Environmental improvements through vehicle technology

Report on research elements for quick wins in trans-national cooperation

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Summary

The ERA-NET TRANSPORT (ENT) research programme is a joint effort of 13 partners in 11 European countries to promote efficient trans-national research cooperation in the field of transport. Until now transport research and networks have been seen from a national perspective. In 2004 ENT identified 6 potential areas for trans-national cooperation based on the actual research programmes within the participating countries. In the beginning of 2005 Work Package 2 of ENT organised several activities to identify relevant elements for cooperation within one of these identified research areas: *Environmental improvement through vehicle technology*.

The activities are carried out in a sequential three-step-approach. First, three focus elements within this research area were identified to structure the identification process: (1) technology development, (2) financial tools and regulation and (3) market introduction. Next, a scan on relevant supranational and international developments was executed to identify the position of intended ENT activities in the near future in relation to other international objectives and activities.

Based on the scan it was concluded that already many activities are already in operation within this area. Most of the related research programmes are focussed on Technical development and less on Financial Tools and Regulation and (3) Market Introduction. The European Energy in Motion initiative to realise a more sustainable transport sector in Europe can be an important initiative for this theme.

Finally, an *Exploratory* workshop was organised. In this workshop relevant strategic research managers as well as experts in the field of vehicle technologies discussed and prioritised the themes within the research area that are high on the national political agenda and suitable for trans-national cooperation. The themes will be further refined in a following *Targeted* workshop that is planned to be organised in June 2005.

In the *Exploratory* workshop 8 research themes were prioritised as most potential for trans-national cooperation. These research elements can be focussed into three cluster of research:

Research cluster	Description
Alternative fuel and propulsion system cluster	Policy research related to the development and introduction of non-fossil fuels and its relation to alternative propulsion systems
Cleaner car cluster	Policy research related to the introduction of new technologies into the market, with special attention to public demands and the awareness of customer needs and the specific role of governments in this process.
Noise cluster	Policy research related to the implementation of innovative noise reducing measures and techniques, especially related to publicly perceived inconveniences, including effect on human health.

The three research clusters, with their prioritised research elements, will for the basis for the discussion and identification of actual trans-national research activities in the up-coming *Targeted* workshop of ERA-NET TRANSPORT.

1. General introduction

ERA-NET TRANSPORT (ENT) is a joint effort of 11 European countries to promote efficient trans-national research cooperation in the field of transport. Until now transport research and networks have been seen from a national perspective. ERA-NET TRANSPORT aims at developing a European vision on transport research and developing cooperation between national transport research programmes for the short term and trans-national cooperation in research programming for the mid and long term.

The objective of Work Package 2 in the ENT is to identify the relevant research areas and elements for trans-national cooperation. In 2004 the Works Package developed the Road map for trans-national transport research. In this road map 6 potential fields for trans-national cooperation in the short term were identified, based on the actual available research programmes and national preferences for trans-national cooperation within most European countries.

One of these research areas that had been selected for the identification of elements for a quick-win exploration is *Environmental improvements through vehicle technology.* This research area is concerned with the aspects of a transport system and transport patterns that provide the means and opportunities to meet environmental needs efficiently. The area covers all the adverse side effects of transport on the environment with a focus on technologies related to transport vehicles of all modes and is targeting sustainable policy objectives within transport. This comprises analytical, experimental and conceptual work as well as hardware development for research purposes.

1.1 Research approach

The research is carried out in a sequential three-step-approach:

1. Identifying focus domains
2. Scanning supranational and international developments
3. Identifying elements for short term quick wins in trans-national cooperation

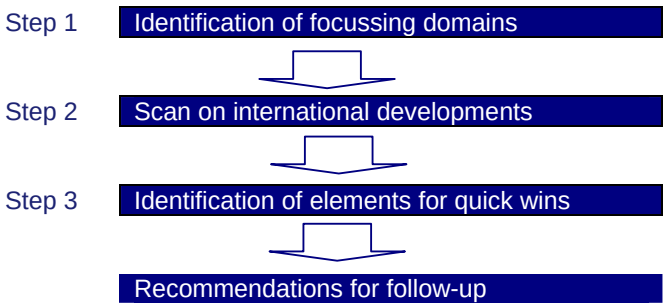
Identifying focus domains
The research area of *Environmental improvements through vehicle technology* covers a wide range of elements. To be able to reflect to this broad research area regarding its international developments and trans-national opportunities for cooperation three related focus elements are identified to structure the discussion. The domains of the three focus domains are described in the next table:

Focus domain	Description
Technology development	Development of the vehicle and fuel technology like new power trains, fuels and energy sources like hydrogen, biomass that can be used in the transport sector. Furthermore, (light) material technology and relations of the vehicle - fuel with their infrastructure has to be taken into account. Finally, besides the development process also the life cycle from production to recycling will be a part of research of the vehicle technology. The infrastructure of the vehicle will not be an item for focussing.
Financial tools and regulation	Fiscal incentives and/or subsidies to stimulate the introduction of environmental friendly transport options and to stimulate the buying, and use of environmental friendly modes. Also legislative options like environmental permits for entering zero emission zones and environmental conditions by tendering of public transport. EU regulation can be of assistance by such arrangements. Finally, also new policies and the regulatory framework to facilitate the innovation needed.
Market introduction	Instruments to bring new technologies onto the market. This is a complex task that requires joint commitment of all major stakeholders involved (i.e. producers, consumers and government). Moreover, we are facing a chicken-and-egg dilemma: consumer demand for clean low-carbon vehicles will not grow without sufficient offer of such vehicles and their fuels, and producers are not tempted to start offering such vehicles if they see no consumer demand

Scanning supranational and international developments
Based on the description of the research area and its focus elements an identification of already existing initiatives and their (policy) context in the international arenas is developed. With this information it is possible to identify the position of intended ENT activities in the near future in relation to the other international objectives and activities. The scan is executed in the period January-February 2005.

Identifying elements for short term quick wins in trans-national cooperation
Based on discussions and prioritisations in an Exploratory workshop on the results of the international scan of developments and short-term intended national initiatives, representatives of the ENT partners identified relevant research elements for trans-national cooperation. The Exploratory workshop is executed in March 2005.

The next figure presents the three-step approach, its order and its results:



1.2 Follow-up activities

The results of this report will be the basis for further the start up of actual transnational cooperation activities. Work Package 3 of ENT organises a Targeted workshop in June 2005, in which the relevant managers of research programmes in the ENT countries will discuss possible working forms and joint outputs of specified activities.

1.3 Structure of the report

In the next chapter of this report the results of the scan of supranational and international developments on the research area will be presented. Finally, chapter three presents the research approach and the identification of elements for the further developments in cooperation within the research area, that are discussed in the Exploratory workshop.

2. International developments

The objective of the ERA-NET TRANSPORT programme is to start up trans-national cooperation, based on the combination of (future) research programmes of individual countries. To identify the trans-nationally potential research elements it is important to have an overview of the already existing and intended research initiatives and its (policy) context. With a reflection of the trans-national preferences for cooperation to the international initiatives the actual possibilities for ENT become clear.

2.1 Introduction

The next paragraph presents the relevant policy objectives and research programmes of the European Commission. Paragraph 2.3 presents the relevant developments in other international organisations with a strong focus on the research area. Appendix 1 presents an overview of the results of the scan.

2.2 European Commission

More than 75% of the population of the European Union lives in urban areas. Therefore urban transport accounts for a significant part of total mobility, and an even greater proportion of damage to the health of citizens and to buildings. For example, one-fifth of all EU kilometres travelled are urban trips with a distance of less than 15 km. Until the year 2030, total kilometres travelled in EU urban areas are expected to increase by 40%.

The car is dominant, contributing about 75% of kilometres travelled in EU conurbations. Cars cause so much congestion that, in some European cities, the average traffic speeds at peak times are lower than in the days of the horse-drawn carriage. Increased car use has been accompanied by safety and environmental problems, as well as by a downward spiral of under-investment in public transport.

Urban transport contributes to global warming. More than 10% of all carbon dioxide emissions in the EU come from road traffic in urban areas, which is also the main source of carbon monoxide and fine particulates in European cities. These emissions pollute the immediate area and pose serious health hazards. The Kyoto protocol calls for an 8% cut in total EU carbon dioxide by 2008–2012 with respect to 1990 levels, but if current trends continue, CO_2 from transport will be some 40% higher in 2010 than it was in 1990.

The challenge for future urban transport systems will be to meet the demand for accessibility for people, including people with reduced mobility and goods, while at the same time minimising the impacts on the environment while safeguarding the quality of life.

Environmental concerns have underpinned the drive towards efficient transport technologies including cleaner vehicles/fuels and non-technical measures to reduce emissions. The European Union is working toward the definition and implementation of a strategy to promote sustainable mobility in an urban context, which would include a range of actions such as:

- promoting market take-up of lower-consumption vehicles and new propulsion technologies to reduce emissions
- promoting the use of improved collective and non-motorised modes in conjunction with mobility management schemes

- demand management schemes such as parking controls and access restrictions
- information systems for better traffic management and improving traffic flow
- integrated intermodal freight and passenger transport systems such as city logistics and improved terminals
- fair and efficient pricing regimes
- supporting integrated land-use and urban transport planning to minimise the need to travel and facilitate public transport
- promoting efficient public transport modes to people with reduced mobility
- supporting and promoting cycling
- possible contribution of Tele-working

Air Quality

Air quality is one of the areas in which Europe has been most active in recent years. Transport is one of the main causes of bad air quality. The EC aim has been to develop an overall strategy through the setting of long-term air quality objectives. A series of Directives has been introduced to control levels of certain pollutants and to monitor their concentrations in the air. In 1996, the Environment Council adopted Framework Directive 96/62/EC on ambient air quality assessment and management. This Directive covers the revision of previously existing legislation and the introduction of new air quality standards for previously unregulated air pollutants, setting the timetable for the development of daughter directives on a range of pollutants.

The Framework Directive was followed by daughter directives, which will set the numerical limit values, or in the case of ozone, target values for each of the identified pollutants. Besides setting air quality limit and alert thresholds, the objectives of the daughter directives are to harmonise monitoring strategies, measuring methods, calibration and quality assessment methods to arrive at comparable measurements throughout the EU and to provide for good public information.

In the year 2005 the health limit values for SO2 and PM10 must be met. In the year 2010 the other health limit values for NO2 and Pb must be met. Member States will have to prepare attainment programmes showing how the limit values will be met on time for those areas where attainments by "business as usual" cannot be presumed. These programmes must be made directly available to the public, and must also be sent to the Commission.

Noise

Further to its 1996 Green Paper (COM(96)540), the European Commission developed a new framework for noise policy, based on shared responsibility between the EU, national and local level, and including measures to improve the accuracy and standardisation of data to help improve the coherency of different actions. This document leads to a comprehensive set of measures, including:

1. The creation of a Noise Expert Network, whose mission is to assist the Commission in the development of its noise policy.
2. The Directive on Environmental Noise aimed at requiring competent authorities in Member States to produce strategic noise maps on the basis of harmonised indicators, to inform the public about noise exposure and its effects, and to draw up action plans to address noise issues.
3. The Directive on Equipment Used Outdoors that simplifies the legislation about many noisy types of equipment.

4. The follow-up and development of existing EU legislation relating to sources of noise, such as motor vehicles, aircraft, railway rolling stock and the provision of financial support to different noise related studies and research projects.

Energy saving

Energy and Transport policies are at the centre of environment concerns, jointly contributing with more than 90% to Europe's CO2 emissions balance and causing other negative environmental impacts. Both sectors have developed a guiding vision and first practical steps to put environmental integration and sustainable development into practice.

Today's understanding is that sustainable energy and transport policies should maximise the long-term welfare of citizens by keeping a reasonable balance between the traditional policy objectives of "secure (safe)", "competitive" and "environment-friendly" energy and transport services.

Monitoring energy and transport markets reveals that - while some progress is being made - major problems remain and some developments give rise to major concerns.

Critical trends are especially:

- Europe's increasing energy import dependency and its implications for energy security,
- the return of growth in European fossil fuel consumption and the corresponding increase in CO_2 emissions
- finally, the continuous growth of road and aviation transport demand, which is creating traffic congestion of a size and a frequency that will further escalate its current negative impacts on European industry's competitiveness.

In addition, the great variety of different and serious environmental problems in these two sectors is a specific challenge.

Road Vehicles

Motor vehicle emissions are regulated by Directive 70/220/EEC (light vehicles) and 88/77/EC (heavy vehicles) and amendments to those directives. A whole series of amendments have been issued to stepwise tighten the limit values. Emissions are measurably falling because of this, even though traffic volumes continue to rise. The implementation of the Auto-Oil Programme will result in a notably improved air quality in our cities. The programme focused on the emissions of carbon monoxide (CO), Volatile Organic Compounds (VOC), nitrogen oxides (NO_x) and particles. By the programme stricter limit values will be implemented for light vehicles 2005 (Directive 98/69/EC) and for heavy-duty vehicles 2005 and 2008 (Directive 1999/96/EC).

Addition legislation has been implemented on the use of on-board diagnostic systems (OBD) which will tell vehicle owners if the emissions of the vehicle is too high and a light on the instrument panel will indicate that there is a need to repair the vehicle. Regarding vehicle in use there is legislation introduced for periodic inspections at which the vehicle-owners maintenance of the vehicle is checked (Directive 96/96/EC). The Auto-Oil Programme legislation on durability makes the manufacturer responsible for the emissions from light vehicles during five years or 80.000 km, whichever occurs first, providing that the vehicle has been properly maintained. A similar legislation is on its way for heavy-duty vehicles.

To reduce emissions during short trips, when the catalytic converter is less effective, and driving during wintertime, a separate requirement on "cold start emissions" was

introduced. This part of the legislation is of particular importance for city driving where the average trip normally is very short.

By amending Directive 1999/24/EC the emissions from motorcycles will be lowered as well. The current legislation will be tightened from 2006. This also covers Directive emissions from mopeds.

Energy in Motion

At the initiative of the Dutch Presidency, leading officials from 25 EU member states met on 19. and 20. October 2004 with representatives from industry, NGOs and the research community to discuss the question: "*How can Europe bring about a clean and climate-neutral road transport system in such a way as to secure our future energy supply and boost the innovativeness of our economy?"* The aim was to help reach a better understanding in Europe of the implications of these challenges, their urgency, the role that the transport sector can and must play in this and the prospects for solutions. In addition, the discussions identified concrete next steps that would lead to visible results for European citizens within the short term.

The discussions focussed on the potential contributions that innovations in fuels and power trains could make, a key precondition for meeting these challenges in the longer term. Eco-efficient innovations of this kind offer European industry the opportunity to strengthen its global competitiveness and thereby make a major contribution towards realising the Lisbon objectives as endorsed in the report of the Kok Commission.

On the basis of the discussions, the Presidency concludes that there is broad consensus on the following (in short terms).

- There is an urgent need for short-term action on regulated emissions of PM_{10} and NO_x, in particular for reasons of people's health in urban areas. Improvement of current technology offers the prospect of the introduction of near-zero emission passenger vehicles by 2015.
- Reducing CO_2 emissions is considered to be the most persistent and most urgent long-term problem for the transport sector, not to be solved by existing policies. Society´s long-term goal should be to eliminate transport as a major source of CO_2 emissions. The transport sector should take a fair share in solving the problem. The Commission's post-Kyoto strategy must offer a clear and inspirational long-term perspective to promote innovation and provide industry with a stable framework in which to develop their products.
- There is no single solution to solving the CO_2 problem; all routes under discussion will be needed to achieve the goals. There is support for the car industry´s call for an integrated approach, providing there is a guarantee that the industry can be expected to make maximum efforts to reduce CO_2 emissions and promote energy efficiency.
- The most effective EU-instruments to reduce CO_2 emissions from passenger cars are the voluntary agreements with the car industry. This approach deserves to be continued, but must become more ambitious if emissions are to be reduced to a sustainable level.
- Key conditions may serve as a guide for the EU portfolio of promising fuel and power train options, the basis for which was laid in the Communication on Alternative Fuels (COM, 2001, 547) :
- There is a preference for indicative EU targets under the boundary conditions of environmental performance (reduction of emissions), without indicating a fuel of

choice. EU member states are invited to include criteria for CO2 reduction in the elaboration of the biofuels directive.

- The Commission is invited to take the initiative for long-running and strongly funded R&D and demonstration programmes for advanced biofuels and hybrids at a European level, similar to the efforts made for hydrogen.
- Governments, industry and consumer organisations should shoulder their responsibilities to support market uptake of clean low carbon fuels and vehicles, and close the loop between product development, policies to encourage take up, and consumer demand.
- Cities are the best places to kick-start markets for clean low carbon vehicles. Cities are invited to follow the good example of the CIVITAS cities.
- There is a strong need for new kinds of partnerships at a strategic level, in which governments, industry and other stakeholders take the lead in making the EU´s transport sector more sustainable, attractive, innovative and competitive.

The 2004 Dutch Presidency asked the Commission to take special note of the conclusions drawn at "Energy in Motion" as it develops its proposals in the coming years, and in particular in its mid-term review of the White Paper in 2005. Furthermore, the 2004 Dutch Presidency asked the member states and stakeholders to mobilise their specific competencies in order to provide concrete contributions towards realising a more sustainable transport sector in Europe. Finally, it was stressed that future presidencies should work actively with the Commission to continue this process.

6th Framework Programme DG TREN

Its objectives are (1) to strike a balance between economic development and the quality and safety demands made by society in order to develop a modern, sustainable transport system for 2010 (White Paper) a (2) to place users at the heart of transport policy, i.e. to reduce the number of accidents, harmonise penalties and develop safer, cleaner technologies and to establish a new multi-annual programme for action in the field of energy reflecting the European Union's current objectives in this field, namely sustainable development and security of supply.

Energy and transport play a large part in climate change since they are the leading sources of greenhouse gas emissions; this is why energy policy is particularly important in the European Union's sustainable development strategy. The EU is increasingly dependent on energy imported from third countries, creating economic, social, political and other risks for the Union.

The EU therefore wishes to reduce its dependence and improve its security of supply by promoting other energy sources and cutting demand for energy. Consequently, it is putting the accent, above all, on improving energy efficiency and promoting renewable energy sources.

The new multi-annual programme for action in the field of energy, "Intelligent Energy for Europe", implements the broad lines of action described in the Green Paper on the European Strategy for security of energy supply which is aimed at strengthening the security of energy supply, combating climate change and boosting the competitiveness of EU businesses.

The specific aims are to provide the necessary factors to promote energy efficiency and develop renewable energy sources with a view to reducing energy consumption and CO_2 emissions and to promote efficient and intelligent schemes for the

production and consumption of energy, based on solid and sustainable foundations, through awareness-raising and education.

To achieve these aims, the programme must ensure that there is a real change in energy behaviour in the EU on the part of individuals as well as industry and enterprise. It must also develop instruments to ensure effective follow-up, monitoring and evaluation.

The STEER programme of IEE is concerned with supporting initiatives relating to the energy aspects of transport and fuel diversification by using renewable energy sources.

6th Framework Programme DG Research

Its objectives is to strengthen the necessary scientific and technological capacity by integrating environmental, economic and social objectives, in particular with regard to renewable energy sources, transport and the sustainable management of terrestrial and marine resources in Europe.

Sustainable development in the field of transport is closely linked to European citizens' quality of life. In this context, the Commission's Green Paper on security of energy supply and White Paper on transport policy place the spotlight on energy and on transport, the sources of over 80% of total greenhouse gas emissions and over 90% of CO_2 emissions. The transport sector is likely to see the largest increase in energy use, with a 16% rise expected by 2010.

Research is being carried out into:

- new technologies and new concepts for inland transport, including propulsion systems and the use of fuel cells;
- advanced design and production techniques to improve quality, safety, reliability, comfort and economy;
- the stability, integration and interoperability of modes of transport at urban and regional level;
- increasing safety and combating urban congestion using electronic and telematics solutions, as well as advanced satellite navigation systems.

6th Framework Programme DG Information Society

The objective of sustainable development has been a central EU priority for several years.

Information society technologies can make a significant difference, from 'intelligent roads and vehicles' - which have less accidents and produce less pollution - to new management tools for improving transport system efficiency and making our urban environment a better places to live. Several examples are:

- Galileo's transport applications, which will have a major role in the development of Intelligent Transport Systems and Services.
- One of the three main action lines of the Marco Polo programme, which aims to help shift international cargo traffic from Europe's roads to other modes, is "Stimulating cooperative behaviour in the freight logistics market";
- E-Safety for road and air transport - a Strategic Objective of the IST research priority, this funds research into using IS technologies to improve both safety and efficiency, reducing fuel consumption and pollution;

- Sustainable development, Global Change and Ecosystems: one of the top priorities of this 2.1 billion euro effort is sustainable surface transport, including logistics research;
- CIVITAS, which supports cities pioneering urban transport development, funds measures such as innovative mobility management, logistics and information technology schemes;
- Thematic Strategy on the Urban Environment: one of the key actions outlined in the Commission's proposed Sixth Community Environment Action Programme, this has four priority themes, including urban environmental management and urban transport, both of which can benefit from IS technologies.

2.3 Other International programmes and initiatives

In total 7 relevant international organisations are identified, which have relevant aspects of research.

OECD

The overall objectives of the EST, the Environmentally Sustainable Transport project of the OECD, are to provide an understanding of EST its implications and requirements, and to develop methods and guidelines towards its realisation. The core of the EST approach was to develop long-term scenarios and identify instruments and strategies capable of achieving it by using a back-casting methodology

In 1998, Environment Ministers of OECD countries requested the OECD to develop guidelines for moving towards EST. In response to this request, the OECD has developed a set of key guidelines that makes the 1996 Vancouver Principles towards Sustainable Transportation and the strategic directions more concrete. The Ministers endorsed the EST Guidelines in May 2001. The EST project attempts to demonstrate what strategies to achieve EST might look like, as well as their economic and social impacts, considering long-term environmental issues. It is an attempt to establish a basis for a diverse range of policy-makers and economic actors to communicate and a framework for government to set goals, objectives, targets or standards and initiate actions.

JTRC= Joint OECD –CEMT Research Transport Committee

The mandate of the Centre is to promote economic development and contribute to structural improvements of OECD and ECMT economies, through cooperative transport research programmes addressing all modes of inland transport and their intermodal linkages in a wider economic, social, environmental and institutional context.

The study on Sustainable Surface Transport will address the need to improve transport sustainability over a 10 to 20-year time horizon; it will identify market-based and other approaches and develop policy options to significantly improve the sustainability of land-based passenger and freight transport.

EUREKA (pan-European network for market-oriented, industrial R&D)

Created as an intergovernmental Initiative in 1985, EUREKA aims to enhance European competitiveness through its support to businesses, research centres and universities who carry out pan-European projects to develop innovative products, processes and services.

IEA, International Energy Agency

IEA Member countries commit themselves to take effective measures to meet any oil supply emergency and, over the long term, to reduce dependence on oil. Means to attain their objective include increased energy efficiency, conservation, and the development of coal, natural gas, nuclear power and renewable energy sources.

The IEA provides support for international cooperation and collaboration agreements in energy technology R&D, deployment and information dissemination, called the IEA Framework for International Technology Cooperation.

The Framework sets out the legal and management support for the activities of more than 40 active technology agreements in the programme, called Implementing Agreements.

Implementing Agreements can be established on a cost-sharing basis, a task-sharing basis, or a combination of both. They contribute significantly to speeding technological progress, lowering costs, eliminating technological risks, duplicating efforts, facilitating harmonisation of standards, and protecting intellectual property. Implementing agreements in transportation are:

- Advanced Fuel Cells (http://www.ieafuelcell.com)
- Advanced Materials for Transportation Applications (contact: tom.howes@iea.org)
- Advanced Motor Fuels (http://www.iea-amf.vtt.fi)
- Hybrid and Electric Vehicle Technologies and Programmes (http://www.ieahev.org)

ERTRAC

The European Road Transport Research Advisory Council was established to mobilise all stakeholders, develop a shared vision, and ensure timely, coordinated and efficient application of research resources to meet the continuing challenges of road transport and European competitiveness. ERTRAC members are high level representatives from all road transport sectors including consumers, vehicle manufacturers, component suppliers, road infrastructure operators and developers, service providers, energy suppliers, research organisations, cities and regions as well as public authorities at both European Union and national level. The solutions required for our society can only be achieved through a multi-disciplinary, systems approach to research activities and the subsequent development and implementation by the private and public sectors at the European and national level.

The research challenge in the Strategic Research Agenda of ERTRAC is to deliver low emissions while also meeting individual and social demands for mobility, vehicle performance, reductions in GhG emissions and improvements in energy efficiency.

ERRAC

The European Rail Research Advisory Council (ERRAC) is an advisory body to the EU, representing Member States, the railway manufacturing and supply industry, rail operators and infrastructure managers, users, academia, environmental and urban planning organisations and the EU.

Its primary mission is to establish and carry forward a Strategic Rail Research Agenda that will influence all stakeholders in the planning of research programmes, particularly national and EU programmes. The Strategic Rail Research Agenda sets out the steps needed to achieve ERRAC's ambitious objectives by promoting inno-

vative products and services on a joint basis through pre-competitive research. The SRRA identifies interoperability, intelligent mobility, safety and security, environment, and innovative materials and production methods as key sectors where collaboration is needed to revitalise rail transport.

Hydrogen Fuel Cells

The European Hydrogen and Fuel Cell Technology Platform (HFP) facilitates and accelerates the development and deployment of cost-competitive, world class European hydrogen and fuel cell based energy systems and component technologies for applications in transport, stationary and portable power

The Strategic Research Agenda (SRA) of the Platform provides a strategic outline to stimulate investment in research, provide guidance for policy options and deliver a realistic and inspirational research program that will mobilise stakeholders and ensure that European competencies are at the forefront of science & technology worldwide. It shall take into account the imminent FP7 and subsequent programs, the needs for coordinating R&D with demonstration, deployment and financing.

3. Research elements for quick wins in trans-national co-operation

3.1 Introduction

The previous chapter described the results of the scan on supranational and international developments on the research area of Environmental improvements through vehicle technology. This chapter presents the relevant elements for ENT within the research area for the starting up of actual trans-national cooperation, identified in the Exploratory workshop.

The next paragraph describes the research approach towards and in the workshop. Finally, paragraph 3.3 presents the results of the workshop and the elements for further activities within the ENT programme. A complete report on the process and results of the workshop is available in Part 1 of the Appendix report.

3.2 Research approach

The objective of the Exploratory workshop was to identify the, ERA-NET TRANSPORT relevant, research elements for quick wins in trans-national cooperation within the research area Environmental improvements through vehicle technology. In order to reach this aim two types of information where discussed with representatives from the partners in the ENT programme:

1. the results of the scan on supranational and international developments, especially to be used as basic and background information
2. nationally preferences of elements for trans-national cooperation within the research area, especially to be used as the starting point of the identification of joint interests

In the preparation of the workshop all partners in the ENT were asked to prepare a presentation. Each presentation followed the same format what lead to a comparable overview of interests by the participating countries. The format existed of at least the following 5 items:

1. the important policy objectives in the country
2. the important research and programme objectives in the country
3. the important research and programme elements in the country
4. the positioning of the research elements in the three focus elements (technology development, financial tools and regulation and market introduction)
5. the main elements for supra-national and trans-national cooperation

These presentations were given in 2 sub-group, which each discussed the list of suggested elements for trans-national cooperation by the introducing presentation, completed the list of elements and finally prioritised all discussed elements.

The results of both sub-group sessions were presented and discussed in a plenary session with all participants in the workshop and finally overall prioritised by expressing its interest for financial investment in the identified elements.

3.3 Results of the Exploratory workshop

In total 7 countries, all partners in the ENT, participated in the workshop. Based on the discussions on the selected research elements in the sub groups and the overall discussions rather clearly focused interests were identified.

Conclusions regarding selected research elements (sub groups)
Based on the introducing presentations, lively discussions and clearly set priorities, the following 14 elements (with the related focus elements) were selected in the subgroup sessions:

	Research elements	Focus domains[1]
Group 1	Cleaner cars	TD, MI
	Hydrogen	TD
	Green trucks	TD, MI
	Policy instruments	MI
	Noise	TD, FR, MI
	Alternative (bio) fuels	TD, FR, MI
Group 2	Energy efficient vehicle unit – APU	TD
	Alternative propulsion systems	TD
	New vehicles	TD
	Filters, Catalytic, After treatment	TD, FR
	Bio and non-fossil fuel	TD, MI
	Noise	TD, FR
	Awareness public demand	FR, MI
	Awareness launching customer	FR, MI

Regarding *Cleaner cars* France has taken initiative in working together on a vehicle programme with Germany in which technical development and regulation aspects will be taken into account. The aim of the programme is developing clean cars being less dependent of oil. The French Ministry of Research has already done quite some preparatory work in this field. It appears that it is not only a matter of energy and fuel aspects, but also vehicle aspects. It is difficult to get a clear position of the car industry, because their research in that field is not particularly fundamental. The important questions that are left to be solved are:

- Is there a market without regulation?
- Who has to be seen as the one responsible for obtaining a market for clean cars anyhow, related to the cost/benefit ratio of the industry actors?

This research element is focussed on the domains of technical development and market introduction.

Hydrogen is focussed on the domain of technical development and especially interesting in relation to the fuel aspects but has as well direct implications on the propulsion system. The main difficulty of this element to overcome is market introduction. Car industry and fuel producers seem not able or willing to agree in which year the introduction of alternative fuels will have to be expected on the market. This leads to an imbalance in the production of hydrogen instead of oil. The production of hydrogen needs careful consideration as in all cases (including production on the basis of gas and oil) a substantial amount of energy is needed. For the reason of security of energy supply as well as reduction of greenhouse gases the production

1 TD is Technology development, FR is Financial tools and regulation and MI is Market introduction

of hydrogen should concentrate on renewable energy sources. The very strong interest of the industry and policy makers on hydrogen technologies is reflected by numerous national programmes, the HFP-technology platform of the European Commission as well the “International Partnership for a Hydrogen Economy” initiated by the USA. Therefore ENT could play an important role in integrating national programmes into these international activities and by adapting this technology to the specific requirements of the transport system.

There are several integration programmes regarding *Green trucks* that concern urban and long-distance trucks. Much preliminary work has been done in France who is already initiating international cooperation (with Sweden). Because the element of Green trucks is an important political issue in several countries new trans-national research is interesting. This research element is focussed on the domains of technical development and market introduction and implementation.

Policy instruments consist of a wide range of research activities regarding market introduction and implementation instruments.

Noise was mentioned in both subgroups and is focussed on all the domains of technical development, market introduction as well as financial tools and regulations. Noise is an important EU-item with important implications to legislation. Besides research for new options to reduce noise it is particular important to start up research to understanding the way noise effect human health and how noise is perceived and as follows acted accordingly by the public.

It is stated that no country will be able to meet the EU-goals in oil reduction what leads to a prominent position of the element *Alternative (bio) fuels.* In that context this element is slightly related to hydrogen element described just before, though hydrogen is mainly a production (system) matter. Bio fuels are heavily subsidised. It is primary a market introduction matter but deals as well with market competition aspects. There are many of possibilities for the production of bio fuels that have not been researched yet including regulation aspects. This leads, especially in relation to the element of hydrogen, to an emphasis on bio-fuels and other alternative fuels in cooperation between national programmes. This research element is focussed on the domains of technical development, market introduction as well as financial tools and regulations. *Bio and non-fossil fuel*, mentioned in the parallel subgroup is relevant on all aspects in the domains of technology development and financial tools and regulation

Energy efficient vehicle unit – Auxiliary Power Unit (APU) focuses on the domain of technology development. Because this element is so close related to actors in the market the threat for trans-national cooperation is quite evident. Similar to other proposed elements for the market introduction and creation of awareness and public demand international cooperation within ENT could be beneficial due to the high potential for greenhouse gas reduction of this technology.

Technology development is also the research domain of *Alternative propulsion systems (New vehicle concepts from hybrid to fuel cells)*. Possibilities for trans-national research are evident and potential because of EU policy stimulation of to the development of new services by the market for clean urban areas. Still it is quite important to reflect to initiatives from the technical platforms, because they are rather active in this research element.

New vehicles, low weight materials are focussed on the domain of technology development. An interesting possibility for cooperation is the coupling of this element

to traffic safety testing consumer standards. On the other hand the possible recycling issues can cause a possible problem for this element.

The domains of *Filters, Catalytic and After-treatment* are technology development and financial tools and regulation. Potential options for trans-national cooperation appear to be in the quick wins you will get meeting air pollution goals, though this element is again rather close to market initiatives.

Awareness public demands and Awareness launching customer focus on the domain of market introduction. Because of the rather importance of these elements as a political issue the start up of trans-national cooperation on these elements are quite potential. As ENT acts of the basis of coordination of national transport research programmes a sufficient R&D-content of these activities must be kept.

Conclusions regarding the overall prioritisation of research elements

Based on the selected research elements an overall prioritisation was established. All 7 countries participating in the Exploratory workshop divided a maximum of 10 point to all 14 research elements presented in the previous table. A top 5 list can be identified, based on the criterion that the elements should be supported by at least 3 countries because ENT is aiming at multinational cooperation

In the next table the top 5 of the 14 prioritised research elements is presented:

	Prioritised research element	Score	Nr. of countries
1	Cleaner cars	14	5
2	Noise research	13	5
3	Bio and non-fossil fuel	12	4
4	Alternative propulsion systems	11	5
5	Green Trucks	6	3

In appendix 2 presents to the total list of priorities with a reflection of the ENT supporting countries to the elements.

3.3 Recommendations for next activities

In June 2005 Work Package 3 of ENT will organise a Targeted workshop, in which research programme managers on the selected elements will identify and start up actual research activities. The number of research elements to be discussed is limited to 3.

The number 1-3 in the top 5 of prioritised research elements from the workshop form the basis for the selection of the elements for the Targeted workshop. Because of the strong relation of these three elements with several other identified elements, three clusters of research can be identified:

1. Alternative fuel and propulsion system research cluster
   Policy research related to the development and introduction of non-fossil fuels and its relation to alternative propulsion systems

2. Cleaner car research cluster

Policy research related to the introduction of new technologies into the market, with special attention to public demands and the awareness of customer needs and the specific role of governments in this process.

3. Noise research cluster

Policy research related to the implementation of innovative noise reducing measures and techniques, especially related to publicly perceived inconveniences, including effect on human health.

This leads to the following overview with the recommendation of research elements to be discussed in the Targeted workshop and background information regarding the relative importance (based on the scores per element), number of countries supporting the cluster and the possible form for cooperation mentioned in the Exploratory workshop.

Research cluster	Score	Countries	Suggested form for cooperation
Alternative fuel and propulsion system cluster • Bio fuels • Bio and non-fossil fuel • Hydrogen • Alternative propulsion	24	7	Project cluster Joint project / call / activities
Cleaner car cluster • Cleaner cars • Awareness/launching customer • Awareness/public demand	18	6	Joint project / call / activities
Noise cluster • Noise research	13	5	Project cluster Joint project / call / activities

Appendixes

Appendix 1 Overview of relevant supranational and international research programmes

In this overview of the Research programmes the programmes have been scored in the themes Technology development, Financial and regulation and Market introduction and implementation.

Organisation	Programme	Technology development	Financial tools and regulation	Market Introduction / implementation
DG TREN	CIVITAS II		Policy measures and tools in order to cover both the transport demand and supply side	The integration of alternative fuels / clean Vehicle fleets into the city transport system with a wider package
	STEER			Supporting initiatives relating to the energy aspects of transport and fuel diversification by using renewable energy sources.
DG Research	CALM	Calming noise pollution		
	CUTE	Key Technologies Car Efficiency		
	TECABS	Low weight Auto parts		
	RATIN	Low weight Auto parts		
	PREMTECH	Lean and Green, clever vehicle		
DG Information Society	GALILEO	Intelligent Transport Systems and Services.		
	CIVITAS		See above	See Above
OECD	Environmental Sustainable Transport EST	Extension of global emission projections for motor vehicles and impacts from advanced technology	Decoupling transport impacts and economic growth	Implementation of the EST guidelines

CEMT & OECD =JTCR	Sustainable Surface Transport			
EUREKA	Environment	In several Countries project have been started		
	Energy			
	Transport			
IEA	Implementing Agreement Transportation	Advanced Fuel Cells		
			Hybrid and Electric Vehicle Technologies and Programmes	Hybrid and Electric Vehicle Technologies and Programmes
		Advanced Materials for Transportation Applications		
ERTRAC	Reduced emission	Strategic Analyses: System approach to vehicle, fuel and infrastructure		Social trends and behaviours
		Efficient ICE vehicles & advanced fuels		
		Hybrids & Intelligent Energy Management systems		
		Fuel Cell Vehicles and low carbon/ hydrogen fuels		
	Environment and impact	Low emissions vehicles		
		Low noise transport system		
	Environment and impact	Infrastructure design & management		
		Sustainable resource use		Design for environment and recycling
		Fuel from bio-mass		

ERRAC	Environment	Noise Performance		
		Emission reduction		
		Energy efficiency		
		Design / technologies		
		Innovative materials; weight reduction		
Hydrogen and Fuel Cell Platform	H2 From production to End-Use	Projects in this Area		
	Fuel Cells	Project in this Area		

Appendix 2 Overall list of prioritised research elements and country reflections

	Prioritised research element	Score	Nr. of countries	Country reflection (if available)
1	Cleaner cars	14	5	*Denmark*: Limited amount of research programmes. Both new and retrofit cars. Consumer stimulation buying cleaner cars. Very political, takes a lot of commitment. Targeted workshop might result in more specific elements. *Norway:* Focus on demonstration. Support from the *Netherlands*. Support from *Austria* (joint activities). Demonstration projects. Gaining citizen support (public acceptance). *France:* Impact on households. Public acceptance of non-technological measures (speed limits that effects greenhouse). Technological demonstration projects.
2	Noise research	13	5	*Denmark*: Many elements. National plan for traffic noise (since 6 months) all modes. *Norway:* Isolation and measuring noise effects. Focus on source, e.g. production of silent pavement, with special focus on (harsh) climate. *Finland:* Under consideration. Might be interested in cooperation depending on specific topic. *Austria:* Difficulties with market introduction of potentially very good technical project results. Targeted workshop might lead to speed up the process and market introduction. *Netherlands*: Innovation program on noise. Exchange of programmes? Introduction of new small investments with big impact. *France:* Joint call (call in preparation on policy aspects; noise maps both testing aspects and perception of noise) for June. Furthermore noise effects in general. *Germany*: All modes, multiple aspects, broad approach.
3	Bio and non-fossil	12	4	*Denmark*: Research on production of bio fuels from waste materials. *Norway*: Political focus of importance. Some production of bio-diesel. Some production of waste material. *Finland*: ClimBus (climate business) program (M€ 70 2004-2008) focus is amongst other topics also on bio-fuels and supply chain management. *Netherlands*: No specific content choice. *Austria*: Trying to cover al kinds of content focus. Strong wood industry e.g. different reasons (climatic, political) for not choosing a lead topic. *France*: Fuel from biomass and supply chain management, Common denominator: do not invest in all fuels, make choices.
4	Alternative propulsion systems	11	5	*Denmark*: Not interested at this moment. *Netherlands*: PPP (platform for sustainable mobility). There are a lot of interesting projects. *Austria*: Broad variety of activities, strong support for this element. *Germany*: Looking for common strategy (both public acceptance and key measures for mar-

				ket introduction) for vehicle concepts into the European market, together with European partners.
5	Green Trucks	6	3	*Finland*: Much research on heavy vehicles, measurement and testing systems, information technology. Minimizing energy use. Especially propulsion systems like Austria. *Austria*: Relation to propulsion systems important. *France*: 5-year Programme in preparation that will be open for other countries (M€ 300). Commission level is needed. Several new truck concepts for use in future years. Hybrid urban trucks for different weight categories. How to get much heavier trucks on for instance the French road network. Energy management inside trucks, truck corridors etcetera (horizontal issues).
6	Awareness/launching customer	4	2	*Germany*: Advantages of environmental friendly transport modes > politicians and users (what's in it for me?).
7	Energy efficient vehicle units/APU	4	2	*Austria*: Increase of energy demand in-vehicle, research focuses on fuel cells in relation to APU. *France*: Support for APU (call still open). Ambition of project clustering. Support for in-car climate management.
8	Hydrogen	2	2	*Norway*: Interested in close-to-the-market projects. Interested in common projects together with other parties.
9	Filters/Catalytic/After treatment	2	1	*France*: Nox project cluster depending on industrial involvement. *Finland*: Interested in after treatment (exhaust gasses).
10	Bio fuels	1	1	
11	Lightweight vehicles	1	1	
12	Noise	0	0	
13	Policy instruments	0	0	
14	Awareness/public demand	0	0	*Finland*: Could be all kinds of support (e.g. SSA, demonstrators, CA). Benchmarking best practices. Question articulation for politicians. Financial incentives, raising awareness. Vehicle technology unit is in need of tools. *Netherlands*: proposal (with UK + France) from R&D to market. How to speed up the process? Either a joint project or a joint call.