Alpine Transit Traffic – Policy Scenarios 2020

Three Policy Scenarios Compared to Business as Usual:

- **Best Available Technology**
- **Alpine Emissions Trading System**
- **Alpine Crossing Exchange**

iMONITRAF!

Alpine SPACE
EUROPEAN TERRITORIAL COOPERATION
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A Common Voice for More Sustainability

«iMONITRAF!» is a project of the Alpine Space Programme and co-funded by the European Regional Development Fund. In its frame, eight Alpine regions developed a common transport strategy and aim at putting it into action. By building a long-glasting political network, the Alpine regions strengthen their common voice on national and EU level. As basis for their work, project partners have developed evaluation tools to visualise and interpret regional indicators and assess the effects of Alpine traffic. To meet the common objective of improving modal shift and reducing environmental pressures, the project partners have evaluated best practice measures and innovative steering instruments. Results have been published and presented at the annual Transport Forums in Innsbruck (2010), in Lucerne (2011) and in Lyon (2012) to share iMONITRAF! outputs, views und experiences with politicians, stakeholders and the public. Their feedback was then incorporated into the project activities.

DPSIR indicator system

To visualise traffic flows and environmental effects of several scenarios in 2020, a DPSIR indicator system has been developed. This DPSIR system serves as a decision making tool since it shows an integral picture for a number of specific indicators and targets:

- Freight traffic volume (D = driver)
- Emissions of air pollutants and greenhouse gases (P = pressure)
- Ambient air quality (S = state)
- Noise exposition (I = impact)
- Measures to reduce environmental burdens (R = responses)

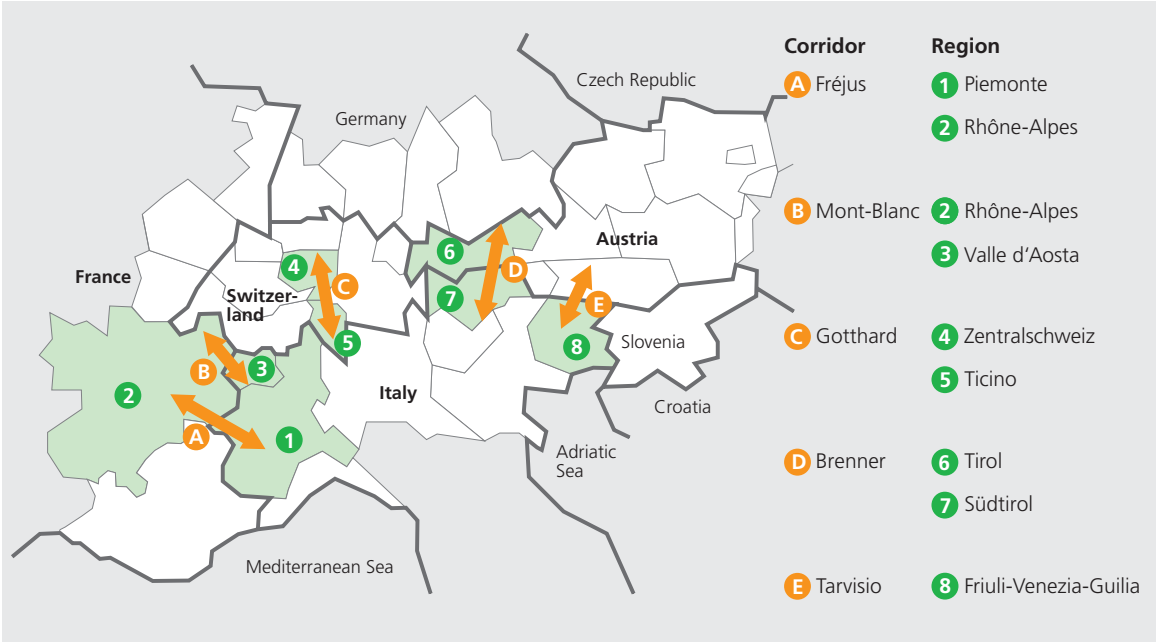

Figure 1: The project focuses on five Alpine corridors and eight Alpine regions in four countries (France, Italy, Austria, Switzerland).

Rationales for a Common Target System

The iMONITRAF! regions currently base their policies and measures on different political objectives and rationales. Some focus on technological improvement while others highlight environmental or modal-shift approaches. With the DPSIR system, the potential contribution of these different rationales to a common strategy can be analysed. Four different scenarios were defined:

- Business as usual scenario to specify the need for action (BAU).
- Best available technology scenario to show influence of technological change.
- Scenario with an Alpine emissions trading system to limit climate change impacts.
- Scenario considering an Alpine crossing exchange to limit the overall freight traffic volume.

Specific targets for each corridor

In all four scenarios the DPSIR indicators for 2020 are compared with specific targets defined for all corridors and all regions individually (table 1). The most essential target refers to the driver indicator – the number of transalpine heavy goods vehicles:

- Fréjus and Mont-Blanc set a common target due to their close interlinkage. The target shall guarantee compliance with environmental targets (specifically for climate change) resulting in an approximate 10 % reduction of current traffic flow to 1990 level.
- For the Gotthard corridor the target is set according to the national «Law on Modal Shift». This needs to be reached two years after the commissioning of the Gotthad basetunnel, i.e. 2018.
- For the Brenner corridor a mid-term target for the number of heavy duty vehicles is set that aims at meeting the EU-2020-target regarding CO_2 emissions.
- For the Tarvisio corridor a base year approach is applied that requires a reduction equal to a 20% reduction compared to the level in the year 2000.

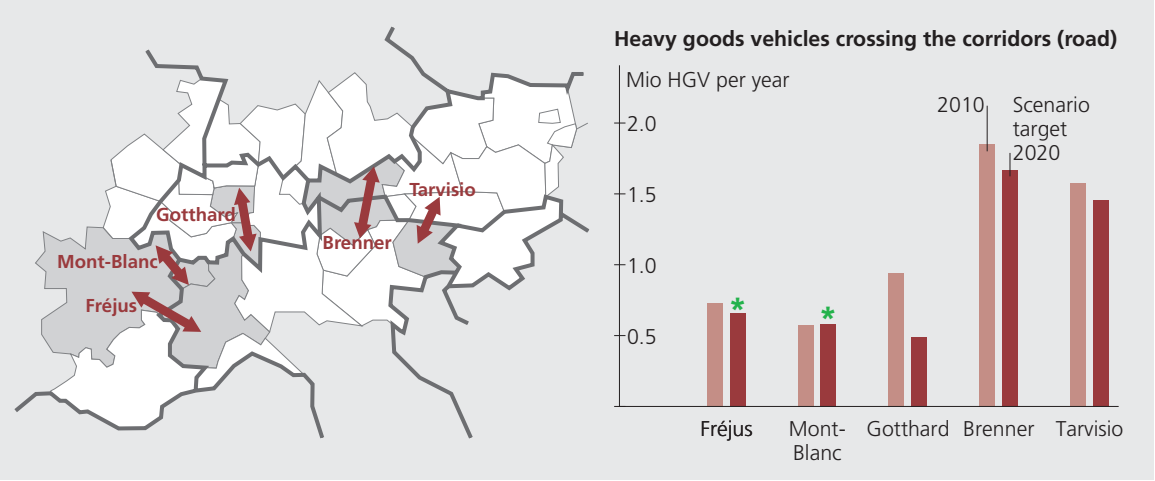

Figure 2: Scenario targets for the driver indicator.

* For the corridors Fréjus and Mont-Blanc a common target for the number of crossing HGV has been defined (sum of HGV crossing Fréjus or Mont-Blanc). For the sake of the DPSIR-analysis, the common target has been subdivided into two corridor-specific targets.

Scenario Targets for the Year 2020 and Rating Scheme for the Assessment of Different Policy Scenarios						
	Corridor	Fréjus	Mont-Blanc	Gotthard	Brenner	Tarvisio
Driver (HGV/a)	Scenario target	657 000 HGV/a	584 000 HGV/a	492 000 HGV/a	1 668 000 HGV/a	1 460 000 HGV/a
	Rating	■ Reached/almost reached: maximal 25% above scenario target ■ Missed: 25% to 75% above scenario target ■ Far off: more than 75% above scenario target				
Pressure (NO_x, PM10, fossil CO_2 in t/km/a)	Scenario target	NO_x: 0.63 t/km/a PM10: 0.06 t/km/a CO_2: 345 t/km/a	NO_x: 0.56 t/km/a PM10: 0.05 t/km/a CO_2: 259 t/km/a	NO_x: 0.48 t/km/a PM10: 0.04 t/km/a CO_2: 445 t/km/a	NO_x: 1.61 t/km/a PM10: 0.14 t/km/a CO_2: 885 t/km/a	NO_x: 1.41 t/km/a PM10: 0.13 t/km/a CO_2: 987 t/km/a
	Rating	■ Reached/almost reached: maximal 25% above scenario target ■ Missed: 25% to 75% above scenario target ■ Far off: more than 75% above scenario target				
State (NO_2, PM10 in µg/m³)	Scenario target	NO_2: 40 in µg/m³ PM10: 40 in µg/m³	NO_2: 40 in µg/m³ PM10: 40 in µg/m³	NO_2: 30 in µg/m³ PM10: 20 in µg/m³	NO_2: 40 in µg/m³ PM10: 40 in µg/m³	NO_2: 40 in µg/m³ PM10: 40 in µg/m³
	Rating	■ Reached/almost reached: maximal 25% of measuring stations show values above scenario targets. ■ Missed: 50% to 75% of measuring stations show values above scenario targets. ■ Far off: more than 75% of measuring stations show values above scenario targets.				
Impact (population exposed to traffic noise)	Scenario target	9300 persons	4400 persons	44 900 persons	79 600 persons	1000 persons
	Rating *	■ Reached/almost reached: maximal 0% above scenario target ■ Missed: 0% to 10% above scenario target ■ Far off: more than 10% above scenario target				
Response	Scenario target	To assess the response (counteractive measures), the average value of all the other indicators (driver, pressures, state and impact) is calculated and rated by the following scale:				
	Rating	■ Reached/almost reached: the average of all indicators (in all regions) is maximally 25% above scenario target. ■ Missed: the average of all indicators (in all regions) is between 25% and 75% above scenario target. ■ Far off: the average of all indicators lies 75% above scenario target.				

Table 1: Driver scenario targets: derived from regional objectives and targets (see page 4). Pressure (NO_x, PM10): targets correspond to driver targets. Pressure targets (CO_2): based on the national CO_2 targets. State targets: derived from the European Air Quality Directive (except for Gotthard: derived from the Swiss Ordinance on Air Pollution). Noise impact: exposed population should not increase in 2020 compared to 2010 (arbitrarily set by iMONITRAF! project team).

* Impact rating scheme differs from other indicators.

Scenario 1: Business as Usual

Traffic Growth Increases Necessity to Act

The business as usual scenario describes a situation without any common action of the Alpine regions and assumes that the current policy-mix will be maintained. According to traffic forecasts developed for the European Union (Primes), rising complexity of production processes and stronger integration of the European and global markets will lead to a further increase of road traffic volumes on the Alpine corridors. In the DPSIR model, these forecasts result in a driver indicator with «target missed» (Fréjus, Mont Blanc, Brenner, Tarvisio) or «far off» (Gotthard) in 2020 (table 2).

Without any common action the pressures on human health and environment will exceed the capacities of the sensitive Alpine region.

Rising pressure for human health and environment

While the flow of commodities will increase, the vehicle fleet will become more efficient: In the business as usual scenario, heavy goods vehicles with the new Euro VI standard will account for nearly three quarters of the fleet in 2020. Nevertheless, pressure indicator 1 for NO_x and PM10 (exhaust) misses the target in 2020 in all the regions (table 2) since the vehicle fleet improvement is already considered in the corresponding scenario target. The targets for CO_2 emissions (pressure indicator 2) are also «missed» on most of the corridors, in Tirol they are even «far off» the target path in 2020. On the other hand, the state indicator targets (NO_2, PM10) are missed in Rhône-Alpes, Ticino and Tirol while they are reached or almost reached in the other regions.
Since traffic increases and no specific measures are implemented, people will continue to be exposed to increasing levels of noise: For the Mont-Blanc, Brenner and Tarvisio corridors the impact indicator is «far off» the target while for Gotthard it improves due to the new railway tunnel. Finally, since the business as usual scenario assumes no common action, the response indicator will miss the target, too.

Scenario 1: Business as Usual, Year 2020								
Corridor	Fréjus	Mont-Blanc		Gotthard		Brenner		Tarvisio
Region	Piemonte	Rhône-Alpes	Valle d'Aosta	Zentralschweiz	Ticino	Tirol	Südtirol	Friuli-Venezia-Guilia
Driver (HGV/a)	+43%	+43%	+25%	+128%	+128%	+42%	+42%	+38%
Pressure 1 (NO_x, PM10 in t/km/a)	+43%	+43%	+25%	+128%	+128%	+42%	+42%	+38%
Pressure 2 (fossil CO_2 in t/km/a)	+67%	+60%	+74%	+55%	+55%	+76%	+64%	+26%
State (NO_2, PM10 in µg/m³)	0%	+50%	0%	0%	+75%	+50%	+25%	0%
Impact (population exposed to traffic noise)	+1% (40 exposed inhabitants above scenario target)	+19% (480 exposed inhabitants above scenario target)	+19% (340 exposed inhabitants above scenario target)	-5% (950 inhabitants less exposed than in 2010)	-9% (2520 inhabitants less exposed than in 2010)	+13% (4320 exposed inhabitants above scenario target)	+11% (5200 exposed inhabitants above scenario target)	+10% (100 exposed inhabitants above scenario target)
Response	+42%	+42%	+42%	+42%	+42%	+42%	+42%	+42%

Figure 3 (page 6): In the period 1990 to 2000 the number of HGV crossing the five iMONITRAF! corridors almost doubled from 3.0 mio to 5.5 mio vehicles. From 2001 to 2007, this trend continued on a lower level and was only broken in 2008 and 2009 caused by the financial crises. In 2010 the previous growth trend was continued.

Table 2: Assessment for the business as usual scenario. In most of the regions the indicators miss the targets or are even far off the targets till 2020.

- target path reached or almost reached
- target path missed
- target path far off

Scenario 2: Best Available Technology

Technology as Universal Remedy?

This scenario analyses the potential of an accelerated technological change – triggered by the common implementation of driving bans and transit pricing systems depending on the emission standard of the heavy goods vehicles. Traffic volumes remain the same as in the business as usual scenario (driver indicator, table 3). The fleet, however, is modernised at faster pace, with a 95 % share of «Euro VI» and 5 % of «Euro V» vehicles in 2020. According to European targets, vehicles also use a higher share of sustainable biofuels. However, alternative fuels do not yet play a major role for heavy goods vehicles.

Triggering technological change won't be enough to compensate the growth in traffic volumes.

Technical improvements affect pressure and state indicators

The accelerated technological change will primarily reduce NO_x emissions and thus influences pressure indicator 1 (NO_x, PM10). The targets are «reached or almost reached» in most of the regions except along the Gotthard corridor due to ambitious driver targets in Switzerland. Use of biofuels leads to only a small reduction of specific CO_2 emissions. Accordingly, targets remain «missed» in most of the corridors. For Tarvisio, the target for CO_2 is reached. Noise impacts remain the same as in the scenario business as usual since no additional shift to rail is assumed and the number of affected people remains constant. The response indicator improves as a result of the common measures to accelerate technological change but still misses the target.

Figure 4: The sensitive Alpine environment is especially affected by old and high-emitting heavy goods vehicles. Today, most corridors still have a considerable share of old vehicles on their transit routes. With adequate incentives, the turnover of the vehicle fleet could be accelerated.

Scenario 2: Best Available Technology, Year 2020								
Corridor	Fréjus	Mont-Blanc		Gotthard		Brenner		Tarvisio
Region	Piemonte	Rhône-Alpes	Valle d'Aosta	Zentralschweiz	Ticino	Tirol	Südtirol	Friuli-Venezia-Guilia
Driver (HGV/a)	+43%	+43%	+25%	+128%	+128%	+42%	+42%	+38%
Pressure 1 (NO_x, PM10 in t/km/a)	+6%	+6%	-7%	+69%	+69%	+5%	+5%	+3%
Pressure 2 (fossil CO_2 in t/km/a)	+56%	+49%	+62%	+45%	+45%	+65%	+54%	+17%
State (NO_2, PM10 in µg/m³)	0%	0%	0%	0%	+75%	+25%	+25%	0%
Impact (population exposed to traffic noise)	+1% (40 exposed inhabitants above scenario target)	+19% (480 exposed inhabitants above scenario target)	+19% (340 exposed inhabitants above scenario target)	-5% (950 inhabitants less exposed than in 2010)	-9% (2520 inhabitants less exposed than in 2010)	+13% (4320 exposed inhabitants above scenario target)	+11% (5200 exposed inhabitants above scenario target)	+10% (100 exposed inhabitants above scenario target)
Response	+29%	+29%	+29%	+29%	+29%	+29%	+29%	+29%

Table 3: The shift to cleaner vehicles reduces the emissions of local air pollutants NO_x and PM10. CO_2 emissions are reduced slightly, too. The number of HGV as well as the noise impact are not affected. Thus, the evaluation remains the same as in the business as usual scenario (page 7). The response indicator improves while targets are still «missed».

- target path reached or almost reached
- target path missed
- target path far off

A Contribution to Tackle Climate Change

This scenario introduces an Alpine Emissions Trading System (AETS) based on the objective to reduce CO_2 emissions from transalpine freight traffic by 20 % in 2020. The AETS is a market-based instrument following a cap-and-trade approach: the reduction target sets a limit to overall CO_2 emisisons for freight transport per corridor (cap).

Although the Emissions Trading System focuses on CO_2 emissions, it has a considerably positive effect on HGV volumes in most regions.

A corresponding and tradeable amount of CO_2 allowances is distributed to transport operators. The design of the AETS is thus similar to the existing EU ETS for stationary sources and aviation.

As the cap for an AETS is based on an environmental indicator, operators have an incentive to use only high-capacity and fuel efficient vehicles. However, since the business as usual scenario already considers a high share of Euro V and VI vehicles, the additional incentive of the AETS to modernize the vehicle fleet is low.

Some challenges remain

Since technical optimization potentials are limited, the AETS will limit the road transport volume as well. Targets for the driver indicator and for the pressure indicator 1 (NO_x, PM10) are «reached or almost reached» in most of the regions. Only along the Gotthard corridor they remain «far off» due to the ambitious driver target and lower limit values for air quality. The pressure indicator 2 (CO_2) improves as well (main objective of the AETS). However, the target is still «missed» in some of the regions since the target has been formulated on the basis of overall national CO_2 emissions.

The reduction of road traffic volumes leads to a shift from road to rail which results in lower noise impacts – except on Fréjus where the increased number of trains induces higher noise impacts because the railway tracks are located in populated areas. On Gotthard, the impact indicator target is reached because of the new tunnel being oparational in 2020.

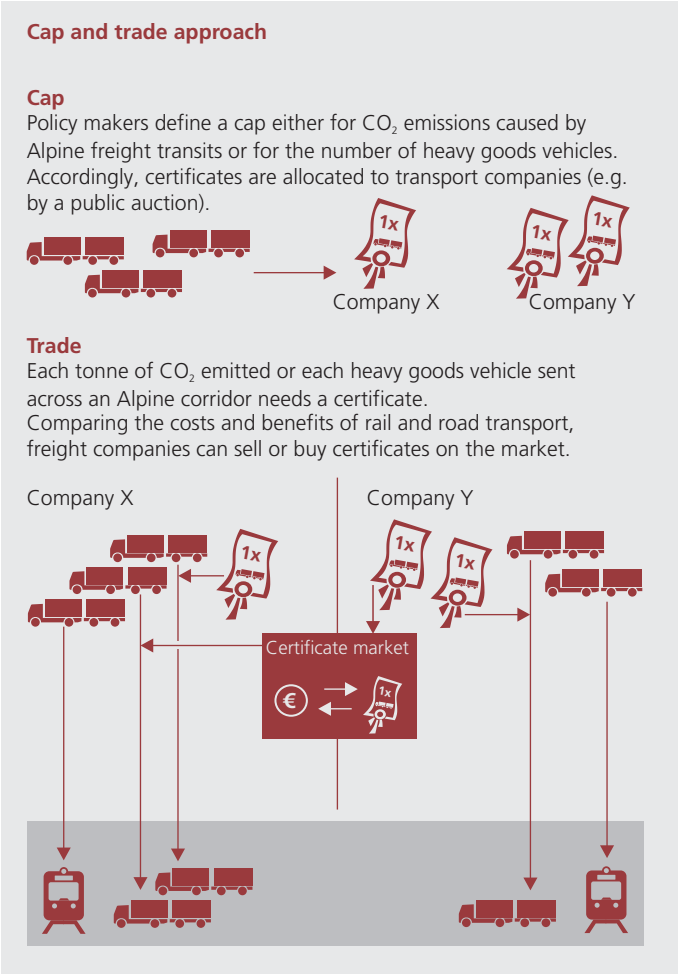

Figure 5: With a cap and trade approach the total CO_2 emissions or the number of heavy goods vehicles crossing the Alpine corridors can be reduced.

Scenario 3: Alpine Emissions Trading System, Year 2020								
Corridor	Fréjus	Mont-Blanc		Gotthard		Brenner		Tarvisio
Region	Piemonte	Rhône-Alpes	Valle d'Aosta	Zentralschweiz	Ticino	Tirol	Südtirol	Friuli-Venezia-Guilia
Driver (HGV/a)	+18%	+18%	+9%	+91%	+91%	-1%	-1%	+4%
Pressure 1 (NO_x, PM10 in t/km/a)	+18%	+18%	+9%	+91%	+91%	-1%	-1%	+4%
Pressure 2 (fossil CO_2 in t/km/a)	+38%	+38%	+51%	+30%	+30%	+23%	+14%	-6%
State (NO_2, PM10 in µg/m³)	0%	+50%	0%	0%	+75%	+50%	+25%	0%
Impact (population exposed to traffic noise)	+23% (620 exposed inhabitants above scenario target)	+17% (1130 exposed inhabitants above scenario target)	+6% (100 exposed inhabitants above scenario target)	-4% (660 inhabitants less exposed than in 2010)	-6% (1500 inhabitants less exposed than in 2010)	+2% (700 exposed inhabitants above scenario target)	+1% (240 exposed inhabitants above scenario target)	+9% (90 exposed inhabitants above scenario target)
Response	+23%	+23%	+23%	+23%	+23%	+23%	+23%	+23%

Table 4: For driver and pressure indicator 1 (NO_x, PM10), the target path is reached or almost reached in most of the regions. Challenges remain at the Gotthard corridor due to more ambitious targets. Pressure indicator 2 (CO_2) improves as well but further need for action remains. The impact indicator improves slighty compared to the business as usual scenario (exception: Fréjus, where more trains have a significant noise impact).

- target path reached or almost reached
- target path missed
- target path far off

Scenario 4: Alpine Crossing Exchange

A Common Steering Instrument

In this scenario, the Alpine regions decide to improve the traffic management along their corridors with an «Alpine Crossing Exchange (ACE)». Similar to the Emissions Trading System (page 10), the ACE is a cap and trade instrument. The underlying approach however is different, since the cap defines a maximum number of heavy goods vehicles passing the corridor per year (cap). The remaining goods are shifted to rail transportation which requires the provision of appropriate rail infrastructures and additional combined transport services.

An Alpine Crossing Exchange allows a direct steering of heavy goods vehicle numbers.

The caps for the ACE are defined on the basis of the iMONITRAF! target system (see page 3). It is assumed that the permits are not differentiated according to emission classes or weight. Thus, the modernization of the vehicle fleet is equal to the business as usual scenario without specific measures. However, there is an incentive to use only high-capacity vehicles which leads to a shift in the weight classes.

Less HGV traffic as common rationale

In the ACE scenario, the HGV targets are met per definition (driver indicator). The targets for pressure indicator 1 are met as well (NO_x, PM10). The limitation of road traffic volumes also leads to a considerable reduction of CO_2 emissions. Pressure indicator 2 is improving considerably but still significant discrepancies remain: While CO_2 targets are even overfulfilled along the corridors Gotthard and Tarvisio, they remain «missed» along the Mont-Blanc corridor. The state indicator assessment gives the same – mainly positive – results as for the emission trading scenario. The impact indicator is «missed» or «far off» due to increased number of freight trains (exception: Gotthard). The targets concerning political responses are met as this scenario is based on an ambitious common steering instrument.

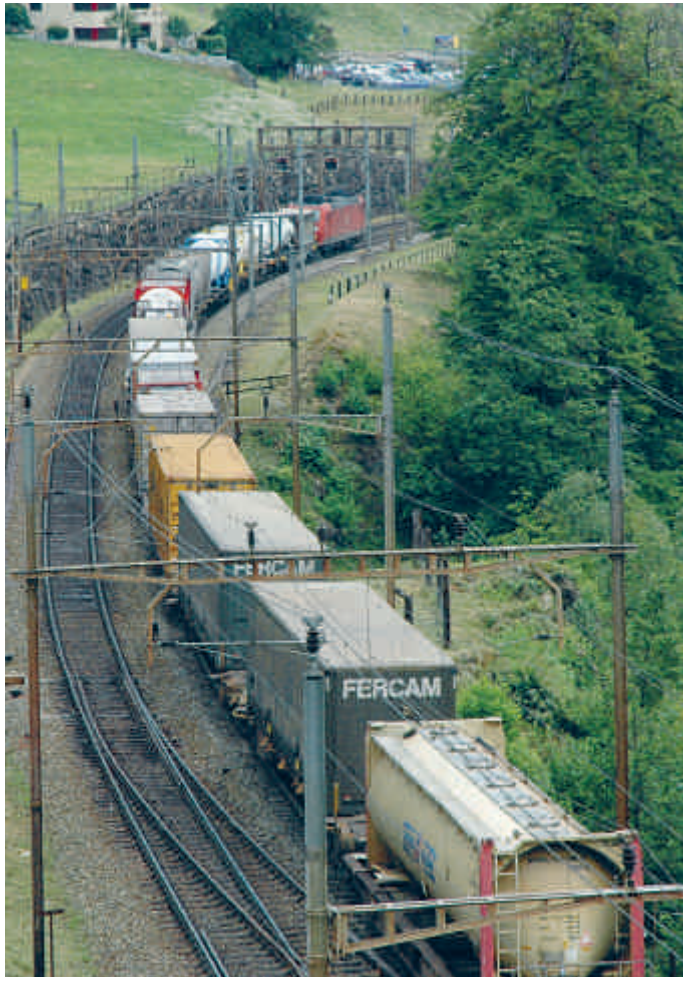

Figure 6: The ACE needs to be accompanied by new combined transport services.

Scenario 3: Alpine Crossing Exchange, Year 2020								
Corridor	Fréjus	Mont-Blanc		Gotthard		Brenner		Tarvisio
Region	Piemonte	Rhône-Alpes	Valle d'Aosta	Zentralschweiz	Ticino	Tirol	Südtirol	Friuli-Venezia-Guilia
Driver (HGV/a)	0%	0%	0%	0%	0%	0%	0%	0%
Pressure 1 (NO_x, PM10 in t/km/a)	0%	0%	0%	0%	0%	0%	0%	0%
Pressure 2 (fossil CO_2 in t/km/a)	+17%	+27%	+39%	-32%	-32%	+24%	+16%	-9%
State (NO_2, PM10 in µg/m³)	0%	+50%	0%	0%	+75%	+50%	+25%	0%
Impact (population exposed to traffic noise)	+33% (900 exposed inhabitants above scenario target)	+20% (1310 exposed inhabitants above scenario target)	+2% (30 exposed inhabitants above scenario target)	-4% (750 inhabitants less exposed than in 2010)	-2% (430 inhabitants less exposed than in 2010)	+6% (1980 exposed inhabitants above scenario target)	+5% (2150 exposed inhabitants above scenario target)	+38% (360 exposed inhabitants above scenario target)
Response	+9%	+9%	+9%	+9%	+9%	+9%	+9%	+9%

Table 5: For driver and pressure indicator 1 (NO_x, PM10), the target path is reached in all regions. Despite a considerable reduction of the CO_2 emissions, the targets remain missed in some of the regions. State indicator: Other sources of pollution prevent a significant improvement of ambient air concentration. Noise impacts are slightly higher than in the AETS scenario (page 11). Note that the Alpine Crossing Exchange does not have an influence on light vehicles (e.g. motor bikes), which contribute significantly to noise emission levels.

- target path reached or almost reached
- target path missed
- target path far off

Need for Common Action

The policy scenario analysis points out that without any coordinated measures, negative environmental impacts will further increase (business as usual scenario). A forced technological development has some potential to limit the impacts but will not be sufficient to reach the targets. An Alpine Emissions Trading System or an Alpine Crossing Exchange are effective instruments for coordinated action (page 10 to 13).

The iMONITRAF! action plan is based on a common target system and defines specific steps for coordinated measures beyond the project duration.

Note that iMONITRAF! definition of these two scenarios does not consider specific incentives of instruments to improve technology (like energy effiency, air pollutant or noise emission reductions), which might further decrease their impacts as presented in this document.

In an overall ranking of the four scenarios, the Alpine Crossing Exchange reaches the best results.

A common strategy

The Alpine regions have already recognized the need for coordinated action in a resolution signed in Innsbruck in January 2008 which served as main basis for the project iMONITRAF!. Meanwhile the regions have developed a common strategy built on a set of principles (cooperation, solidarity, fairness, polluter pays principle, integrated approach). The strategy defines a common target system which is used for the analysis of the four scenarios in the document at hand. For common measures on freight transport, it specifies the harmonisation of existing regional measures, a common modal shift policy and a common cap-and-trade instrument. For passenger transport, speed limits and the development of a multimodal information and ticketing platform for public transportation are recommended. Effects of measures targeting at passengers, however, have not been considered in the modelling of the four scenarios.

Interregional action plan

Based on targets and common measures, the strategy defines an action plan towards the implementation of the measures and the continuation of the regional cooperation:

- Implementation of measures on regional level.
- Initiation of political discussions, processes and lobbying towards the implementation of measures on national levels. Accounting for trade-offs with regional economic interests, since a common steering instrument might need a differentiated mechanism to prevent unwanted economic impacts in the Alpine regions.
- Lobbying on European level, using the common voice of the Alpine regions.
- Set up of a project office that is funded by the regions or of a flexible partnership with either financial or immaterial contributions from the regions.

Figure 7: The implementation of common measures requires a further development of rail infrastructures and services in the Alpine regions.

iMONITRAF!'s elements towards a sustainable Alpine transit traffic

- Continuation of the established inter-regional network of administration and political representatives.
- Annual compilation of selected indicators and their interpretation.
- Harmonisation of existing measures,
- Further specifications of the regional conditions for international steering instruments.
- Strengthen the common voice to support and implement further measures.

Further information

Background documents (download from www.imonitraf.org → publications):

- Monitoring data (implemented in the WebGIS system).
- «Best Practice Guide»: Toolbox for the development of regional policies and common measures.
- Report «Innovative approaches – a regional viewpoint» with an analysis of a common steering instrument.

Rising traffic volumes pose a challenge for the Alpine regions. To meet that challenge, they have joined forces and developed an interregional strategy including common measures for a sustainable Alpine transit traffic.

The policy scenarios analysed in this brochure underpin the need for action and the crucial role of a common steering instrument.