049 were extrapolated from the period 2030-2039.

[32] In this step, HEATCO (Bickel et al. 2006) values were also compared to global warming values supplied by CE DELFT (see Maibach et al. (2008)), and values supplied by AIR CAFÉ on air pollution (see Holland et al. (2005)). Both AIR CAFÉ and CE DELFT values attribute higher costs to emissions based on differences in the methodology applied (the overall difference in total costs with an SDR of 5.5 % were found to amount to 132 % of HEATCO values for global warming and 154 % for air pollution). The HEATCO approach was chosen for consistency reasons, but a strong emphasis has to be made on the wide range that should be considered in a sensitivity analysis.

7.2.1 National results

Figure 30 gives an overview of positive external effects over time by country in EUR. This graph shows that all countries profit from a positive effect due to reductions in emissions, with Hungary, Croatia and Austria as the main long term beneficiaries, and Slovenia with strong profits in the period 2020-2029 (these are significantly lower after this period as some of the effects in Vzhodna Slovenija are negative in the period 2039-2049, see Table 50). In the IHS consolidated economic analysis (see next chapter), these values will be discounted together with the outcomes of the financial and economic analysis.

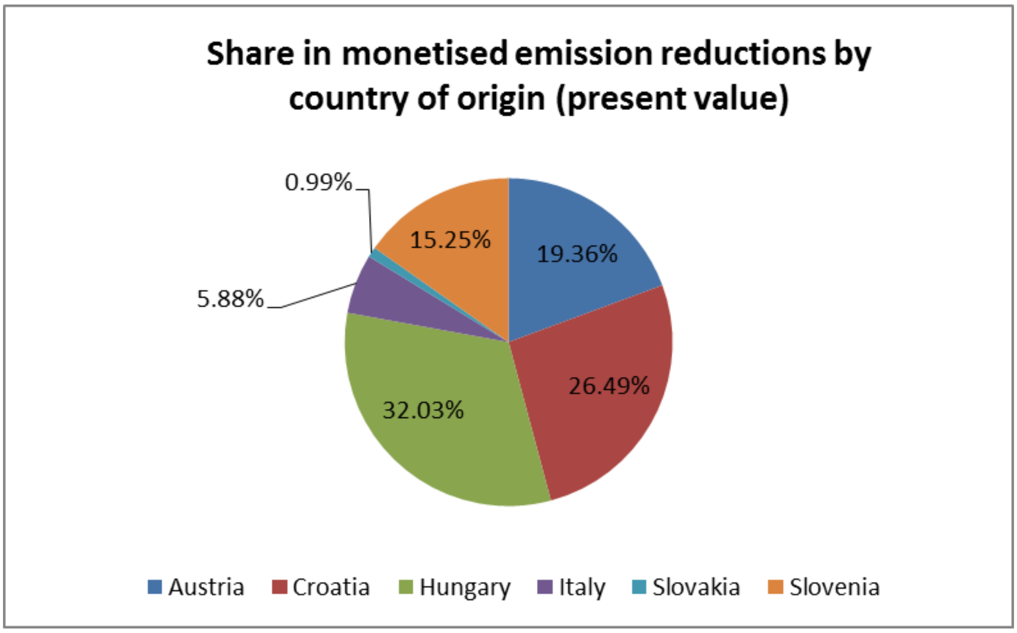
Figure 30: Positive external effects by country and year in EUR[33]



Source: IHS – Institute for Advanced Studies, 2013.

[33] Jumps can be explained either by changes in emissions or changes in the monetary value assigned to CO2 emissions, as these also vary over time (see Table 49).

Figure 31: Distribution of cumulated monetised positive environmental effects by country, monetized present value 2012[34]



Source: IHS - Institute for Advanced Studies, 2013.

Figure 31 shows the distribution of overall positive effects, which accrue to large parts in Hungary, Croatia, Austria and Slovenia.

All countries accrue positive environmental effects from the proposed SETA measures: Table 51 shows the distribution of the monetised effects of the SETA measures on a national level.

Table 51: Present value of total positive effects of emission reductions in million EUR[35]

Country	Net pesent value in million EUR
Austria	3.81
Croatia	5.21
Hungary	6.30
Italy	1.16
Slovakia	0.20
Slovenia	3.00
TOTAL	**19.66**

Source: IHS - Institute for Advanced Studies, 2013.

[34] Assuming an SDR of 5.5 % for Croatia, Hungary, Slovakia and Slovenia and 3.5 % for Austria and Italy.

[35] For the period 2012-2049, assuming an SDR of 5.5 % for Croatia, Hungary, Slovakia and Slovenia and 3.5 % for Austria and Italy.

7.2.2 Regional results

Table 52: Net Present value by region in 2012 (base year 2012)

Net present value in million EUR		
Austria	Burgenland	1.15
	Niederösterreich	2.65
Slovakia	Bratislavský kraj	0.20
Hungary	Nyugat-Dunántúl	6.30
Slovenia	Vzhodna Slovenija	1.21
	Zahodna Slovenija	1.79
Croatia	Sjeverozapadna Hrvatska	1.77
	Jadranska Hrvatska	3.43
Italy	Friuli Venezia Giulia	1.16
Total		**19.66**

Source: IHS - Institute for Advanced Studies, 2013.

Table 52 provides a more detailed picture of the regional origins of savings in emissions, showing clearly that the largest savings occur in Nyugat-Dunántúl (Hungary) with 6.3 million EUR, followed by Jadranska Hrvatska (Croatia) with 3.4 million EUR. These are followed by the regions Niederösterreich (2.7 million EUR), Zahodna Slovenija (1.8 million EUR) and Sjeverozapadna Hrvatska (1.8 million EUR). Burgenland, Vzhodna Slovenija and Friuli Venezia Giulia also each have a positive net present value in excess of 1 million EUR. Even though savings do occur at a regional level, emphasis should be placed on the fact that the emission type has a significant influence on whether those savings have regional effects (e.g. in the case of particulate matter) or global impacts (in the case of global warming). This analysis by type of emission is shown below.

7.2.2.1 Results by emission type

Table 53: Share of different monetised emissions by type (before discounting)

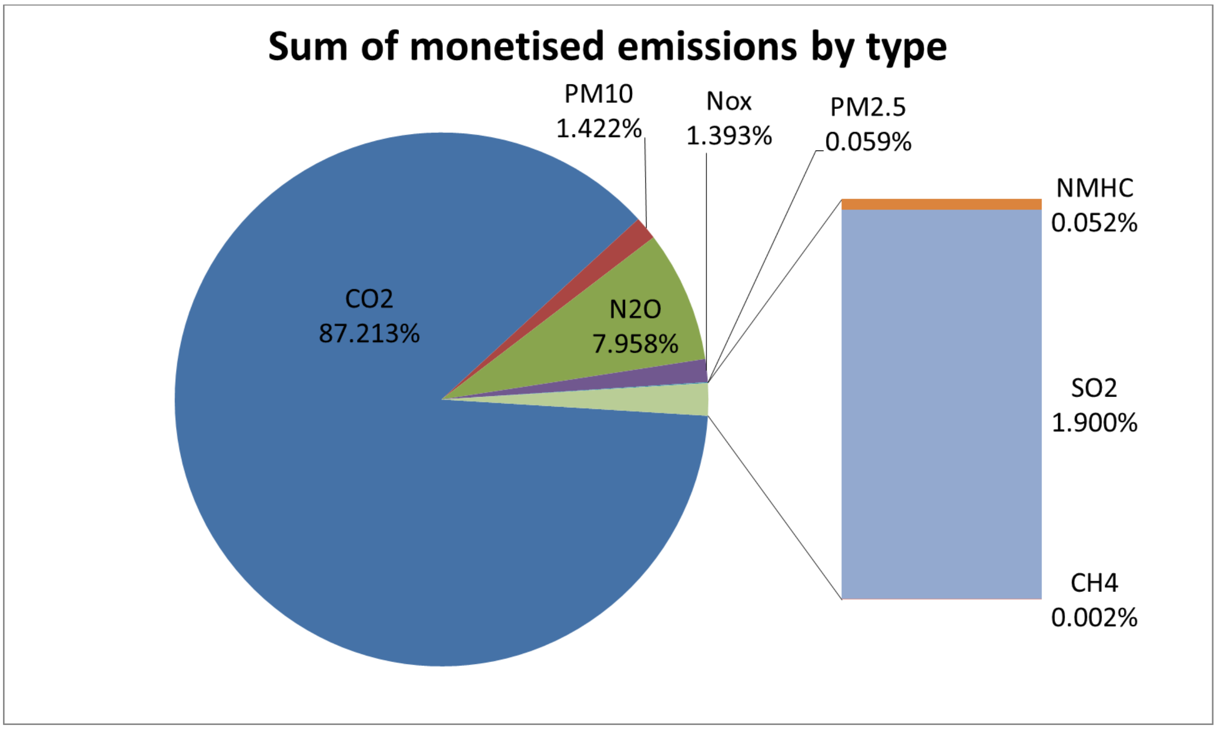
Share of monetised effects by emission type	
CO_2	87.21%
PM10	1.42%
N_2O	7.96%
NOx	1.39%
PM2.5	006%
NMHC	0.05%
SO_2	1.90%
CH_4	0.00%
Total	100.00%

Source: IHS - Institute for Advanced Studies*, 2013.*

Table 53 and Figure 32 clearly show that the majority of monetised benefits (87.2 %) arise from saved CO_2 emissions, followed by reductions in N_2O with a share of 7.96 %. Accordingly, the most monetised effects are the result of climate change implications with

95 %. As these emissions have global ramifications not specific regional effects, this share has to be taken into consideration when looking at the share of positive effects attributed to different regions. Even though, for example, CO_2 savings through the implementation of the proposed measures along the SETA corridor can be attributed to a specific region, the effect of those savings is not restricted simply to that region, but instead has to be seen as a global phenomenon.

Figure 32: Shares of monetised emissions by emission types (before discounting)



Source: IHS - Institute for Advanced Studies, 2013.

7.2.3 Results of alternatives

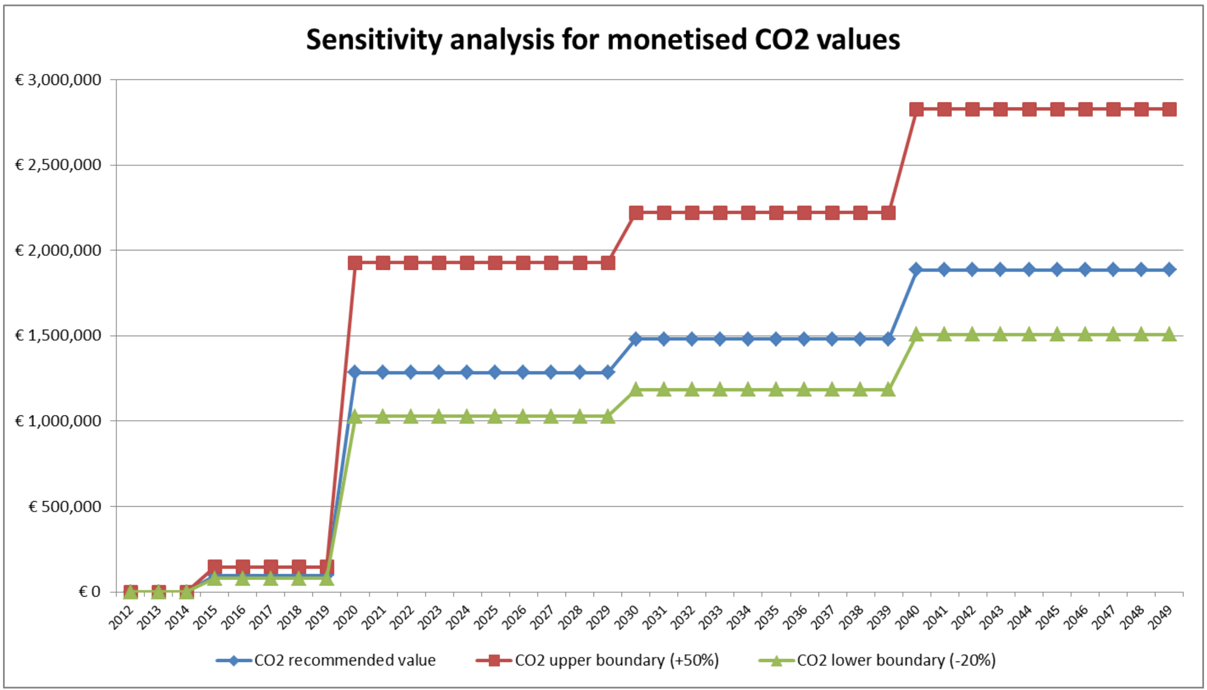
The effects described are those for Alternative 2. Since the input data for the environmental effects are based on the same traffic demand model as the EAR model, the effects for the alternatives were also calculated in accordance with the EAR model. Results for Alternative 1 and 3 were generated according to the procedure described in Section 6.6.

7.2.4 Sensitivity of results

Studies such as the AIR CAFÉ study also emphasise that the monetisation of effects is not complete. Accordingly, the monetary value they supply should be seen as a lower boundary. In the case of CO_2 in particular, the evaluation trend is moving from estimating avoidance costs towards estimating overall damage costs. The latter are hard to evaluate as scientists are not yet fully aware of all the environmental effects of CO_2, and estimates tend to be revised upwards. We therefore applied the values suggested by Watkiss (2005) –

see also Table 49 – for a sensitivity analysis of the monetised values of CO_2, which vary greatly as can be seen in Figure 33.[36]

Figure 33: Sensitivity analysis of monetised CO_2 values (before discounting)

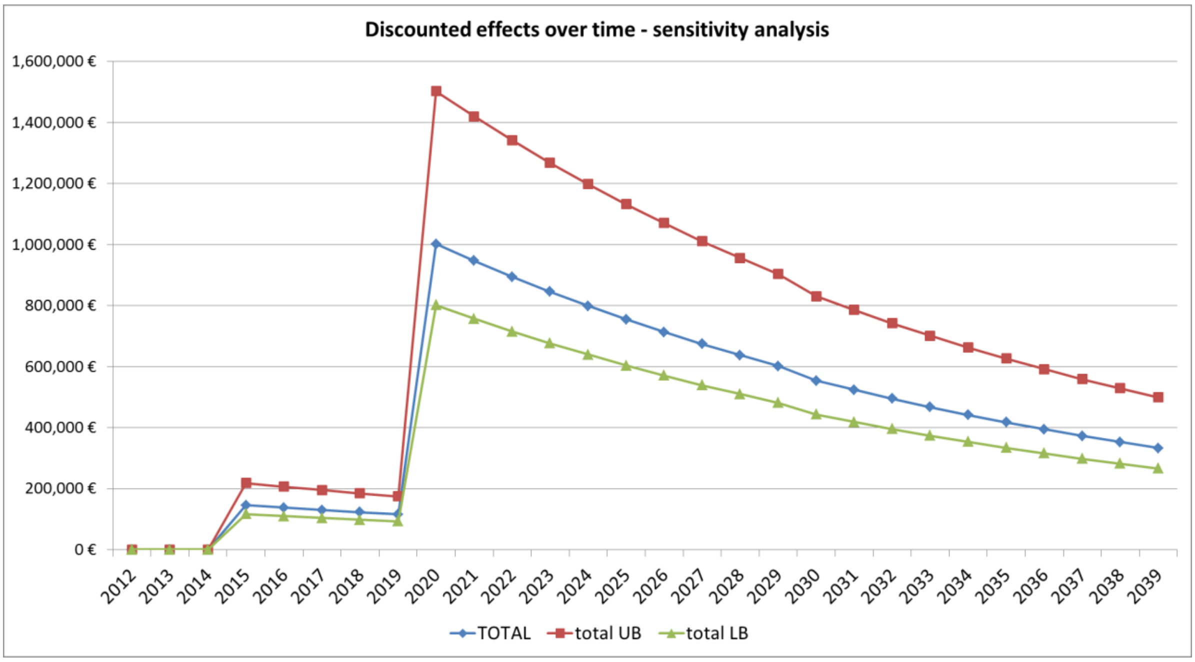


Source: IHS - Institute for Advanced Studies, 2013.

It is therefore crucial to note that the monetary values supplied here have to be considered more as lower boundaries. Comparing overall HEATCO values with competing monetisation values in other studies already gives a possible range of more than +50 % (which would equal an NPR of 29.5 million EUR). For this reason, the upper range for the emission sensitivity analysis has been set at +50 %, whereas the lower boundary remains at the standard range of 20 %.

[36] If social discounting is not taken into account, the range of the sensitivity analysis for total CO_2 effects would vary from 61 % to as much as 255 % of the estimated value. However, as most impacts happen in the later stages, the application of a SDR lowers the range significantly, as these changes have a lower impact on the present value. To achieve an overall illustrative sensitivity analysis of environmental effects, an approach comparing HEATCO with AIR CAFÉ and CE DELFT monetisation values has been chosen in our case.

Figure 34: Sensitivity analysis of discounted effects over time.



Source: IHS - Institute for Advanced Studies, 2013.

Figure 34 shows the discounted values of the total, upper boundary and lower boundary scenarios.[37] Total differences are especially visible after 2020. They then decline over time as values are increasingly discounted.[38]

7.3 Summary

Aggregated positive environmental effects through SETA measures are estimated to be approximately 19.6 million EUR according to standard evaluation methods[39]. Large parts of these effects are accrued in Hungary (32 %), Croatia (26.5 %), Austria (19.4 %) and Slovenia (15.3 %), but Italy (5.9 %) and Slovakia (1 %) also profit significantly from positive environmental externalities. Even though reductions in emission can be attributed to specific regions, consideration must also be given to the fact that since roughly 95 % of the monetised benefits are accrued from reductions in carbon dioxide and nitrous oxide, the environmental effects of the proposed measures along the SETA corridor have not only regional but also to a large part global effects.

A sensitivity analysis based on comparative values gained from other studies shows that the monetised values presented here should be considered more as lower boundaries, and that the actual monetised value may be up to 50 % higher based on monetisation criteria alone. In addition, it should be emphasised that all factors which could not be included due to estimation and measurement difficulties (noise) or ethical issues (accidents and deaths) are, since they were not monetised, set to have no effect. The estimations of future prices

[37] Assuming an SDR of 5.5 % for Croatia, Hungary, Slovakia and Slovenia and 3.5 % for Austria and Italy.

[38] Jumps can be explained by either changes in emission levels or changes in the monetary value assigned to CO2 emissions, as those also vary with time (see Table 49).

[39] Bickel et al. (2006)

were also not adjusted for GDP growth as most of them are in the global warming area, for which no adjustment is recommended.[40]

It can therefore be concluded that the estimated monetised environmental benefits presented here have to be considered as conservative values, with a high chance of producing increased actual benefits for the reasons mentioned above.

[40] This, however, leads to a possible underestimation of effects on air pollution, as these are recommended for GDP adjustment.

8 Consolidated economic analysis (IHS and TMC)

The previous chapters analysed the SETA measures with regard to a variety of aspects. Chapter 4 contained the financial analysis, Chapter 5 a short-term economic analysis by means of a multiregional input-output analysis, Chapter 6 analysed the long-term economic effects using a regional accessibility-dependent model (EAR) and, finally, Chapter 7 evaluated the environmental and socio-economic aspects of the SETA measures. This chapter aims to consolidate these different aspects and present a single, aggregated view. The IHS developed the so-called consolidated economic analysis for this specific purpose. The result of this analysis is presented on the following pages.

8.1 Consolidated summaries of financial analysis, short-term and long-term economic analysis, and environmental analysis

This chapter reviews the summaries of the four different analyses. All figures presented here are present values (except where stated otherwise). This means that future values were discounted[41] to reflect present values, where present refers to the year 2012. Further, these values are real values rather than nominal values. All nominal values were inflated or deflated to reflect 2012 prices.

There are three different alternatives to be evaluated. For an overview please refer to chapter 3.1.3 . These three alternatives can be summarized as follows:

- **Alternative 1** includes all measures that reduce travel time.
- **Alternative 2** includes all measures that reduce travel time (Alternative 1) AND eliminate capacity constraints on the Skrljevo-Rijeka line.
- **Alternative 3** comprises Alternative 1 and Alternative 2 and further improves capacities.

In other words, Alternatives 1 and 2 are subsets of Alternative 3.

8.1.1 Results of the financial analysis

Alternative 1 with a nominal investment sum of 150 million EUR (including 3.7 million EUR for the period 2012-2015) generates costs with a present value of 157 million EUR[42] and revenues with a present value of 127 million EUR. From the point of view of all railway undertakings involved, its **net present value** is therefore **-30 million EUR**.

Alternative 2 with a nominal investment sum of 335 million EUR (including 3.7 million EUR for the period 2012-2015) generates costs with a present value of 378 million EUR[43] and revenues with a present value of 145 million EUR. From the point of view of all railway undertakings involved, its **net present value is -233 million EUR**.

[41] According to the present value method.
[42] In 2012 EUR, including discounted operating and maintenance costs.
[43] In 2012 EUR, including discounted operating and maintenance costs.

Alternative 3 with a nominal investment sum of 690 million EUR (including 3.7 million EUR for the period 2012-2015) generates costs with a present value of 744 million EUR[44] and revenues with a present value of 145 million EUR. From the point of view of all railway undertakings involved, its net **present value** is **-598** million **EUR.**

Table 54: SETA investment measures

ADDITIONAL SETA MEASURES Investment costs in million EUR				
country	SETA - RAILWAY SECTION	2020 Alternative 1	Alternative 2	Alternative 3
AT	Side tracks Neudörfl, Sauerbrunn, Mattersburg	2.8	2.8	2.8
	Electrification Wr.Neustadt - Sopron	28.4	28.4	28.4
	Loop Ebenfurth	44.8	44.8	44.8
	Side track "Steinbrunn"	13.0	13.0	13.0
HU	Bősárkány & Csorna reduction of block distance	0.7	0.7	0.7
	Hegyeshalom-Csorna increasing the loading class*			33.9
	Szombathely reduction of block distance + reconstruction of station	7.5	7.5	7.5
	Csorna-Porpác increasing the loading class*			47.9
	Nagycenk &Lövő electrification of third side track	0.3	0.3	0.3
	Upgrading of Körmend-Zalalövö line (and electrification)			22.1
	Vasvar & Egervár lengthening of side tracks	0.6	0.6	0.6
	Increasing axle loading class Szombathely - Zalaszentivan*			44.4
	Electrification Zalaszentivan - Nagykanizsa	31.0	31.0	31.0
	Zalaszentiván loop	6.0	6.0	6.0
	Increasing axle loading class Zalaszentivan - Nagykanizsa*			44.5
	Nagykanizsa lenghten side track	2.4	2.4	2.4
	Loop Gyekenyes/Zarkany	6.0	6.0	6.0
HR	2nd track Koprvinica-Kotoriba			161.9
	Dry port connection Skrljevo-Rijeka-Miklavje		189.1	189.1
SLO	3 side tracks Koper - Divaca	6.8	6.8	6.8
Total	Investment costs (million EUR)	**150.2**	**339.3**	**694.0**

Source: TMC, 2013

An isolated view of the financial analysis reveals that **none of the financial net present values are positive.** This means that from the point of view of all railway infrastructure companies involved none of the measures should be implemented as their investment will not result in a positive return in the period of observation (until 2049). The only financial internal rate of return (FIRR) that could be calculated was for Alternative 1 with a rate of

[44] In 2012 EUR, including discounted operating and maintenance costs.

1 %, pushing the break-even point beyond 2049. No FIRR could be calculated for Alternatives 2 or 3. Accordingly, there is no financial justification for recommending the implementation of the measures. A positive recommendation of this kind depends on the results of the economic and environmental and the socio-economic evaluations.

It should also be noted that in a cooperation-dependent situation like this, even if the financial net present value were positive, without a supra-national body that supports the implementation of the SETA measures it would only require one railway infrastructure company to not fully agree with the rest of the companies for none of them to be able to benefit. This is a typical situation in which the "weakest link" in the corridor determines the benefit for the rest of the companies involved.

8.1.2 Results of the short-term economic effects (multi-regional input-output-model)

The highest GVA effects for **Alternative 1** are obtained in Austria (84 million EUR), followed by Hungary (34 million EUR) and Slovenia (6 million EUR). However, Hungary ranks first in terms of employment effects with 2,487 full-time employees, followed by Austria in second place with 1,455 secured full-time positions for one year, then Italy. At the regional level, Niederösterreich (34 million EUR) generates the highest GVA effect with Alternative 1, while the highest employment effects are generated in the Hungarian Nyugat-Dunántúl region with 1,955 full-time equivalents. The total GVA for Alternative 1 **for all SETA countries** amounts to **129 million EUR**. The **full-time employment effects** amount to **4,255** FTEs **for Alternative 1** when added up across all SETA countries.

Alternative 2 would produce 123 million EUR of GVA and 3,276 full-time employees in Croatia, two-thirds of which would be generated at the coast in the Jadranska region. The second highest economic outcome would come into effect in Austria, with a GVA amount of 88 million EUR and 1,511 full-time employees, followed by Hungary with 36 million EUR in GVA and 2,600 secured full-time positions. From a **global perspective**, the GVA generated with Alternative 2 would total **407 million** EUR, while the **employment effects would equal 5,020 full-time positions in the EU-28 area**.

Alternative 3 would generate the highest effects with a total GVA of **535 million EUR for the SETA countries**. Croatia profits most from Alternative 3, with a share of over 43 % of total GVA effects across the SETA countries, followed by Hungary (162 million EUR - around 69 % of which in the Nyugat-Dunántúl region). Austria ranks third in the beneficiary ratings for Alternative 3 with a share of approx. 18 % of the total SETA GVA. With regard to employment effects for Alternative 3, these are highest for Hungary (12,548 FTEs), where the Nyugat-Dunántúl again profits most (10,070).The second highest employment effects are achieved in Croatia with 6,253 full-time equivalents. Austria ranks third with 1,632 secured full-time positions. Alternative 3 would reach aggregated **full-time employment effects across all SETA regions of 21,780 FTEs and 25,259 for the whole EU-28 area**.

In terms of how investment in one region generates GVA effects in the whole SETA area and beyond, the results show that the highest effects always remain in the region itself, followed by regions within the same country and the EU without SETA regions. However, economic spill-over effects with other SETA countries are fairly small.

8.1.3 Results of the long-term economic effects (IHS EAR 2.0 model)

The IHS EAR 2.0 model is an accessibility-dependent regional model which estimates the long-term economic effects by adding up all future additional increases in GVA for the years 2015-2049 which are generated through improvements in accessibility due to the implementation of SETA measures.

The overall present value (in 2012 terms) of additional GVA for **all SETA countries equals 2.7 billion EUR**. Hungary benefits the most with a present value of GVA of 912 million EUR, as it is located in the centre of the SETA corridor. Next come Austria and Croatia, with 595 million EUR and 564 million EUR, respectively. Italy follows next with a present value of 422 million EUR, while Slovenia and Slovakia benefit with 143 million EUR and 104 million EUR, respectively.

The overall effect for all countries included in the evaluation, i.e. all EU-28 plus the EFTA countries, generate a present value of **nearly 4 billion EUR** of additional GVA over a 35-year period (2015–2049). This shows how far-reaching the benefits derived from the SETA measures are. The values provided here reflect the implementation of SETA measures as described in Alternative 2. Alternative 1 is estimated to have an overall present value of 2.2 billion EUR for SETA countries and an overall present value of 3.3 billion EUR for all EU-28 and EFTA countries. Since the proposed capacity-increasing measures would exceed the estimated necessary capacity, Alternative 3 has the same long-term economic effects (from an EAR model perspective) as Alternative 2.

In relative terms, this means that the regions located in the heart of the SETA corridor benefit by an increase of up to 10 to 20 basis points in terms of additional annual GDP growth. In other words, that is an **increase of the GDP growth rate between 0.1 and 0.2 percentage points** which is remarkable on the one side given the low investment costs (in relation to other infrastructure projects), but on the other side obvious as SETA measures aim at removing organizational and infrastructural bottlenecks.

8.1.4 Results of the environmental and socioeconomic analysis

Aggregated positive environmental effects through SETA measures are estimated to be **approximately 16 million EUR (Alternative 1) and 20 million EUR (Alternative 2 and 3)** according to standard evaluation methods[45]. Large parts of these effects in [46]are accrued in Hungary (32 %), Croatia (26.5 %), Austria (19.4 %) and Slovenia (15.3 %), but Italy (5.9 %) and Slovakia (1 %) also profit from the reduction in negative environmental externalities. Even though reductions in emission can be attributed to specific regions, consideration has to be given to the fact that since roughly 95 % of the monetized benefits are accrued from reductions in carbon dioxide and nitrous oxide, the environmental effects of the proposed measures along the SETA corridor have not only regional but also to a large part global effects.

[45] Bickel et al. (2006)

[46] Number from Alternative 2

8.2 Consolidated economic analysis

This section summarizes the results of the previous chapters over all SETA-countries and presents the aggregated results from three different points of view.

View 1 presents the **viewpoint of a potential subsidising institution.** It includes the results of the financial analysis (Chapter 3), the long-term economic effects derived with the help of the regional accessibility-dependent model (EAR)(Chapter 5), and the environmental and socio-economic analysis (Chapter 6). In the view 1 aggregation, the results of the input-output analysis – short- and medium-term economic effects – (Chapter 4) are not included.[47]

View 2 reflects the **viewpoint of government, national/regional administration and relevant supra-national entities** and focuses on the fiscal effects. More precisely, it takes the state revenues, i.e. tax revenues, into account. This approach incorporates the tax revenues (e.g. from value added taxes, corporate taxes, excise duties, etc.) resulting from different analyses and compares the aggregated sum of tax revenues to total investment and maintenance costs. This view includes the results of all previous chapters and methodological aspects: the results of the financial analysis (Chapter 3), the short-term economic effects (multiregional input-output analysis, Chapter 4), the long-term economic effects (regional accessibility-dependent model (EAR), Chapter 5) and the environmental and socio-economic analysis (Chapter 6).

Finally, **view 3** reflects the **viewpoint of the economy and focuses solely on economic effects, i.e. economic benefits**. Value added effects calculated in the single methodological approaches in the different chapters are aggregated and compared to the investment and maintenance costs. This view also includes the results of all previous chapters and the methodological aspects described in Chapters 3 to 6.

In short, the three viewpoints presented are as follows:

View 1: Potential subsidising institution

View 2: Tax revenues (state/government)

View 3: Economic benefits (economy)

A ratio between the total benefit of the particular outcome to the total investment and maintenance costs is calculated in all three views for all three SETA investment measures alternatives. These ratios refer to a comparison between the positive outcome (benefits) and the costs of the project, i.e. the sum of the benefits (state revenues, economic effects, etc.) is expressed as a proportion of the investment costs.

One further distinction was made in the consolidated economic analysis: the views are first presented in aggregated terms from the perspective of the SETA countries only and are then aggregated in a second step from the perspective of the EU-28 countries. Only views 1

[47] The short-term effect calculations are required by the Funds regulations, but should not be part of the cost-benefit analysis (European Commission 2008, p. 57).

and 3 are presented for the latter, since view 2 – the description from a government viewpoint – is not applicable in the EU-28 area context.

8.2.1 Consolidated economic analysis for SETA countries

The three tables below (Table 55 to Table 57) show the results of the aggregation for the SETA countries and the calculated benefit-cost ratios for the three SETA investment alternatives.

Table 55: Aggregation of results for SETA countries, View 1 (potential subsidising institution)

View 1: potential subsidising institution	Alternative 1	Alternative 2	Alternative 3
Financial analysis: costs	157	378	744
Financial analysis: benefits	127	145	145
Financial net present value (FNPV)	-30	-233	-598
Long-term economic effects (EAR)	2,240	2,739	2,739
Environmental effects (ESA)	16	20	20
Economic net present value (ENPV)	**2,226**	**2,526**	**2,161**
Benefit-cost ratio	14	7	3

Source: IHS – Institute for Advanced Studies, 2013

Table 55 shows the aggregated results for the SETA countries for a potential subsidising institution. It can be seen that the benefit-cost ratio for Alternative 1 (14) is higher than those for the other two alternatives. A ratio >1 indicates that the investment is profitable. In the case of Alternative 1, the triggered effects are 14 times higher than the sum of the initial investment costs and maintenance- and operational costs.

Table 56: Aggregation of results for SETA countries, View 2 (tax revenues)

View 2: tax revenues	Alternative 1	Alternative 2	Alternative 3
Financial analysis: costs	157	378	744
Financial analysis: benefits	18	20	20
Financial net present value (FNPV)	-139	-358	-723
Short-term economic effects (IOA)	50	99	201
Long-term economic effects (EAR)	841	1,021	1,021
Environmental effects (ESA)	2	3	3
Economic net present value (ENPV)	**754**	**765**	**501**
Benefit-cost ratio	5	2	1

Source: IHS - Institute for Advanced Studies, 2013

View 2 in Table 56 reflects a government standpoint and focuses on state revenues. The ratio shows public revenues as the sum of all economic approaches in proportion to the costs. The benefit-cost ratio for Alternative 1 (4) is the highest of the three alternatives. Accordingly, it can be said that state revenues are 4 times higher than the costs (investments plus maintenance- and operations) for Alternative 1. Alternative 3, however, exhibits a ratio <1, i.e. the costs incurred exceed the fiscal effects generated.

The problem here is that this is what game theorists refer to as a cooperative game with six players. Since this is a project that involves several countries, it only takes one country to not be able to allocate the necessary funds or to not be willing to provide the funds, since the SETA project is competing with other projects for the same funds. In such a case, the benefits for the remaining countries would potentially decrease to a drastic extent. The involvement of an incentive-providing supra-national entity is therefore strongly recommended.

Table 57: Aggregation of results for SETA countries, View 3 (economic effects)

View 3: economic benefits	Alternative 1	Alternative 2	Alternative 3
Financial analysis: costs	157	378	744
Financial analysis: benefits	47	53	53
Financial net present value (FNPV)	-110	-325	-690
Short-term economic effects (IOA)	129	273	535
Long-term economic effects (EAR)	2,240	2,739	2,739
Environmental effects (ESA)	6	7	7
Economic net present value (ENPV)	**2,265**	**2,695**	**2,592**
Benefit-cost ratio	14	7	3

Source: IHS - Institute for Advanced Studies, 2013

View 3 in Table 57 reflects the results from an economic perspective and focuses solely on the economic effects caused by an investment. The ratio compares the sum of all economic effects to the investment, maintenance and operational costs. Again, the benefit-cost ratio for Alternative 1 (14) is the highest of the three alternatives. Accordingly, it can be concluded that the economic effects of Alternative 1 are 14 times higher than the costs. The economic effects of Alternative 2 exceed the initial investment costs (plus maintenance and operational costs) sevenfold, while Alternative 3 generates effects which are three times higher than the initial investment. It can therefore be concluded that all three investment alternatives have an economic impact that outweighs the initial investment.

8.2.2 Consolidated economic analysis for the EU28 countries

The following two tables (Table 58 and Table 59) illustrate the results of an aggregation for the EU-28 area and show the calculated benefit-cost ratios for the three investment alternatives. Because the state’s (government) point of view is not applicable in an EU-28 context, and a calculation of state revenues is not possible, View 2 has been omitted from this analysis.

Table 58: Aggregation of results for the EU-28 countries, View 1 (potential subsidising institution)

View 1: potential subsidising institution	Alternative 1	Alternative 2	Alternative 3
Financial analysis: costs	157	378	744
Financial analysis: benefits	127	145	145
Financial net present value (FNPV)	-30	-233	-598
Long-term economic effects (EAR)	3,268	3,898	3,898
Environmental effects (ESA)	16	20	20
Economic net present value (ENPV)	**3,253**	**3,684**	**3,319**
Benefit-cost ratio	21	10	4

Source: IHS - Institute for Advanced Studies, 2013

Table 59: Aggregation of results for the EU-28 countries, View 3 (economic effects)

View 3: economic benefits	Alternative 1	Alternative 2	Alternative 3
Financial analysis: costs	157	378	744
Financial analysis: benefits	47	53	53
Financial net present value (FNPV)	-110	-325	-690
Short-term economic effects (IOA)	162	341	679
Long-term economic effects (EAR)	3,268	3,898	3,898
Environmental effects (ESA)	6	7	7
Economic net present value (ENPV)	**3,325**	**3,921**	**3,893**
Benefit-cost ratio	21	10	5

Source: IHS - Institute for Advanced Studies, 2013.

In both the potential subsidising institution perspective (Table 58) and the economy-based perspective (Table 59), the benefit-cost ratios for Alternative 1 (21) are by far higher than those for Alternatives 2 and 3. The ratio for Alternative 2 is about half that of Alternative 1, while the ratio for Alternative 3 corresponds to approximately to one quarter of Alternative 1's ratio.

8.3 Conclusions

Five different tables have been presented in this chapter, each depicting a different point of view (potential subsidising institution, public body, economy) either for the SETA countries alone or for all 28 EU Member States.

In the EU Guide to Cost Benefit Analysis of Investment Projects, the preferred performance indicator is the net present value (NPV). The results show that Alternative 1 has a positive NPV in any case, but also that the NPV will grow if the additional measures in Alternative 2 are also implemented. The step to Alternative 3 would decrease the NPV. From each point of view, Alternative 2 is the best solution from an economics perspective since the NPV is highest for this alternative in all circumstances.

Accordingly, the implementation of Alternative 2 is recommended from a consolidated economic perspective.

Further, since this is a project that involves several countries, it may only take one country not being able or willing to allocate the necessary funds and therefore some regional measures not being operationalised in order to drastically decrease the benefits for all remaining countries as well. The involvement of an incentive-providing supra-national entity is therefore strongly recommended.

The profit for the EU-28 countries (SETA countries excluded) from the upgrading of the SETA corridor is estimated to be around 1 billion EUR.

There are not many projects that show benefit-cost ratios of up to 20. However, this is not surprising at all in the case of the upgrading of the SETA corridor. On the contrary, it is a simple consequence of the SETA project’s overall aim to eliminate organisational and infrastructural bottlenecks in order to ensure that small adjustments trigger large improvements in prosperity for the regions involved and elsewhere.

Summarizing the effects, this project contributes to the implementation of the European Union’s regional policy. The “cohesion countries” mainly benefit from the implementation of the SETA measures. This can be seen best in Figure 29 Further, many regions within the “cohesion countries” will be set on a higher growth path as a result. Thus, this project ultimately also contributes to the European Union’s convergence objective.

9 Literature

Anderson, W. P. and Lakshmanan, T.R. (2004): Infrastructure and Productivity: What are the underlying mechanisms? Center for Transportation Studies, Working Paper Series # CTS2004B.

Aschauer, D. (1989): Is public expenditure productive? Journal of Monetary Economics 23, pp. 177-200.

Barro, R. J. and Sala-i-Martin, X. (2003): Economic Growth. MIT Press.

Bickel et al. (2006): HEATCO -Developing Harmonised European Approaches for Transport Costing and Project Assessment. Deliverable 5, Proposal for Harmonised Guidelines + Appendices.

BMVIT - Austrian Federal Ministry for Transport, Innovation and Technology (no year): Gesamtwirtschaftliche Bewertungsverfahren. Grundlagen und Anwendungen von Bewertungsverfahren für Entscheidungsfindungen von Infrastrukturinvestitionsvorhaben.

European Commission (2008): Guide to cost-benefit analysis of investment projects. Structural Funds, Cohesion Fund and Instrument for Pre-Accession.

FSV (2010): RVS 02.01.22: Nutzen-Kosten-Untersuchungen im Verkehrswesen.

Fujita, M., Krugman, P. and Venables, A. J. (2001): The Spatial Economy: Cities, Regions and International Trade. MIT Press, Cambridge, Massachusetts.

Graham, D. J. (2007): Agglomeration Economies and Transport Investments, Discussion Paper 2007-11, OECD: Joint Transport Research Centre.

Gwartney, J. et al. (2011): Macroeconomics: Private and Public Choice, 13th edition. South-Western CENGAGE Learning.

Hansen, W. G. (1959): How accessibility shapes land-use. Journal of the American Institute of Planners 25, pp. 73-76.

Holland, M. et al. (2005): Damages per tonne emission of PM2.5, NH3, SO2, NOx and VOCs from each EU25 Member State (excluding Cyprus) and surrounding seas. Service Contract for carrying out cost-benefit analysis of air quality related issues, in particular in the clean air for Europe (CAFE) programme.

Holub, H.W., Schnabl, H. (1994): Input-Output-Rechnung: Input-Output-Analyse, München/Wien.

Hujer, J. (2008): Regionalökonomische Effekte von Flughäfen, Verlag: Lang, Peter Frankfurt .

Lakshmanan, T.R. (2011): The broader economic consequences of transport infrastructure investments. Journal of Transport Geography 19, pp. 1-12.

Leontief, W. (1936): Quantitative Input and Output Relations in the Economic System of the United States. In: The Reviews of Economic Statistics 18 (3), pp. 105-125.

LeSage, J. P., and Pace, R. K., (2009): Introduction to Spatial Econometrics. Chapman & Hall/CRC.

Maibach, M. et al. (2008): Handbook on estimation of external costs in the transport sector. Internalisation Measures and Policies for All external Cost of Transport (IMPACT), Version 1.1. Delft, CE, 2008.

Martellato, D., Nijkamp, P. and Reggiani A. (1998): "Measurement and measures of network accessibility: economic perspectives", in European Network Developments and Policies, Eds.: K. Button, P. Nijkamp and H. Priemus ,Edward Elgar, Cheltenham.

Nagl, P., Schwarzbauer, W. and Sellner, R. (2010): Überlegungen zu Methoden der Bewertung des Nutzens von Maßnahmen im Verkehr, Zeitschrift für Verkehrswissenschaften 81 (1), pp. 13 – 26.

Nobel Media AB (no year): Wassily Leontief - Facts". *Nobelprize.org*. URL http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1973/leontief-facts.htmlm, [accessed Aug. 28, 2013].

OECD (Eds., 2013): OECD Economic Outlook, Volume 2013 Issue 1. URL 10.1787/eco_outlook-v2013-1-en, [accessed Aug. 28, 2013].

Pischner, R., Stäglin, R. (1976): Darstellung des um den Keynes'schen Multiplikator erweiterten offenen statischen Input-Output-Modells. In: Mitteilungen aus der Arbeitsmarkt- und Berufsforschung, 9 (3), pp. 345-349.

Polasek, W., Schwarzbauer, W. and Sellner, R. (2010): Aggregate and Regional Effects of New Railway Infrastructure, Review of Economic Analysis (2), pp. 73-85.

Richardson, H.W. (1979): Regional and Urban Economics, Pitman: London.

Rietveld, P. (1989): Employment Effects of changes in Infrastructure: Methodological Aspects of the Gravity Model. Papers in Regional Science, 66 (1), pp. 19-30.

Rietveld, P. (1994): Spatial Economic Impacts of Transport Infrastructure Supply. Transportation Research Part A: Policy and Practice, 28A (4), pp. 329-341.

Schürmann, C. and Talaat, A. (2000): Towards a European Peripherality Index – Final Report. Report for General Directorate XVI Regional Policy of the EURpean Commission.

Spiekermann, K. and Neubauer, J. (2002): European Accessibility and Peripherality: Concepts, Models and Indicators. Nordregio Working Papers 202 (9).

Spiekermann, K. and Wegener, M. (2006): Accessibility and Spatial Development in Europe. Scienze Regionali 5 (2), pp. 15-46.

Spiekermann, K. and Wegener M. (2007): Update of Selected Potential Accessibility Indicators. European Planning Observation Network, final report 2007.

Vickerman (2007): Recent Evolution of Research into the Wider Economic Benefits of Transport Infrastructure Investments. Discussion Paper No. 2007-9, OECD, Paris.

Watkiss, P. et al. (2005): The Social Cost of Carbon (SCC) Review – Methodological Approaches for Using SCC Estimates in Policy Assessment. Final Report November 2005. Research on behalf of UK Defra.

Wegener, M. and Bökemann, D. (1998): The SASI Model: Model Structure. Deliverable 8 of the EU Project Tansport and Infrastructure Investments and Transport System Improvements (SASI).

10 Appendix 1

Table 60: Classifications for goods (CPA) and companies (NACE): sectors 01 to 30.

	CPA	NACE
01	Products of agriculture, hunting and related services	Crop and animal production, hunting and related service activities
02	Products of forestry, logging and related services	Forestry and logging
03	Fish and fishing products	Fishing and aquaculture
05	Coal and lignite	Mining of coal and lignite
06	crude petroleum and natural gas	Mining of crude petroleum and natural gas
07	Metal ores	Mining of metal ores
08	Other mining and quarrying prod.	Other mining and quarrying prod.
09	Mining support serv. activ.	Mining support serv. activ.
10	Food products	Manufacture of food products
11	Beverages	Manufacture of beverages
12	Tobacco products	Manufacture of tobacco products
13	Textiles	Manufacture of textiles
14	Wearing apparel	Manufacture of wearing apparel
15	Leather and related products	Manufacture of leather and related products
16	Wood and products of wood and cork	Manufacture of wood and of products of wood, except furniture
17	Paper and paper products	Manufacture of paper and paper products
18	Printing and recording services	Printing and reproduction of recorded media
19	Coke and refined petroleum products	Manufacture of coke and refined petroleum products
20	Chemicals and chemical products	Manufacture of chemicals and chemical products
21	Basic pharmaceutical products and preparations	Manufacture of basic pharm. products and pharm. preparations
22	Rubber and plastic products	Manufacture of rubber and plastic products
23	Other non-metallic mineral products	Manufacture of other non-metallic mineral products
24	Basic metals	Manufacture of basic metals
25	Fabricated metal products, exc. machinery and equipment	Manufacture of fabricated metal products
26	Computer, electronic and optical products	Manufacture of computer, electronic and optical products
27	Electrical equipment	Manufacture of electrical equipment
28	Machinery and equipment n.e.c.	Manufacture of machinery and equipment n.e.c.
29	Motor vehicles, trailers and semi-trailers	Manufacture of motor vehicles, trailers and semi-
30	Other transport equipment	Manufacture of other transport equipment

Source: EUROSTAT.

Table 61: Classifications for goods (CPA) and companies (NACE): sectors 31 to 74.

	CPA	NACE
31	Furniture	Manufacture of furniture
32	Other manufactured goods	Other manufacturing
33	Repair a.installation services of machinery a.equipment	Repair and installation of machinery and equipment
35	Electricity, gas, steam and air conditioning	Electricity, gas, steam and air conditioning supply
36	Natural water; water treatment and supply services	Water collection, treatment and supply
37	Sewerage services; sewage sludge	Sewerage service activities; sewage sludge
38	Waste collection, treatment and disposal services; materials recovery services	Waste collection act., treatment and disposal service act.; materials recovery service act.
39	Remediation services and other waste management services	Remediation service act. A. other waste management service act.
41	Buildings and building construction works	Construction of buildings
42	Constructions a.construction works for civil engineering	Civil engineering
43	Specialised construction works	Specialised construction activities
45	Wholesale- a. retail trade, repair of motor vehicles	Wholesale a. retail trade and repair of motor vehicles a. motorcycles
46	Wholesale trade, exc. o.motor vehicles a. -cycles	Wholesale trade, except of motor vehicles and motorcycles
47	Retail trade, exc. o.motor vehicles a. -cycles	Retail trade, except of motor vehicles and motorcycles
49	Land transport services a. transport services via	Land transport and transport via pipelines
50	Water transport services	Water transport
51	Air transport services	Air transport
52	Warehousing and support services for transportation	Warehousing and support activities for transportation
53	Postal and courier services	Postal and courier activities
55	Accommodation services	Accommodation
56	Food a.beverage serving services	Food and beverage serv. activities
58	Publishing activities	Publishing activities
59	Audiovisual services	Motion picture, video and television programme production, sound recording a. music publishing activities
60	Programming and broadcasting services	Programming and broadcasting activities
61	Telecommunications services	Telecommunications
62	Computer programming, consultancy and related services	Computer programming, consultancy and related service act.
63	Information services	Information service activities
64	Financial services	Financial service activities, except insurance and pension funding
65	Insurance, reinsurance and pension funding services	Insurance, reinsurance and pension funding, except compulsory social security
66	Services auxiliary to financial a. insurance services	Activities auxiliary to financial services and insurance activities
68	Real estate services	Real estate activities
69	Legal and accounting services	Legal and accounting activities
70	Serv. of head offices; management consulting services	Activities of head offices; management consultancy activities
71	Architectural and engineering services	Architectural and engineering activities; technical testing and analysis
72	Scientific research and development services	Scientific research and development
73	Advertising and market research services	Advertising and market research
74	Other professional, scientific and technical services	Other prof., scientific and technical activities

Source: EUROSTAT.

Table 62: Classifications for goods (CPA) and companies (NACE): sectors 75 to 99.

	CPA	NACE
75	Veterinary services	Veterinary activities
77	Rental and leasing services	Rental and leasing activities
78	Employment services	Employment activities
79	Travel agency, tour operator and related services	Travel agency, tour operator a. o. reservation service a.related activities
80	Security and investigation services	Security and investigation service activities
81	Services to buildings and landscape	Service activities to buildings and landscape
82	Office administrative, office support and other business support services	Office administrative, office support and other business support service act.
84	Public administration, defence, social security services	Public administration and defence; compulsory social security
85	Education services	Education
86	Human health services	Human health activities
87	Residential care services	Residential care activities
88	Social work services without accommodation	Social work activities
90	Creative, arts and entertainment services	Creative, arts and entertainment activities
91	Library, archive, museum and other cultural services	Libraries, archives, museums and other cultural
92	Gambling and betting services	Gambling and betting activities
93	Sporting services, amusement and recreation services	Sports activities and amusement and recreation activities
94	Services furnished by membership organisations	Activities of membership organisations
95	Repair services of computers, pers. a. household goods	Repair of computers and personal and household goods
96	Other personal services	Other personal service activities
97	Services of households as employers of dom. personnel	Activities of households as employers of domestic personnel
99	Services provided by extraterritorial organisations and bodies	Extraterritorial organisations and bodies activities

Source: EUROSTAT.

13 Appendix 2: Regional fact sheets

FACT SHEET:

SETA Countries

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	339.3	in Mio. EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	273	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	2 739	in Mio. EUR	Present value in 2012 Additional yearly GDP growth
Environmental effects (ESA)	20	in Mio. EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	1 250	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	100	in persons	Average additional employment
Improved accessibility (EAR)	4 625	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	99	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	1 020	in Mio. EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

a) Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

b) Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

c) Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

1) Main effects take place in the period 2012-2020. 2) 2015 - 2049. 3) 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

FACT SHEET:

SETA Regions

Investment Cost of Additional SETA Measures

		Unit	Description
SETA Measures (Alternative 2)	339.3	in Mio. EUR	Nominal value

Additional Effects on Gross Value Added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	223	in Mio. EUR	Present Value in 2012
Long-term[2] economic effects (EAR)	1 597	in Mio. EUR	Present Value in 2012
	0.62	in %	Average add. yearly GDP growth
Environmental effects (ESA)	20	in Mio. EUR	Present Value in 2012

Additional Employment Effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	1 157	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	90	in persons	Average additional employment
Improved accessibility (EAR)	3 145	in persons	Average additional employment

Additional Tax Revenue contributing to the Overall State Revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	73	in Mio. EUR	Present Value in 2012
Long-term[2] economic effects (EAR)	608	in Mio. EUR	Present Value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

a) Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

b) Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

c) Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

1) Main effects take place in period 2012-2020. 2) 2015 - 2049. 3) 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

FACT SHEET:

FRIULI-VENEZIA GIULIA

Friuli-Venezia Giulia

General information[a]:

		Unit	Description
Population:	1 236 103	in persons	Eurostat: 2012
Employment:	496 400	in persons	Eurostat: 2012
Gross value added:	32 140	in Mio. EUR	Eurostat: 2011, Camecon

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	0.0	in Mio. EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	0	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	25	in Mio. EUR	Present value in 2012
	0.01	in %	Additional yearly GDP growth
Environmental effects (ESA)	1	in Mio. EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	1	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	0	in persons	Average additional employment
Improved accessibility (EAR)	20	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	0	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	7	in Mio. EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

a) Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

b) Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

c) Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

1) Main effects take place in the period 2012-2020. 2) 2015 - 2049. 3) 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

FACT SHEET:

CROATIA
Hrvastka

General information[a]:

		Unit	Description
Population:	4 398 150	in persons	Eurostat: 2012
Employment:	1 395 400	in persons	Eurostat: 2012
Gross value added:	37 568	in Mio. EUR	Eurostat: 2011, Camecon

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	189.1	in Mio. EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	123	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	564	in Mio. EUR	Present value in 2012
	0.14	in %	Additional yearly GDP growth
Environmental effects (ESA)	5	in Mio. EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	564	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	57	in persons	Average additional employment
Improved accessibility (EAR)	1 550	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	43	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	190	in Mio. EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

[a)] Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

[b)] Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

[c)] Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

[1)] Main effects take place in the period 2012-2020. [2)] 2015 - 2049. [3)] 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

Due to data availability full NUTS2 level disaggregation was not possible.

FACT SHEET:

SOUTHERN TRANSDANUBIA

Dél-Dunántúl

General information[a]:

		Unit	Description
Population:	933 873	in persons	Eurostat: 2012
Employment:	333 400	in persons	Eurostat: 2012
Gross value added:	5 508	in Mio. EUR	Eurostat: 2011, Camecon

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	0.0	in Mio. EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	1	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	126	in Mio. EUR	Present value in 2012
	0.14	in %	Additional yearly GDP growth
Environmental effects (ESA)	0	in Mio. EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	8	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	0	in persons	Average additional employment
Improved accessibility (EAR)	320	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	0	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	54	in Mio. EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

a) Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

b) Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

c) Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

1) Main effects take place in the period 2012-2020. 2) 2015 - 2049. 3) 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

FACT SHEET:

CENTRAL TRANSDANUBIA
Közép-Dunántúl

General information[a]:

		Unit	Description
Population:	1 090 346	in persons	Eurostat: 2012
Employment:	440 300	in persons	Eurostat: 2012
Gross value added:	7 869	in Mio. EUR	Eurostat: 2011, Camecon

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	0.0	in Mio. EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	0	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	135	in Mio. EUR	Present value in 2012
	0.10	in %	Additional yearly GDP growth
Environmental effects (ESA)	0	in Mio. EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	12	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	0	in persons	Average additional employment
Improved accessibility (EAR)	320	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	1	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	58	in Mio. EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

a) Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

b) Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

c) Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

1) Main effects take place in the period 2012-2020. 2) 2015 - 2049. 3) 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

FACT SHEET:

WESTERN TRANSDANUBIA

Nyugat-Dunántúl

General information[a]:

		Unit	Description
Population:	993 439	in persons	Eurostat: 2012
Employment:	418 400	in persons	Eurostat: 2012
Gross value added:	7 852	in Mio. EUR	Eurostat: 2011, Camecon

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	54.4	in Mio. EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	24	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	259	in Mio. EUR	Present value in 2012
	0.21	in %	Additional yearly GDP growth
Environmental effects (ESA)	6	in Mio. EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	373	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	5	in persons	Average additional employment
Improved accessibility (EAR)	590	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	10	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	112	in Mio. EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

[a)] Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

[b)] Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

[c)] Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

[1)] Main effects take place in the period 2012-2020. [2)] 2015 - 2049. [3)] 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

FACT SHEET:

BURGENLAND
Burgenland

General information[a]:

		Unit	Description
Population:	286 215	in persons	Eurostat: 2012
Employment:	133 900	in persons	Eurostat: 2012
Gross value added:	6 139	in million EUR	Eurostat: 2011, Camecon

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	44.2	in million EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	22	in million EUR	Present value in 2012
Long-term[2] economic effects (EAR)	110	in million EUR	Present value in 2012
	0.08	in %	Additional yearly GDP growth
Environmental effects (ESA)	1	in million EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	58	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	5	in persons	Average additional employment
Improved accessibility (EAR)	80	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	2	in million EUR	Present value in 2012
Long-term[2] economic effects (EAR)	42	in million EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

a) Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

b) Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

c) Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

1) Main effects take place in the period 2012-2020. 2) 2015 - 2049. 3) 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

FACT SHEET:

LOWER AUSTRIA
Niederösterreich

General information[a]:

		Unit	Description
Population:	1 617 455	in persons	Eurostat: 2012
Employment:	784 800	in persons	Eurostat: 2012
Gross value added:	43 569	in Mio. EUR	Eurostat: 2011, Camecon

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	44.8	in Mio. EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	34	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	77	in Mio. EUR	Present value in 2012
	0.01	in %	Additional yearly GDP growth
Environmental effects (ESA)	3	in Mio. EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	75	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	13	in persons	Average additional employment
Improved accessibility (EAR)	40	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	7	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	30	in Mio. EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

[a] Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

[b] Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

[c] Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

[1] Main effects take place in the period 2012-2020. [2] 2015 - 2049. [3] 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

FACT SHEET:

VIENNA
Wien

General information[a]:

		Unit	Description
Population:	1 731 236	in persons	Eurostat: 2012
Employment:	801 900	in persons	Eurostat: 2012
Gross value added:	72 664	in Mio. EUR	Eurostat: 2011, Camecon

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	0.0	in Mio. EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	12	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	139	in Mio. EUR	Present value in 2012
	0.01	in %	Additional yearly GDP growth
Environmental effects (ESA)	0	in Mio. EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	25	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	5	in persons	Average additional employment
Improved accessibility (EAR)	40	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	7	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	53	in Mio. EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

[a)] Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

[b)] Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

[c)] Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

[1)] Main effects take place in the period 2012-2020. [2)] 2015 - 2049. [3)] 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

FACT SHEET:

BRATISLAVA REGION
Bratislavský kraj

General information[a]:

		Unit	Description
Population:	606 537	in persons	Eurostat: 2012
Employment:	313 100	in persons	Eurostat: 2012
Gross value added:	17 016	in Mio. EUR	Eurostat: 2011, Camecon

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	-	in Mio. EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	1.2	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	19.3	in Mio. EUR	Present value in 2012
	0.01	in %	Additional yearly GDP growth
Environmental effects (ESA)	0.2	in Mio. EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	9	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	-	in persons	Average additional employment
Improved accessibility (EAR)	20	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	0.30	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	6	in Mio. EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

[a] Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

[b] Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

[c] Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

[1] Main effects take place in the period 2012-2020. [2] 2015 - 2049. [3] 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

FACT SHEET:

SLOVENIA
Slovenija

General information[a]:

		Unit	Description
Population:	2 055 496	in persons	Eurostat: 2012
Employment:	906 500	in persons	Eurostat: 2012
Gross value added:	31 636	in Mio. EUR	Eurostat: 2011, Camecon

Investment cost of additional SETA measures

		Unit	Description
SETA measures (Alternative 2)	6.8	in Mio. EUR	Nominal value

Additional effects on gross value added[b]:

		Unit	Description
Short-term[1] economic effects (IOA)	7	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	143	in Mio. EUR	Present value in 2012
	0.02	in %	Additional yearly GDP growth
Environmental effects (ESA)	3	in Mio. EUR	Present value in 2012

Additional employment effects:

		Unit	Description
Construction phase[3]:			
Construction (IOA)	32	in persons	Average additional employment
Operational phase[2]:			
Operation / maintenance (IOA)	5	in persons	Average additional employment
Improved accessibility (EAR)	165	in persons	Average additional employment

Additional tax revenue contributing to the overall state revenues[c]:

		Unit	Description
Short-term[1] economic effects (IOA)	3	in Mio. EUR	Present value in 2012
Long-term[2] economic effects (EAR)	56	in Mio. EUR	Present value in 2012

Important note:

Important: The effects shown here will **only be realised if all regions** install the corresponding SETA measures.

a) Source: Eurostat (latest available data: pop: 2012; emp: 2012; GVA: 2011).

b) Since Alternative 2 is recommended, all addtional effects shown here refer to Alternative 2.

c) Since tax systems differ among SETA regions the additional tax revenue for regional governments could not be evaluated.

1) Main effects take place in the period 2012-2020. 2) 2015 - 2049. 3) 2015-2020.

IOA: input-output model;ESA: socio-environmental model; EAR: regional accessibility model.

Due to data availability full NUTS2 level disaggregation was not possible.