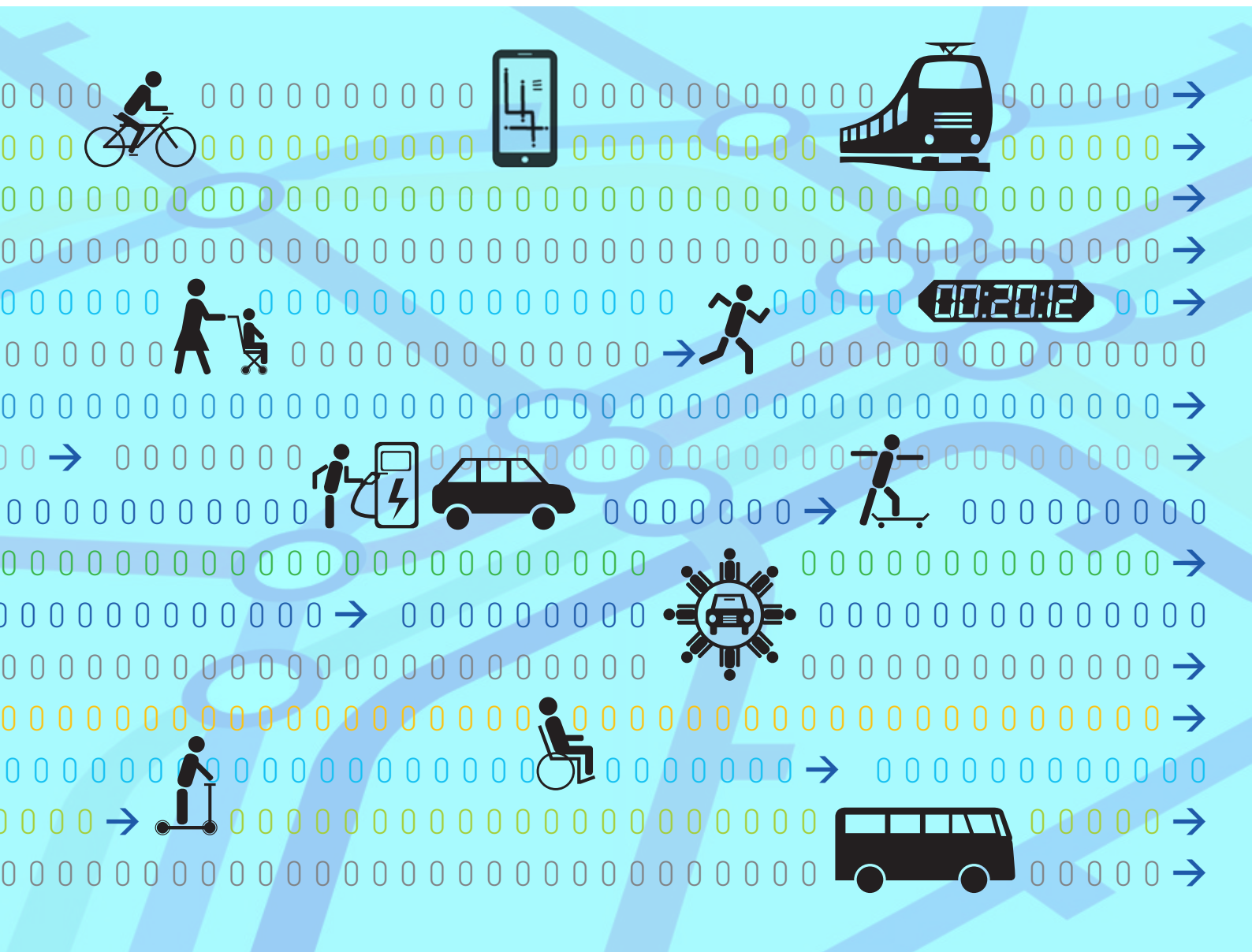


Our Code for the Future

Impulse for Innovation

Low-impact and Intelligent Mobility



Dear readers!

The ITS World Congress, which will be held in Vienna in 2012, brings together decision-makers, provides a platform for open discussion and, not least, promotes the establishment of innovative and climate-friendly concepts. The work of the Climate and Energy Fund is very similar. For years, the Fund has supported and subsidised innovative, climate-protecting projects and also helped bring together experts from research and industry, thereby actively contributing to restructuring the current system of mobility and transportation.

In this brochure, we offer an overview of the Climate and Energy Fund's work to date as well as the projects we have supported in the area of mobility and transportation. The Climate and Energy Fund recognised the urgency of changes in this area early on. Since 2007, we have provided important stimulus with our subsidies in the amount of 190 million euros for a new, more environmentally friendly and forward-looking mobility and transportation system. Numerous pioneering projects that demonstrate possible solutions have since been completed successfully.

But we still have a long way to go. With the current programmes and initiatives, we are working at full steam on continuing our success story and implementing the strategies of our owner, the Republic of Austria, through innovative, forward-thinking and sustainable subsidisation work. Many of these projects will only yield effects that benefit the climate over the medium

or long term. Nevertheless, we can already see today that the projects make valuable contributions toward a fundamental trend reversal and an energy paradigm shift.

The spectrum of projects we support is as multifaceted as the challenges we face in the area of mobility and transportation. They show that there are no simple solutions and range from innovative telematics solutions to new concepts in public transportation as well as the promotion of new drive concepts in the broad field of electromobility. In addition to presenting these projects, we hope to illuminate the context in which they take place in order to demonstrate the need for change as well as the potential they represent for the Austrian economy. The descriptions are accompanied by statements and interviews of numerous business and research experts, offering insights into their agendas and challenges as well as assessing the effectiveness of the Climate and Energy Fund.

We hope you enjoy reading and that you learn many interesting things about our current challenges and initiatives in the area of transportation and mobility.



Theresia Vogel



Ingmar Höbarth

Managing Directors of the Climate and Energy Fund



1.1
RETHINKING
TRAFFIC



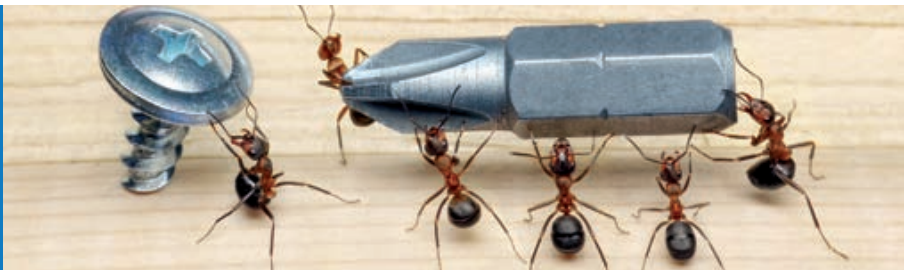
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RETHINKING
TRAFFIC



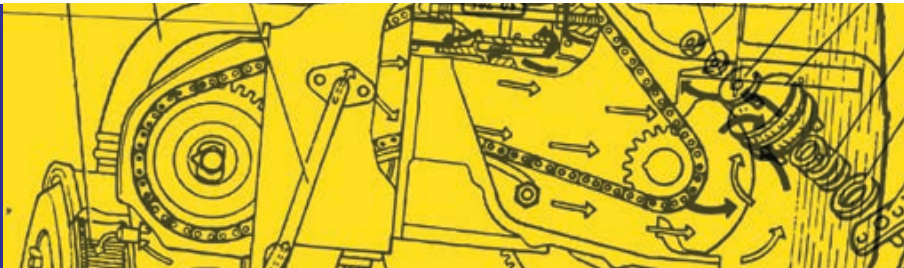
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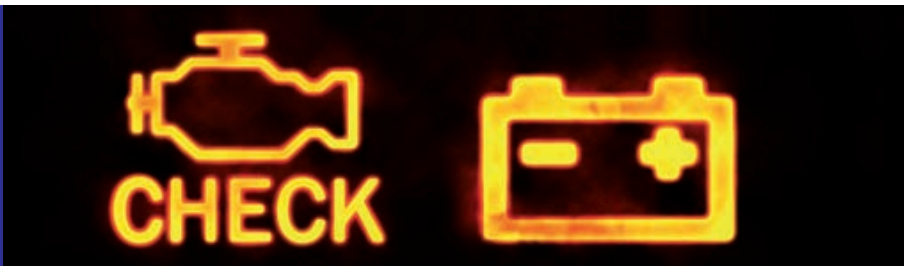
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LOCOMOTION



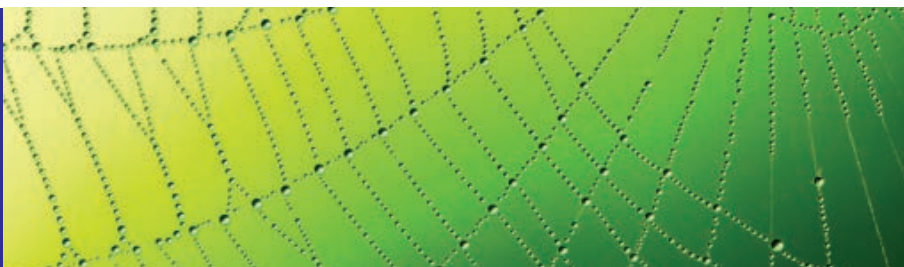
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2.2
REINVENTING
LOCOMOTION



46

2.3
REINVENTING
LOCOMOTION



50

ARE RAILWAYS EXPERIENCING A RENAISSANCE?

Interview with Franz Seiser

Trains have operated in Austria for over 170 years, but there are many reasons why this type of locomotion is far from outdated.

INTELLIGENT TRANSPORTATION SYSTEMS

With intelligent transportation systems, the future of locomotion will be significantly better coordinated and therefore simpler. The Climate and Energy Fund has embraced this trend.

GREEN LOGISTICS

Interview with Dr. Sebastian Kummer

In the areas of logistics and transport in particular, innovative solutions and technological advancements still have the potential for significant reductions in emissions. Pioneering projects are already under way.

ALTERNATIVE DRIVE TECHNOLOGIES

A great many alternatives to conventional cars now exist on the automobile market. But what advantages do the individual technologies offer?

AT THE HEART OF ELECTROMOBILITY: THE BATTERY

High-performance batteries are essential for the future success of electromobility, and battery research can profit from targeted subsidies.

THE RISE OF LIGHTWEIGHT CONSTRUCTION

Modern cars are slimming down. They are often both lighter and smaller than previous models, and this is no accidental trend.

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Up to **150 million** euros
annual subsidy volume

The Climate and Energy Fund was founded by the Austrian Federal Government in 2007 in order to develop new

3

programme lines
Research, Market Penetration and Transportation

approaches to climate protection and the transition to sustainable energy practices. The subsidies are provided to

43,000

Number of subsidised projects by
the end of 2012

climate protection and energy projects in the areas of research, mobility and market penetration.

2007

the Austrian Climate and Energy Fund was created
by the Austrian Federal Government

Sustainability and efficiency are key aspects of all measures and projects.

189 million euros

have been provided since 2007 to mobility and
transportation projects.

The concept of Intelligent Mobility

The area of transportation and mobility offers a good example of the many benefits society can reap from research, technology and innovation. On one hand, technological progress helps make life simpler, more convenient and better. On the other, the Federal Ministry for Transport, Innovation and Technology invests directly in FTI (Research, Technology, Innovation) because we expect this to contribute to solving great challenges to our society like climate change and other environmental problems.

In addition to expanding public transportation, we work in particular on intelligently linking transportation systems as well as developing and implementing environmentally friendly mobility technologies. Intelligent transportation solutions make an especially important contribution to ensuring that we will be able to move around sustainable and environmentally friendly ways in the future. The offerings will be networked together more effectively and intelligently, and the links between the interfaces will be smarter. In the ITS Action Plan, we laid out the goals and strategies that we want to achieve as well as how we will shape the mobility of the future.

Part of this strategy includes developing and testing new technologies. The Climate and Energy Fund supports the federal government here as an important subsidisation institution. This makes possible projects that demonstrate new opportunities, especially in the area of e-mobility. The associated stimulus effect is a critical piece of the larger puzzle of a new and environmentally sound transportation future.

Doris Bures

Doris Bures
Federal Minister for
Transport, Innovation &
Technology

Rethinking Mobility

The current transportation concept, which is still heavily dependent on motorised individual transport, is no longer functioning, and vehicles driven by fossil fuels are pushing owners to their limits, at least as far as costs go. What options exist for overcoming these challenges and what role does the Climate and Energy Fund play here?

SHORTCUT

The Key Points in Brief

- 1 Old transportation concepts have become outmoded. It is time to develop innovative solutions based on new visions.
- 2 Theresia Vogel explains in an interview the role of the Climate and Energy Fund in realising a mobility shift in Austria.
- 3 The project Smart Electric Mobility illustrates the importance of networked and visionary subsidisation work.

■ Automobiles regularly clog up urban cities and their surrounding areas during times of peak traffic volume.

Such phenomena are a product of decades of regional urban and transportation planning. They are caused by forms of low-density settlement practices that take up extensive amounts of land and necessitate the escalating use of individual transportation. They increase the emission of pollutants and particulate matter, lead to stressful situations and significantly curtail quality of life. Since 1990, transportation-related CO₂ emissions have risen in this country by 60%, which has earned Austria a less-than-enviable top position as an emitter compared with other European countries and has also led in many areas to a reconsideration of our transportation habits.

Rural, lightly populated regions, on the other hand, are at risk of "mobility poverty". The operation of smaller bus or train lines, which generally span long distances and only transport a few passengers, is not economically supportable. Cars remain indispensable in these regions as a result.

However, typical truck fleets are highly controversial even in the field of transportation. Due to the internationalisation of commerce, international transport and logistics traffic volumes are increasing significantly, but road infrastructures in transit countries like Austria are reaching their capacity limits. The willingness of the population to accept emissions and noise alongside transport routes is also declining.

With its focus on innovation, Austria does in fact have a number of the structural prerequisites for new, pioneering solutions in the field of transportation. One plan of action offering the prospect of relatively quick results involves the strong domestic automotive sector. By specialising in niche markets and high-tech, high-quality products in various industries, this sector could achieve a top position in the world market. The general economic significance for Austria is correspondingly high. The automotive sector currently supports roughly 365,000 jobs, either directly or indirectly. In the approximately 700 businesses of the Austrian vehicle and automo-

(continue on page 8)



Mrs. Vogel, tell us about the vision of the Climate and Energy Fund.



Since the start of its activities in 2007, the Climate and Energy Fund has subsidised and initiated the development of new and innovative solutions for an intelligent mobility and transportation system, implementing the strategies of the Austrian Ministry for Transport, Innovation and Technology (bmvit). Sustainable mobility and climate-friendly transportation are supported by the Climate and Energy Fund along the entire value creation chain. In the area of technology development, subsidies are provided for everything from research into low-emission solutions to the resource-efficient restructuring of urban regions. New mobility and transportation concepts are tested on the market with regard to their effectiveness in the individual model regions of the Climate and Energy Fund.

Theresia Vogel
is Managing Director of
the Austrian Climate
and Energy Fund.

What is the mobility vision of the Climate and Energy Fund?

We subsidise projects that have intelligent, efficient and multimodal effects in the area of mobility. In other words, projects that incorporate the vision of a forward-looking transportation system and not projects that generate emissions.

The Climate and Energy Fund provides subsidies at the interfaces between the various modes of transport.

The solar cell on the collar proves that the Climate and Energy Fund is sustainable down to the smallest detail.

To what extent does the Climate and Energy Fund act as an intermediate interface in the area of mobility?

We have distributed 189 million euros in subsidies since 2007. We subsidise projects directly at the interfaces between modes of transport, such as between rail and road or between road and daily commuting options,

such as bicycles. These projects involve environmentally friendly, low-emission and forward-thinking solutions.

What areas does the Climate and Energy Fund focus on in transportation research?

In the area of transportation, it is important to promote the key concept of electric mobility in Austria, especially as a research topic. We have already been successful here, and seven projects are now under way. On the other hand, we must support drive technologies that allow for more environmentally friendly transportation.

What contributions is the Climate and Energy Fund making within the framework of the ITS World Congress?

We have made a very tangible contribution to the ITS Congress in the form of the Congress Navigator, the smartphone app that guides visitors to the congress via green routes, such as via public transportation. In addition, our presence at the congress also creates a platform for sharing information about the projects we support.



tive supplier industry, the number of jobs has grown by 21 per cent over the last 15 years.

Austria's automotive industry is also a top performer in research expenditures. Roughly 16,000 euros are invested annually in research per job, corresponding to twice the average amount of all Austrian industries. The Climate and Energy Fund is therefore active here and regularly enters into successful cooperative research projects with companies in the automotive industry. For example, many projects in the area of energy research with renowned suppliers have been supported. These range from research into rail vehicles to utility vehicles and new lightweight design concepts. This broad subsidisation strategy by the Climate and Energy Fund contributes to a diversified and competitive supplier industry that performs successfully on the world market with energy-saving and therefore low-emission mobility technologies.

Intelligent, efficient and cooperative – transportation concepts for the future

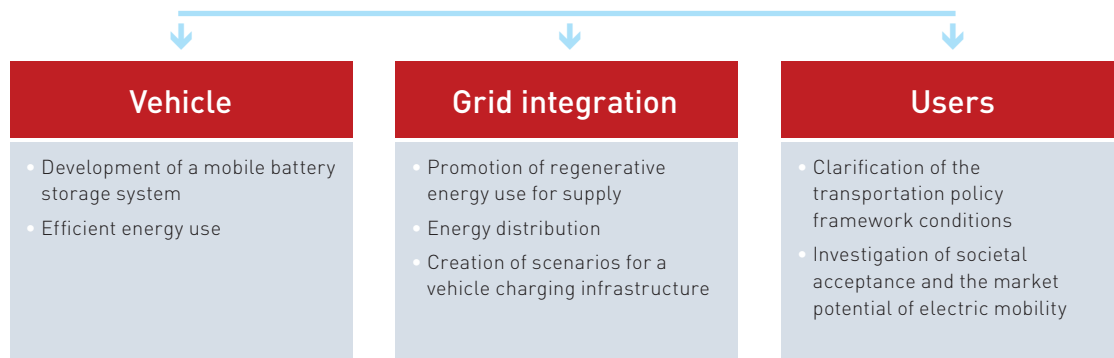
Wherever old transportation concepts fail or reach their limits, prospects for new solutions open up. "Intelligent", "efficient" and "cooperative" are the new buzz words here. Instead of isolated solutions, such as building new roads or regulatory changes, the focus lies on holistic, multimodal transportation and mobility solutions. Under the umbrella term of intelligent transportation systems (ITS), policymakers, public transportation providers, researchers and industry representatives work together to identify efficient and sustainable solutions for the future. New technologies should enable better utilisation of the potential of existing infrastructure, more efficient coordination of various transportation providers, implementation of new, low-emission modes of transportation and expansion of the role of public transportation solutions. The ITS action plan published by the Federal Ministry for Transport, Innovation and Technology (bmvit) in 2011 defines the strategy for implementing an intelligent transportation system in accordance with the European requirements for Austria. This action plan defines the specific fields of



Intelligent Routes to the ITS Congress

The ITS World Congress presents environmental alternatives to traditional transportation concepts. But how can the congress itself become more climate-friendly? **With Congress Navigator from the Climate and Energy Fund, developed by AustriaTech.** This smartphone app guides users to the congress via intelligent and green routes while also assisting with orientation at the site. Congress visitors can use the navigator to assemble a personal program out of the over 1,000 presentations and contact the organisers directly via a feedback function.

Congress Navigator, which was initiated and financially supported by the Climate and Energy Fund, is available for iPhone and Android as well as in mobile browser version.



Project partners:

- Vienna University of Technology
- University of Natural Resources and Life Sciences, Vienna
- Austrian Institute for Technology (AIT)

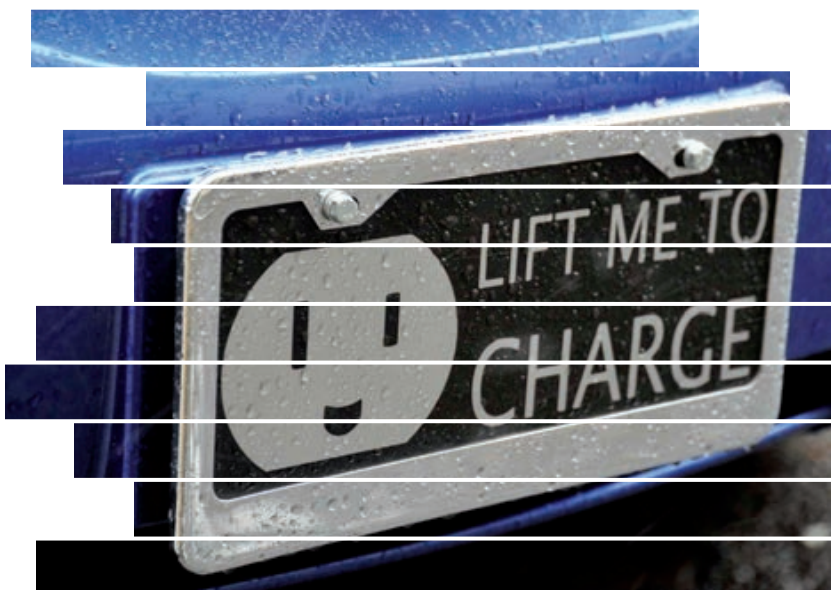
Smart Electric Mobility

One especially clear example of realising an integrated transportation solution is the Smart Electric Mobility project, which was supported by the Climate and Energy Fund.

action for achieving a mobility system capable of meeting the needs of the future. However, long-term success can only be achieved by embedding this system completely into newly designed population areas.

It is therefore essential to integrate railways, buses, trams, electric bikes and electric cars into a comprehensive transportation system and to coordinate these various modes of transport with each other. Continuous implementation of new solutions requires a central mediating agency that acts as a connecting link between the various partners from industry, research, regulation and administration. In Austria, this role is largely filled by the Climate and Energy Fund. With its relationships with policymakers, long-standing collaboration with research and development institutions as well as the experience it has gathered on the market, the Climate and Energy Fund can act as the necessary interface for broad implementation of a new, climate-friendly transportation and mobility system and make an important contribution to realising the ITS action plan on behalf of the bmvit.

The goal of this project was to develop a power storage concept for regenerative electrical mobility and grid stability. However, the focus lay here not only on the technical details of the storage concept itself but also on the requirements on the vehicle side and the needs of the users. In order for new e-mobility transportation solutions to prevail on the market, it is necessary to study the existing infrastructure as well as the transportation policy framework and market potential in addition to the technical details on the vehicle. The comprehensive concept of Smart Electric Mobility satisfies all of these requirements and highlights the integrated approach of the Climate and Energy Fund's mobility vision.



Are Railways Experiencing a Renaissance?



SHORTCUT

The Key Points in Brief

1 Railways are experiencing a renaissance. They are playing a key role in the remodelling of our current transportation and mobility concepts.

2 The Austrian Climate and Energy Fund is supporting ground-breaking railway-projects autoBAHN, SMILE and eMORAIL.

3 Franz Seiser, COO of ÖBB-Holding AG (Austrian Federal Railways), talks about the renaissance of railways and the company's collaboration with the Climate and Energy Fund.

On 23 November 1837, the age of railways began in Austria as the first train travelled from the Floridsdorf train station to Deutsch-Wagram. After 175 years and many ups and downs, the rail network of the Austrian Railways alone spans over 4,800 kilometres and as many as 1,140 transportation stations. Then as now, people have always been fascinated by trains and associate them with wanderlust, mobility, change and innovative technologies.



Rail transportation is experiencing a renaissance. It has a major role to play in restructuring the transportation and mobility system.

encing A Renaissance?

■ Helped in part by high fuel prices and greater environmental awareness, this fascination can also be seen in the statistics: While roughly 226 million train passengers were recorded in Austria in 2006, the number in 2011 was 244 million, an 8 per cent increase.

A similar trend can be observed in most countries in Europe. While the German Railways recorded a passenger increase in 2011 of 1.6 per cent to break the 2 billion passenger mark, the SBB in Switzerland achieved impressive growth of 2.7 per cent to reach roughly 357 million passengers.

What is driving this development? Is it really the high fuel prices motivating commuters in particular to switch to the rails or is a fundamental shift in environmental awareness taking place within the population? The facts speak very clearly: According to information from ÖBB, train travel produces roughly ten times lower CO₂ emissions than travelling by car; for goods transport, trains even produce 22 times lower emissions compared to trucks.

Cars Are Losing Prestige

In addition to these environmental facts, cars are increasingly losing their prestige, especially among the younger demographic in cities. For instance, the number of newly issued driver's licenses in Vienna has fallen by more than one-third over the last ten years. In parallel to this, the level of car ownership declined in 2011 to 394 cars per 1,000 residents, putting Vienna at the lowest level of all Austrian provinces. In rural areas, the level of car ownership is much higher: in Burgenland, for instance, there are 618 cars per 1,000 residents. Even in the country of cars, the USA, this status symbol of old is losing some of its glory. Thirty years ago, eight out of ten 17- to 19-year-olds had a driver's license, but today it's only six out of ten. In Germany, the decline over the last ten years has been reckoned as ten per cent.

For Norbert Ostermann at the Institute for Transportation Sciences of the Vienna University of Technology, Vienna is still far from reaching the zenith of this development. He sees particular potential for railways in the area of improved ease of access for travellers. For example, new groups of passengers could be addressed through e-ticketing. Intelligent planning must also take into account the increasing number of elderly passengers, who have special needs that must be met.

RAILWAYS EXPERIENCE A RENAISSANCE

A number of factors must therefore be considered in the railway renaissance and its associated requirements and measures. The initiatives of the European Union in this area are very ambitious.

All Across Europe

The current transportation policy objectives and legislative frameworks of the European union are intended to strengthen the position of railways. One important requirement for this is the liberalisation and creation of a shared European railway market. While the network was opened up with regard to railway freight transportation in 2007, the European railway network has also now been opened for cross-border passenger transportation for all railway companies certified in the EU as of 1 January 2010. The associated competition supplies valuable motivation for a quality and customer orientation

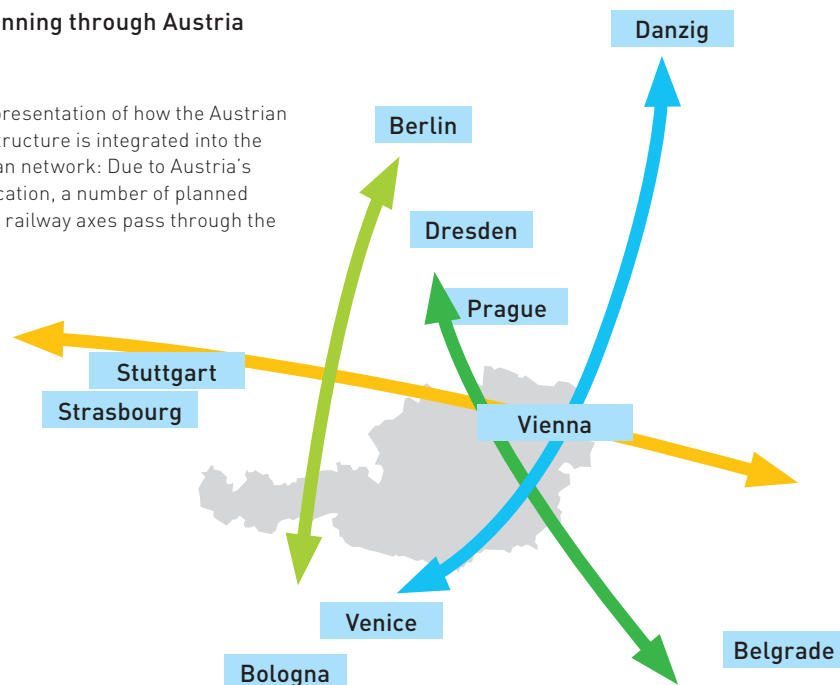
while also simplifying the process of cross-border passenger transportation considerably.

Another factor driving a flourishing railway transportation industry in Europe is the TEN guidelines (TEN = Trans-European Networks). As part of this holistic transportation concept, the rail infrastructure should be expanded by roughly 70,000 kilometres by 2020. This will include the creation of new railway axes such as Berlin–Palermo, Paris–Bratislava and Athens–Dresden.

Due to its location in the heart of Europe, Austria is taking on a central role in these projects. In addition to securing the infrastructure and making the necessary adaptations, it is especially important to guarantee interoperability between the sometimes disparate railway networks of Europe.

Railways running through Austria

Schematic representation of how the Austrian railway infrastructure is integrated into the trans-European network: Due to Austria's geographic location, a number of planned new European railway axes pass through the country.



TEN 01 / Berlin - Verona/Milan - Bologna - Naples - Messina - Palermo

TEN 17 / Paris - Strasbourg - Stuttgart - Vienna - Bratislava

TEN 22 / Athens - Sofia - Budapest - Vienna - Prague - Nuremberg/Dresden

TEN 23 / Gdansk - Warsaw - Brno/Bratislava - Vienna

RAILWAYS EXPERIENCE A RENAISSANCE



Dr. **Norbert
Ostermann**
Vienna University
of Technology

“Improved traffic flow management to increase the performance in railways and greater ease of access for travellers — key words e-ticketing, ageing society — all age groups appear to me as important targets.”

The Climate and Energy Fund is supporting the railway renaissance in Austria, thereby making a valuable contribution to building a sustainable, climate-friendly mobility and transportation system. The Fund acts in particular as an **interface between rail transport and other forms of transportation** while also structuring its offering in line with national strategies.

But what are the specific challenges involved with creating interfaces? How can a family living in the outskirts of a large city or its surrounding environs commute to the city in an environmentally conscious manner? Can the two children at least partially travel to school and their sport activities via public transportation? Or are there no other alternatives? The **eMORAIL** and **SMILE** projects supported by the Climate and Energy Fund can help answer these questions.



RAILWAYS EXPERIENCE A RENAISSANCE

Transfer Here, Please!

The Climate and Energy Fund initiates trail-blazing **lighthouse projects in the area of e-mobility** that live up to the highest technological standards and offer specific benefits to users. The spectrum of subsidised projects ranges from technical components to transportation systems to innovative service offerings. The **long-term goal of the Climate and Energy Fund is to create sustainable alternatives to a personal automobile**. The Climate and Energy Fund has established diverse mobility programmes in pursuit of this goal. One of the focal points of the projects generated by these programs lies on the interface between individual electric mobility and railways, in other words on shifting traffic from road to rails. The Climate and Energy Fund

never support projects in isolation; it always strives to connect the various projects together and take advantage of synergies in order to unite all the developments into an integrated system. The best examples of this practice can be seen in the **eMORAIL** and **SMILE** projects. They both pursue an integrated mobility concept by establishing interfaces between various modes of transportation in order to better meet the needs of the 21st century. Today's transportation users want to be able to choose between various modes of transport simply and conveniently. This requires that the concepts are well-coordinated and that users are offered a good overview. The eMORAIL and SMILE projects show how such needs can be met:



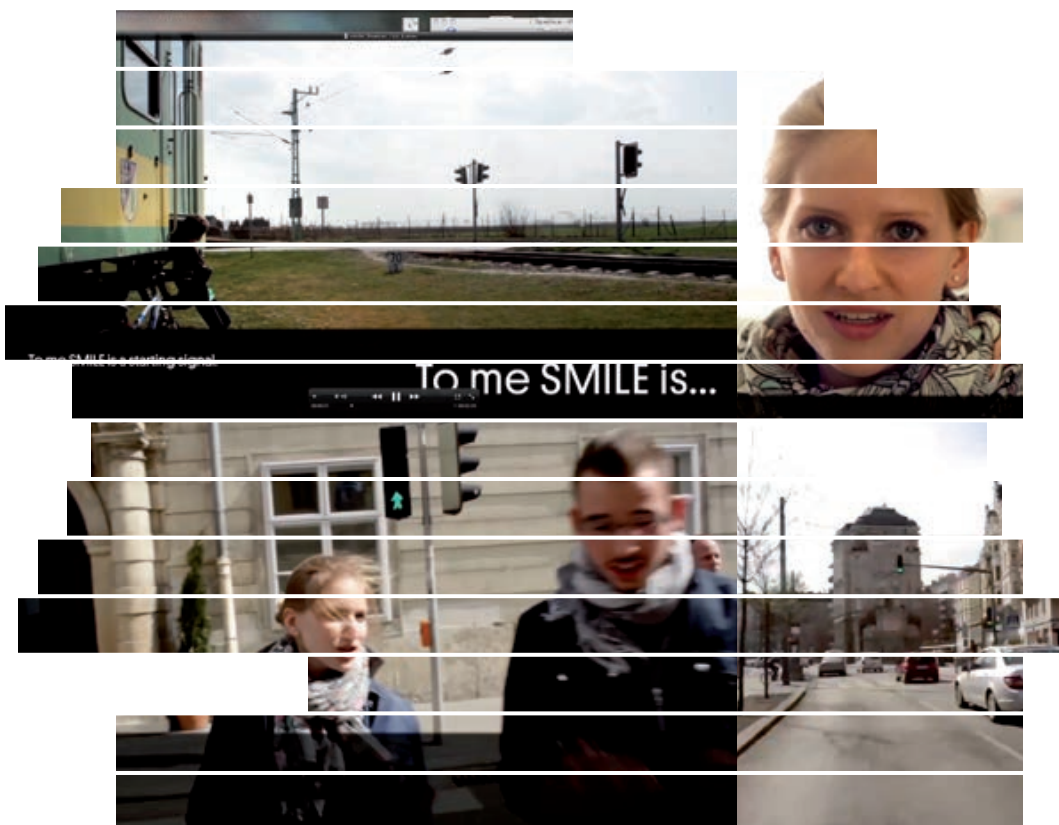
Individual e-mobility solutions are proving to be promising alternatives to the traditional car. eMORAIL shows how such approaches can function in reality.

With **eMORAIL**, the Climate and Energy Fund is supporting a research and development project of ÖBB (Austrian Federal Railways) and twelve other partners that will not only ensure sustainable linking of individual and public transportation but also drive commercial use by the post office during the day. In two rural test regions, commuters are being offered individ-

RAILWAYS EXPERIENCE A RENAISSANCE

ual e-mobility solutions as part of this project. In addition to the provision of electrically powered vehicles, another focus lies on sharing information about the availability and supply of these vehicles. These solutions, termed e-sharing models, give rise to an integrated transportation concept. This makes electric mobility part of a thoroughly conceived complete transportation system that drives changes in individual mobility behaviour to create alternatives that meet everyday needs.

A similar goal is being pursued by the project **SMILE** (Smart Mobility Info and Ticketing System Leading the Way for Effective E-Mobility Services). In SMILE, the project partners ÖBB, Wiener Stadtwerke and Wiener Linien are building a platform to unite diverse public and individual mobility services. With this heavily user-oriented approach, customers should be offered various forms of transport as needed, from bicycles to trams to car-sharing. The end users are then free to flexibly combine the individual options with each other. Simple handling and easy access are top priorities here.



A platform for consolidating diverse mobility services was created in the project SMILE.

autoBAHN – Innovation for Regional Railways

Dense networks, short intervals and high comfort – these are the arguments that are increasingly convincing residents of cities such as Vienna, Salzburg or Graz of the advantages of public transportation.

According to a recent study by the Verkehrsclub Österreich (Austrian Transportation Club), 41 per cent of households in Vienna no longer own their own car and only 27 per cent of everyday travel is undertaken by car. Already 450,000 Viennese are regular customers of the Wiener Linien with annual passes.

In the country, however, a much more difficult situation exists. There, the rail connections for commuters in particular are not available at all in many locations. Smaller regional railways that have been hardly used to date for commuting are typical of the difficulties in rural regions. In the past, many of these regional routes were shut down because they were not profitable for the operators due to high fixed costs and low utilisation.

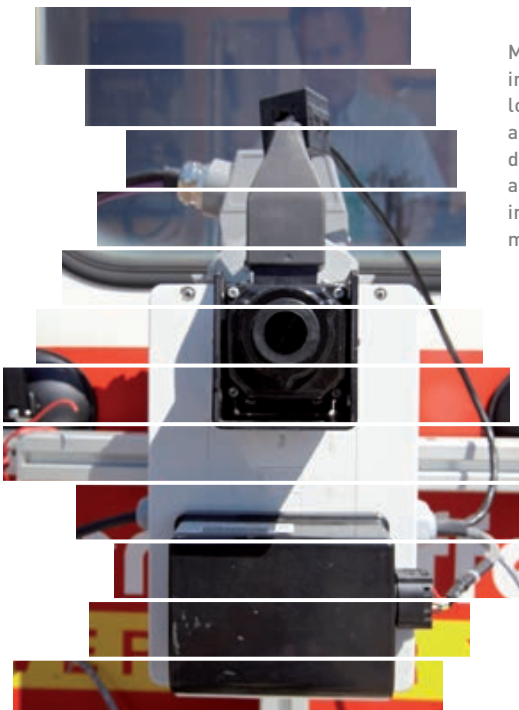
In the area of regional railways, the Climate and Energy Fund is focusing in particular on new technological developments that harbour great potential. For example, the project [autoBAHN](#) is testing out an entirely autonomous prototype that operates without a train driver. The test operation took place on the Stern&Hafferl railway from Vorchdorf to Gmunden in a cooperative project with the University of Salzburg, UAS Wels and Siemens. In particular, the project seeks to



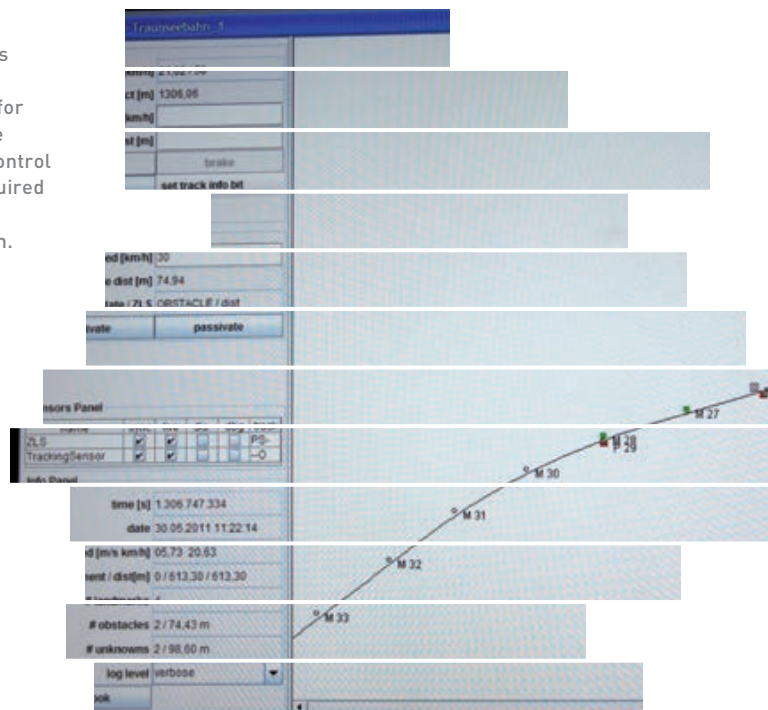
RAILWAYS EXPERIENCE A RENAISSANCE

evaluate which technical, infrastructural and financial requirements exist with regard to operating an unmanned regional railway. In consideration of the driverless locomotive, the use of small train units and the increased frequency this allows, the project participants are hoping to discover significant potential savings in terms of personnel. **Technological advancements should in this way be directly responsible for higher profitability in the operation of regional railways.** In order to ensure this, the project focused from the start on the use of existing infrastructure in addition to the autonomous operation. To guarantee safety, another focus was on development of an autonomously functioning and highly reliable obstacle detection and train control system. The locomotive was equipped with laser, radar, infrared, ultrasound and video sensors, and corresponding detection processes were implemented for each.

The responses of the train upon detecting obstacles were tested, and the autonomous operation was also simulated. The brake curve calculation was performed in consideration of route and vehicle parameters as well as the speed monitoring and was based on the European Train Control System (ETCS). Project manager Wolfgang Peer from the University of Salzburg summarises the future potential of this approach as follows: **"The successful implementation of the autoBAHN vision offers Austria the opportunity to become a global technology leader in autonomously driven trains. The potential for leveraging this position and the status it entails would be tremendous."**



Measurement devices installed on the test locomotive are used for autonomous obstacle detection and train control and transmit the acquired information to the measurement system.





Mr. Seiser, does ÖBB feel the effects

Interview with Franz Seiser, COO of ÖBB-Holding AG

In this interview, Mr. Seiser shares information on the future of the railways, about the role of the Climate and Energy Fund in promoting rail transportation as well as the quality of the collaboration to date.

Mr. Seiser, does ÖBB see rail transportation as experiencing a renaissance?

We're encountering the railway from two perspectives this year. We come across it on the one hand by taking a look at its past. With this year's anniversary of 175 years of the railway in Austria, we can celebrate a long tradition. Even more interesting than looking to the past, however, is looking to the future, because we can also take pleasure from important events this year, including in the area of railway infrastructure. The completed sections of track between Vienna and St. Pölten, as well as the Lower Inn Valley section, represent milestones in improvements

to the quality of the railway infrastructure. Another milestone is the partial commissioning of Vienna Central Station, which in future will be a hub for east-west and north-south traffic. All in all, these innovations signify an important improvement for our customers. We already carry 450 million customers on board our trains and buses, and are anticipating further large increases as these new services come on stream.

How would you describe the collaboration with the Climate and Energy Fund to date based on the SMILE and eMORAIL projects?

The SMILE and eMORAIL projects are true future projects, which are being pursued with our 12 project partners with a great deal of commitment and pleasure. The cooperation is based on the vision of a model region, which in the future will allow commuters to travel into the towns and cities with zero emissions. The Climate and Energy Fund is a very important partner for us in realising this goal.

The SMILE and eMORAIL projects are true future projects, which we are pursuing with a great deal of commitment.

Since 2010, Franz Seiser has been a member of the Managing Board of ÖBB-Holding AG (Austrian Federal Railways), the largest state railway company in Austria. ÖBB has worked together with the Climate and Energy Fund for years on many variously positioned projects. The current fields of cooperation are the SMILE and eMORAIL projects.



of the railways' renaissance?

Where do you see additional fields of cooperation between ÖBB and the Climate and Energy Fund in the future?

We have a very broad and important range of cooperation with the Climate and Energy Fund. For example, much can still be achieved together in the future, especially in the area of saving energy. There is still also huge potential on the topic of climate change. In particular, maintaining the track infrastructure poses a big challenge. I can certainly imagine cooperation in these areas in the future.

What type of investment projects currently take priority for ÖBB?

Modernising the infrastructure is essential for ÖBB. We have already achieved a great deal along the track to the west, and also want to develop the southern railway to perfection by 2025. We want more track capacity, higher speeds and more choice for travellers. A central role in this, of course, is played by the train stations. Which is why over 100 stations will be modern-

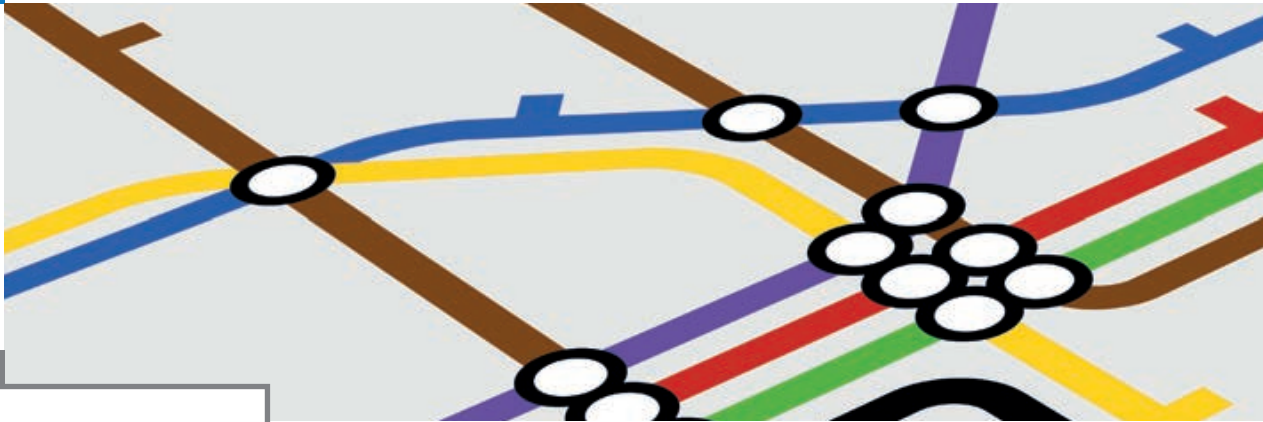
ised or rebuilt in the coming years in order to truly complete the product for our customers.

Where do you see the railways in ten or twenty years' time?

In 20 years, the railways will form the backbone of a modern and new form of mobility. We will see more public transport and less private means of transport – both private and public – will be much more integrated than they are today. Innovations such as single-ticket systems and online information systems will make things easier for our travellers. I see the railways undergoing a renaissance and becoming the backbone of a modern transport system in the future.

In 20 years, the railways will form the backbone of a modern and new form of mobility.

Intelligent Transport



SHORTCUT

The Key Points in Brief

- 1** Intelligent transportation systems function as instruments of both transportation and environmental policy.
- 2** With GIP, VAO and ITS Austria West, the Climate and Energy Fund is supporting pioneering work in intelligent transportation systems.
- 3** Cooperative services are already being tested in the Telematics Test Field.

Freedom of movement is a basic human need. Never before has humanity been as mobile as today, and never before have so many goods been transported around the globe. In parallel with this development, revolutionary information technologies have materialised in recent years that have massively altered our lives with regard to communication and the use of digital data. The possibilities generated by the combination of these aspects harbour the potential to radically change the nature of collective and individual travel and transportation – intelligent transportation systems enabled by these technological advances are the order of the day.

■ Intelligence is understood generally to refer to exceptional mental abilities or cleverness. But when are transportation systems intelligent? Although no official definition exists, this is commonly considered to refer to organising, informing and steering traffic with the aid of information and communication technologies. Thanks to these connective technologies, traffic participants – from car drivers to pedestrians to bus and train passengers – become part of a larger whole and cooperate to create a multimodal transportation system that makes optimal use of the available resources for the greatest number of people.

Innovative and functional transportation systems are essential for modern societies. They affect the competitiveness of a location and significantly improve the residents' quality of life through efficient control of the traffic flows. Developing such systems is a complex endeavour that demands an interdisciplinary approach. Public initiatives and coordinators are therefore indispensable.



ation Systems



**Dr. Norbert
Ostermann**
Vienna University
of Technology

“The environmental potential of intelligent transportation systems, such as the reduction of greenhouse gases, can also be seen in changing of the modal split in favour of transport systems that require less drive energy. This begins with the management of combustion engines in trucks, continues with the control and regulation of traffic flows and ends with widespread adoption of electric drive technologies.”



Whether by train, by bike or both: intelligent transportation systems will shape our mobility behaviour in the future.

Intelligent transportation systems help make our transportation systems safer, better coordinated and more environmentally friendly.



Austria places a high priority on the development and promotion of intelligent transportation systems (ITS) with public funds and support. Following the creation of a framework plan for the use of telematics in 2004, this has been expressed most recently in the form of a national ITS Action Plan published in 2011 by the Austrian Ministry for Transport, Innovation and Technology (bmvit). The plan was created in accordance with the EU ITS directive of the European Commission and promotes the modernisation of Austria's transportation infrastructure and the intelligent coordination of existing transportation solutions. The result is a clear strategy for implementation of an intelligent transportation system in Austria that eliminates the isolation between existing ITS telematics services and promotes the networking of traffic-relevant information services.

The Federal Ministry for Transport, Innovation and Technology (bmvit) is working closely

with AustriaTech and the Climate and Energy Fund to achieve these goals. Together, they have begun a unique initiative in cooperation with the provincial governments that is pursuing the development of holistic transportation solutions for the entire country. The initiative takes aim at three levels of action: An initial step involves the creation of an Austria-wide standardised intermodal transportation map. On this basis, e-government processes will be developed for maintaining the assembled data basis. In the third step, the initiative should establish a uniform Austria-wide platform for transportation information.

The listed goals clearly fit well with the subsidisation work of the Climate and Energy Fund. With [ITS-West](#), [GIP/VAO](#) and the [Telematics Test Field](#), the Fund has already supported projects in line with this strategy. The ITS Action Plan serves as a basis for the Climate and Energy Fund's new requests for proposals in this area.

Intelligent Research to Drive Change

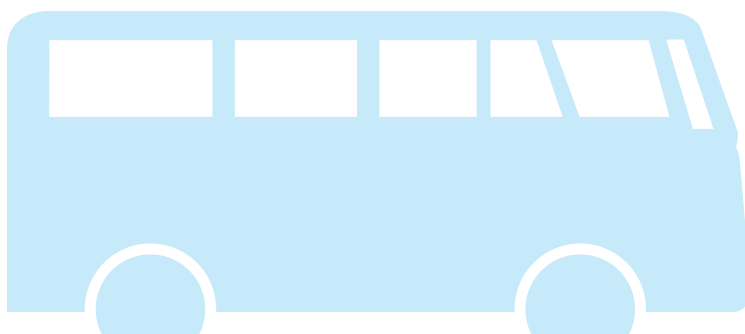
Prof. Norbert Ostermann, Chair of the Institute of Transportation at the Vienna University of Technology, [sees the environmental potential of intelligent transportation systems primarily in changing the modal split in favour of more efficient transport systems](#). In this context, modal split refers to the distribution of transportation traffic among the various modes of transport. According to

The CLIMATE study project is investigating 14 different transportation telematics measures with regard to their emissions reduction potential.

Prof. Ostermann, the applications of intelligent transportation systems are diverse and range from the management of combustion engines in trucks to the control of traffic flows and the promotion of electric drive

technologies. However, the environmental effects that can be achieved in this way are often difficult to measure since they involve extremely complex and intermeshed system architectures. The variety of different evaluation methods further complicates attempts to compare the results.

In consideration of these issues, the Austrian Traffic Telematics Cluster (ATTTC), which was founded in 2003 at the initiative of ASFINAG to promote telematics, spent a year creating a methodology for evaluating the environmental effects of telematics applications in transportation. A comprehensive study with a systematic approach was carried out under the project name CLIMATE (CLimate Impacts of Modern Applications in TElematics). A total of 14 transportation telematics measures were investigated with regard to their emissions reduction potential. High savings potential was attributed in particular to transportation telematics solutions such as traffic control based on fully electronic toll systems, cooperative systems for urban transportation monitoring as well as dynamic measures to influence traffic patterns based on environmental factors. [The Climate and Energy Fund supported this research project within the framework of its programme line "New Energies 2020"](#). Renowned project partners such as the Austrian Institute for Technology (AIT), JOANNEUM RESEARCH, the UAS Technikum Wien and the Federal Environment Agency cooperated on this project in order to illuminate the complex and interdisciplinary subject in detail.



Public Funding with Clear Objectives

Public funding agencies and initiators such as the Climate and Energy Fund play an important role in the development and implementation of intelligent traffic and transportation systems. Prof. Ostermann of the Vienna University of Technology says, "Public funding agencies should stimulate new ideas and financing for companies and innovation-friendly research institutions, while leaving the broad implementation to take place later on the market."

The Climate and Energy Fund has dedicated itself to this mission for many years, relying on the continuity of its subsidisation programs as well as clearly formulated objectives. Starting with "Making Public Transportation More Attractive – Technical Projects" in the year 2009, the programme line was continued with a focus on "Technical Foundations" in 2010 and in 2011 with the implementation measures

outlined in the ITS Action Plan. Further stimulus will be injected into this innovative environment as of October 2012 in the second ITS Call, which will issue requests for proposals for 8 million euros worth of subsidies.

Josef Czako is Vice President of International Business Development at the leading Austrian provider for intelligent transportation systems, Kapsch TrafficCom. He also emphasises the importance of public funding agencies in the implementation of ITS: "The Climate and Energy Fund supports the implementation of intelligent transportation policy measures and framework plans with start-up funding. The subsidisation of pilot projects in real transportation environments not only allows users to experience ITS first-hand, it also stimulates competition and consolidates the competence of Austrian businesses and institutions. Intelligent transportation systems also contribute to better achievement of Austria's climate goals."

Public funding providers such as the Climate and Energy Fund are playing a major role in the market introduction of ITS.



INTELLIGENT TRANSPORTATION SYSTEMS



Prof. Dr.
Barbara Lenz
Institute of
Transport
Research,
German
Aerospace
Center

“If we want to improve the efficiency and quality of the entire “transportation” system, there is no way around intelligent systems. With their help, it will be possible to reduce resource consumption and better connect the various modes of transport. In many cases, however, this also requires the acceptance of the users themselves.”

One successful example of the funding work of the Climate and Energy Fund is the [regional competence centre ITS Austria West](#) established in 2011. The resulting integrated transportation data platform was developed jointly by companies and research partners for the provinces of Salzburg and Upper Austria to support a more balanced utilisation of the transportation infrastructure as well as comprehensive provisioning of current transportation information. ITS Austria West is also responsible for implementation of the project “[FCD Model Region Salzburg](#)”, which is also funded by the Climate and Energy Fund as well as the province of Salzburg. The aim of this project is to develop a transportation model based on floating car data and to perform a comparison of various vehicle fleets in order to model the traffic situation. Additional project goals lie in the areas of dynamic traffic management and traffic control.



An integrated transportation data platform is used at the regional competence centre ITS West for transportation coordination.

GIP and VAO

One excellent example of how various information systems can be efficiently networked together can be seen in the work on GIP.at, GIP.gv and VAO, which have been continuously supported by the Climate and Energy Fund in accordance with its objectives in this area.



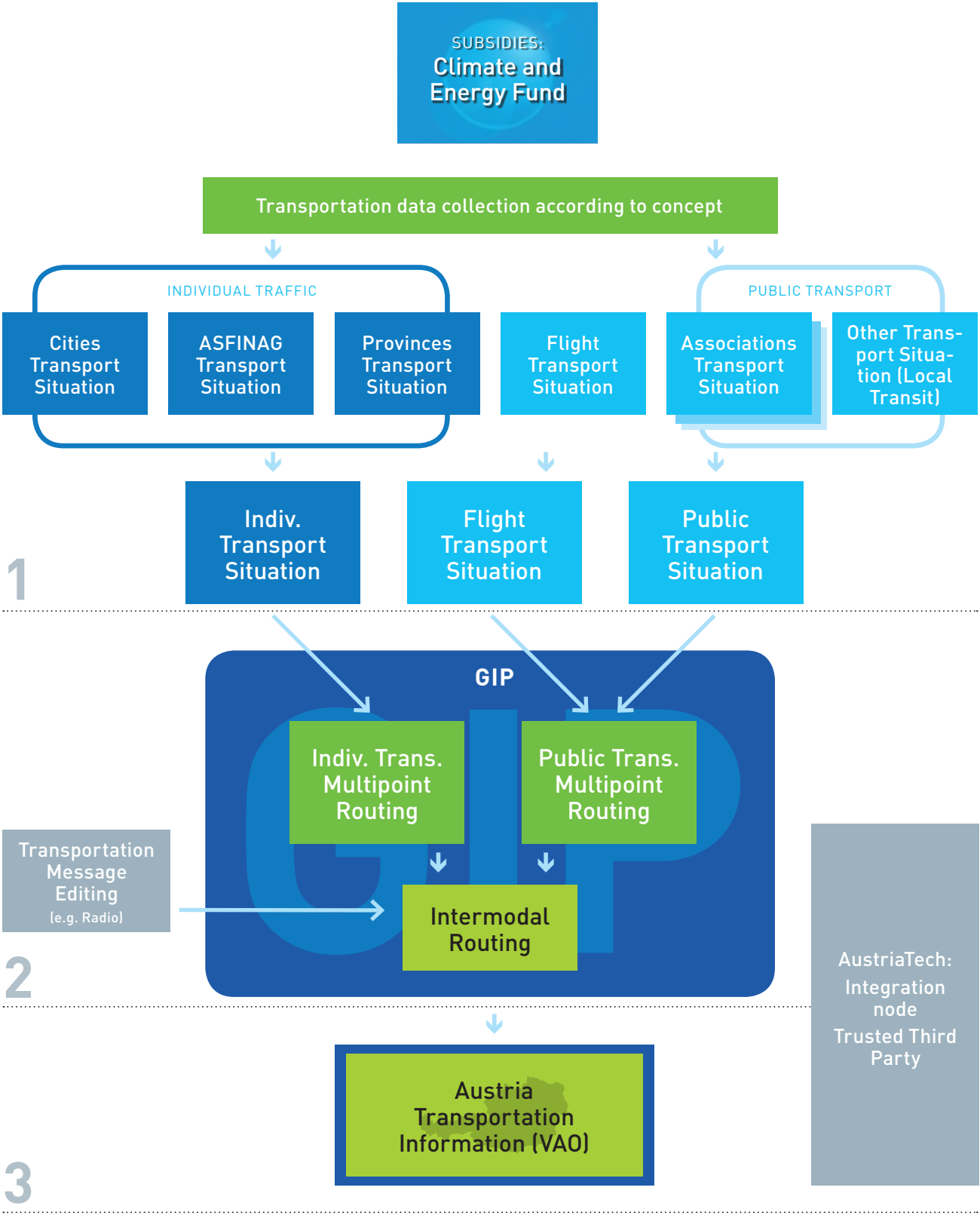
Martin Müllner
Project director,
ASFINAG

“A high-quality intermodal transportation map forms the basis for all transportation information services. Such a map is being created by the Austrian provinces, ASFINAG and ÖBB in the project GIP.at.”

1 The previous individual transportation systems of Austria's provinces and the infrastructure operators were replaced and expanded by this uniform system. Redundancies and overlaps were eliminated, and the administration of transportation data was made more efficient.

2 The GIP (Graph Integration Platform for Austria) depicts the entire transportation network of Austria, including all relevant additional information (road signs, ground markings, addresses, construction sites) in the form of a digital map. The GIP also consolidates and depicts all types of transportation, making it possible to compare them and indicate available alternative modes of transport. Traffic information and modelling services as well as logistics applications also have access to the digital map. Public agencies will in future be able to access transportation-related data directly and digitally via GIP using e-government processes.

3 A collaborative transportation information service (VAO) is also being created as the basis for the Austria-wide GIP. Availability, alternatives and capacity utilisation for all modes of transport will be displayed digitally. In addition, the depiction of the respective “environmental footprint” will also influence the route selection of the end user by indicating the environmental impact of the planned trip. This should improve awareness of environmentally friendly transportation options and promote a shift in behaviour. The intermodal transportation information system will supply useful information about available routes and means of transport both before and during the trip. Various communication channels, such as email and Web applications, will be used for this. The Austria-wide orientation of VAO makes it a trailblazing project compared with other countries. A prototype will be presented in Vienna in October 2012, and this innovative service should go online in spring of 2013. The linking of VAO and GIP will create a shared digital transportation network that lives up to the vision of comprehensive networking, thereby preventing overlap and redundancies in the transportation information.



Source: VAO

Telematics Test Field

For Safer, More Efficient and More
Environmentally Sound Mobility

What is Telematics?

Telematics is a word created from telecommunications and informatics and refers to a field that combines technologies from these two areas. In transportation, telematics is used for controlling and optimising traffic flows.

Intelligent transportation systems and telematics solutions must live up to the requirements of daily use while offering clear benefits to the users. However, the transition from research into concrete applications is often a difficult one. Test fields offer valuable opportunities for testing new solutions under real conditions. In the research project “Telematics Test Field”, which is actively supported by the Climate and Energy Fund, a consortium of research institutions, businesses and public companies have taken up this challenge. The project builds upon the insights obtained from GIP and VAO, and the testing operations also incorporate the results of ongoing research projects. The overarching goal is to develop cooperative services for guaranteeing safer, more efficient and more environmentally sound mobility. These services are based on the exchange of real-time information between the transportation participants and the infrastructure.

The application area encompasses the high-traffic region of the motorway triangle A2/A23–A4–S1 as well as linking to public transportation in the subregions of the Vienna south-east tangent, the east motorway and the Vienna outer ring expressway. Along the main test stretch, various transmission and reception systems are installed in the area of the motorway triangle. To ensure a technology-agnostic architecture, the traffic information is transmitted via various technologies, selected by the traffic control centres and converted into cooperative services. These services include:

- Displaying important road signs in the vehicle
- Floating car data: Transmission of traffic flow information to create a comprehensive picture of the current situation for early detection of traffic jams
- Warning of dangerous situations or traffic jams on a section of road
- Travel and weather information
- Travel times, status messages and routing updates
- Location and capacity utilisation information for park & ride facilities, including recommendations for transfer to public transportation.

Test drivers in the Telematics Test Field try out innovative transportation applications on their smartphones.





The test drivers are informed of relevant traffic changes in real-time.

The research work performed to date by this project, which is supported by the Climate and Energy Fund, has been aimed at the necessary technical preparations in the transportation infrastructure as well as the programming of software solutions for mobile devices such as smartphones and on-board units. Over the course of the project, the broad consortium of project partners from diverse scientific disciplines and companies has proven to be a major strength.

Since autumn of 2012, roughly 3,000 users have tested the real application of the developed telematics solutions on the 45-kilometre long test stretch south of Vienna with the help of mobile applications for smartphones. In addition to this testing, 50 navigation devices will also be tested over a period of three months during the project. Five to ten series-production vehicles will be outfitted with vehicle-integrated solutions and should study the functionality of cooperative systems in this additional framework.

The project is scheduled to end in March 2013. By this time, great strides will have been made in the economic utilisation and market introduction of cooperative services. Valuable effects will also be generated for Austria as a business location and for the domestic labour

market. In an accompanying study, the environmental effects with regard to fuel consumption and greenhouse gas emissions will be investigated in line with the central goal of traffic control with low environmental impact.



The Congress Navigator, which was initiated by the Climate and Energy Fund and implemented by AustriaTech, guides participants along green routes on their way to the ITS World Congress and within the congress itself.

Green Logistics

SHORTCUT

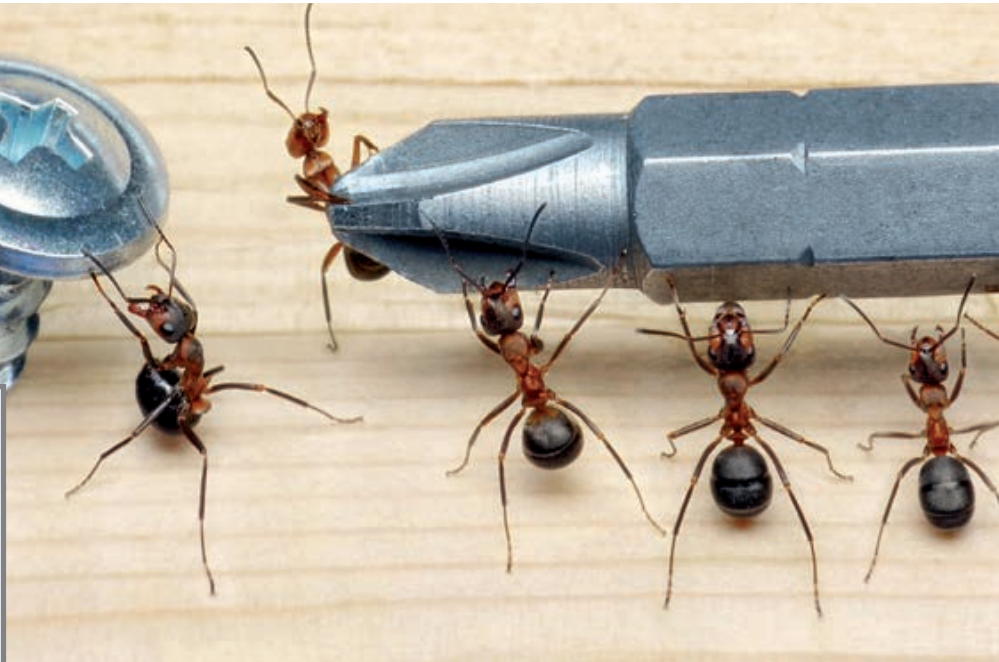
The Key Points in Brief

1 Innovative logistics solutions offer enormous potential for reducing greenhouse gas emissions.

2 With Smart Urban Logistics, the Climate and Energy Fund has initiated a forward-looking logistics project.

3 The project E LOG BioFleet is shedding light on the optimisation potential of intralogistics processes.

4 Prof. Sebastian Kummer, Vienna University of Economics and Business, explains in an interview the importance of subsidisation work in the logistics and transport sector.



■ In evaluating the environmental impact of the logistics industry, it is necessary to observe the entire logistics chain from transport to intralogistics and all the way to logistics real estate. According to the Fraunhofer Institute for Material Flow and Logistics (IML), the actual transport with vehicles does account for the majority (75%) of the energy consumption and greenhouse gas emissions of the industry, but other factors such as noise, particulate matter and high area utilisation also impact the environment. The conversion to a new fleet is therefore no longer sufficient to achieve the goal of lowering the impact as far as possible. In the area of transport, it is necessary to combine an entire package of measures for emissions reduction, including route optimisation, shifting transports to more environmentally friendly modes of transport, using more energy-efficient vehicles and training drivers.

Combined transportation solutions are therefore very important in goods shipping as well. Goods are transported in load units (containers, semi-trailers, etc.), allowing them to be moved easily between various modes of transport. Ideally, a low-emission transport mode is selected for the majority of the route, such as railway or ship transport. The rolling highway is a perfect example in that it brings trucks onto rails along high-traffic routes like the Brenner axis. Based on its belief in the value of these combined transportation methods, the Climate and Energy Fund subsidised a rolling highway along the Brenner axis in the years 2008 and 2009 with start-up financing for new trains

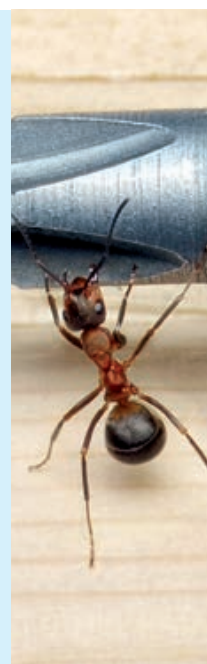
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The logistics industry generally suffers from a negative environmental image due to its association with truck columns, greenhouse gases, noise pollution and traffic jams. As a beneficiary of the increasing globalisation and internationalisation of trade flows, this industry has experienced impressive growth in recent years.

The highly international division of labour in production has led to an increase in the scope and intensity of goods shipping. As a consequence, the associated share of goods shipping in global CO₂ emissions have risen continuously and is variously estimated between 15 and 25 per cent.

New, environmentally friendly and integrated concepts are required – in other words, green logistics.



Theresia Vogel
Managing Director
of the Climate and
Energy Fund

“Our programmes network the various players together, thereby initiating smart, sustainable and forward-looking mobility projects. In this respect, we see solutions for (sub)urban regions as a central challenge in the coming decades in order to maintain the quality of life in Austria’s cities and communities. The requirement of creating efficient and sustainable logistics solutions for urban regions will therefore also be included in our programme design.”



and by supporting discount prices as well as covering production costs, all with a total volume exceeding 12 million euros.

Freight villages also play a central role in improving the environmental footprint of the logistics industry. With their proximity to population centres and a wide-ranging selection of logistics services, they contribute to better bundling of the goods flows, which in turn decreases traffic volumes. Such optimisation measures make it possible to reduce traffic in urban areas in particular.

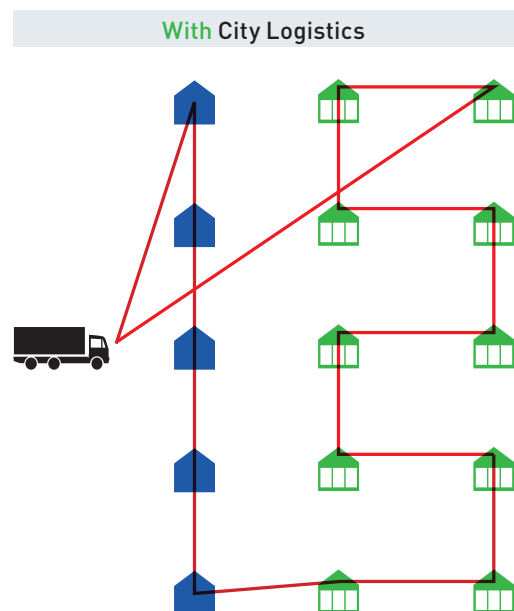
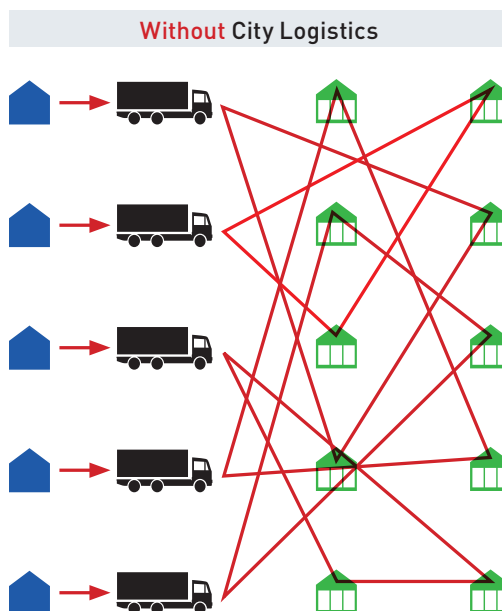
More Efficient Goods Transport in Population Centres

Around the world, cities as well as communities in the commuter belt are facing major changes and challenges with regard to their transportation concepts. There is a need for mobility concepts that allow environmental improvements to the current situation while taking all requirements into account. Goods transport plays an important role here since it comprises roughly one-third of urban business traffic according to a recent study by the Institute for Transport and Logistics of the Regional Innovation Strategy (RIS) Weser-Ems. Just-in-time delivery in commerce and industry as well as higher demands on quality, product diversity and delivery times on the customer side are leading to an increase in smaller quantity deliveries. Modern city logistics terminals that function as coordination centres can help here. They bundle the shipments of multiple suppliers for a single recipi-

Municipal Goods Distribution

Modern city logistics bundles together transport trips. This coordination eliminates unnecessary trips, which lowers traffic volumes and reduces emissions.

-  Forwarding Companies
-  Recipients
-  Routes



ent, which reduces transports and optimises routes. This improves the utilisation of the vehicles, which also lowers the overall CO₂ emissions. However, many companies still lack a long-term strategy and central points of contact for effective logistics optimisation.

The Climate and Energy Fund offers itself here as a reliable partner for bmvit and as a visionary coordinator. Within the framework of its Smart City Initiative, it has gained deep insights into the challenges of mobility and transportation in urban areas. Building on this knowledge, the Climate and Energy Fund has placed a clear focus on the topic of smart urban mobility. The underlying concept is driven by the vision of forward-looking urban agglomerations in which goods are transported with low climate impact and the best possible conservation of resources.

Integrated concepts for organising future-proof transportation systems for goods and commerce in urban regions are being sought after. The challenges involved here are complex. Considering the producers, transporters, customers, transportation service providers and communities, there is a wide range of groups in the logistics chain that must be taken into consideration in designing corresponding subsidisation measures. After all, the end goal is an intelligent, traffic-reducing network that incorporates all the participants mentioned above. Only this way can the subsidy funds be used effectively and

The rolling highway yielded a major CO₂ reduction in road transportation.



in accordance with the actual demand on the market to ensure that the most urgently needed projects are implemented.

As an initial step, bmvit and the Climate and Energy Fund are therefore aiming at networking of the key players and supporting the establishment of suitable conditions.

1,150

industrial sidings
throughout Austria.

50

Roughly
per cent of cargo
handling already
takes place
on railways.

22 times lower
CO₂-emissions than
road transport.¹⁾

1) Resulting in annual CO₂ savings
of 1.8 million tons.

More Industrial Sidings for Low-Impact Goods Transport

The logistics and transport industry operates under high competitive pressures. Price is generally the determining factor in choosing a form of transport. Because environmental costs are not included in this calculation, significant growth rates have been seen for years in goods transport by road in Austria; the share in greenhouse gas emissions of such transport is correspondingly high.

With a rail share of 35 per cent in all goods transport, Austria is nevertheless near the top in a European comparison. According to Dr. Ulrich Puz, Managing Director of the Schieneninfrastruktur-Dienstleistungsgesellschaft (SCHIG - Rail Infrastructure Service Company), roughly 110 million tons of goods are transported annually on Austria's railways. Approximately half of this takes place on what are called sidings, which play an especially important role in industry. They connect production locations to the railway infrastructure and serve for the transport of raw materials and production components as well as finished products. The steel and wood

industries in particular, but also the construction and automotive industries, benefit from the advantages of industrial sidings, enabling reduced use of cost-intensive truck transports.

The Climate and Energy Fund helps tap this potential with its funding and places great value on continuous further development of the associated programmes. Best practice solutions should be created that serve as examples for other companies with regard to their potential for reducing greenhouse gas emissions.

Dr. Puz, Managing Director of SCHIG, explains the background of the funding work as follows: "The subsidy instrument 'Promotion of Sidings' (ASB) of the bmvit has been in use for almost two decades. Starting in 2007 and exclusively since 2011, ASB projects have been subsidised by the Climate and Energy Fund and executed by SCHIGmbH – as have numerous other mobility projects." The selection of the submitted projects, which are

sought out via Austria-wide requests for proposals, is performed by an expert jury in order to ensure the high quality of the subsidised projects and an effective use of the funds.

Effective Strategy

Between 2007 and 2011, a total of 47 siding and terminal projects throughout Austria were subsidised in this fashion with roughly 42 million euros in funds. The CO₂ emissions reductions realised in this way amount so far to 922,000 tons per year.

Further expansion of the sidings should not only establish a competitive balance between rail and road but also improve environmental protection and transportation security. The subsidisation programme takes two approaches here. The first is the inclusion of targeted investments in the construction, expansion, modernisation and maintenance of sidings. As a second goal, systems and facilities that are exclusively dedicated to processing and securing siding operation and siding traffic are also being supported. Alongside the reduction of greenhouse gases and the building of sustainable, climate-friendly goods transport structures, the programme line also aims to improve the competitiveness of Austrian companies.

Subsidisation Projects with Clear Objectives

Every one of the 50 subsidisation projects is unique and pursues very specific objectives. In Landeck, for instance, adaptation and renovation measures for a railway loading facility for minerals of the **Kieswerk Starkenbach** gravel quarry was supported as part of the 2008 annual programme of the Climate and Energy Fund. Due to the topographically limited space conditions in the Inn valley, a largely automated system of conveyor belts was created passing under the nearby motorway and over the Inn river directly to a load-

ing system of the siding line. The loading of the special cars takes place here with the help of a radio-controlled shunting robot and state-of-the-art loading equipment. With this

42 million euros were invested in industrial sidings and terminal projects between 2007 and 2011.

efficient transport of excavated material via conveyor belts, **Kieswerk Starkenbach** eliminates the need for motorised transport vehicles. For realisation of this project, the company received the **VCÖ Mobility Award in the category of goods transport** in 2011. In order to capitalise on synergies from this very successful project, the Climate and Energy Fund initiated a study on the project progress.

Another good example is the project of **Asamer Kies- und Betonwerke GmbH** in Linz. The goal of this project was to create a siding system for the delivery of raw materials by train for concrete production. Through the creation of a mobile system that allows the transport of containers either by train or truck, the logistics chain between the Traunfall gravel quarry and the production site in Linz were to be optimised. In the course of the project realisation, the original loading area in the Traunfall quarry was adapted to the requirements of rail transport and the transfer capacity was increased through the procurement of new wheel loaders. At the **Steyrermühl** peripheral train station, the existing siding tracks were extended and the entire facility was adapted to the new transport concept. The train stations of Linz-Kleinmünchen and the Linz plant were structurally adapted for the future rail transports through construction of a track system, manipulation areas and safety measures.

Optimising Intralogistic Processes

For the Climate and Energy Fund, green logistics does not end with the use of low-emission modes of transportation or with shifting traffic from road to rails; the optimisation of internal processes at logistics companies is another goal. A recent study by the Fraunhofer Institute for Material Flow and Logistics confirmed this strategic orientation of the Fund. According to the study, up to 25% of the energy consumption of the logistics sector can be attributed to conveying, storing and order-picking processes. Harmonisation

of logistical systems and identification of inefficient processes plays a key role here. Especially in the area of intralogistics – which refers to the material and goods traffic within a company's own site – an energy savings of over 30% can be achieved through the avoidance of empty trips. **Efficient material handling equipment plays a central role here.** Handling equipment such as forklifts and pallet trucks is therefore an indispensable component of intralogistic goods transport with a high potential for efficiency improvements.



Floor handling equipment with a climate-friendly drive system was developed in the project E LOG BioFleet.

An outstanding example of this potential is supplied by the E LOG Bio-Fleet project, which is subsidised by the Climate and Energy Fund. In this project, Linde GmbH and five project partners have been working since 2010 to develop an innovative and climate-friendly logistics fleet application. The goal is to significantly improve the operating processes, provide customer benefits and lower the environmental impact of the vehicles with a hydrogen-powered fuel cell acting as a range extender. The purely battery-powered handling equipment used to date often results in productivity losses in multi-shift operation due to short ranges and long charging times. Performance reductions are also observed as the battery level decreases. The range extender based on fuel cells with hydrogen fuels eliminates these shortcomings.

For the Climate and Energy Fund, the multiple applications of this project as well as the purely Austrian value creation chain are of great relevance. It is therefore a model project and the Climate and Energy Fund expects it to have a valuable multiplier effect.



Where do you see the future areas of focus for the Climate and Energy Fund, Dr. Kummer?



Prof. Dr. Sebastian Kummer has directed the Institute for Transport and Logistics Management at the Vienna University of Economics and Business since 2001. He is the author of over 100 publications and copublisher of the academic journal "Logistics Management". His research focus lies in the area of logistics management, logistics controlling, supply chain management and the transport industry.

What importance do you attribute to new transport and logistics concepts in the transformation into an environmental society and economy?

Transport and logistics play a critical part in the transformation. On one hand, a majority of the CO₂ emissions result from the transport and logistics area. On the other: In order to make the energy industry less reliant on petroleum, we need oil-independent transport and logistics concepts. For this, we need not only new drives but certainly also new forms of organisation in transport and logistics that will allow us to move away from an oil-based economy.

What influence do public funding initiatives have in the widespread implementation of such transport and logistics concepts?

Innovative transport and logistics concepts are always associated with tremendous risks, and in some cases there are no private investors willing to bear these risks. In this regard, subsidies play a very decisive role in all innovative environmental concepts. I believe that we would not see any innovative concepts without corresponding subsidisation.

How do you evaluate the potential and role of the Climate and Energy Fund in the environmental transformation of the logistics industry?

The Climate and Energy Fund is very critical for two reasons. Firstly, due of course to the large amount of funding available. Secondly,

due to the clear thematic focus on environmental restructuring. I think we can use this vehicle as a means to advance science as well as to implement practical concepts.

Where do you see the future areas of focus for the Climate and Energy Fund?

There are many possibilities with regard to the environmental restructuring of the transport and logistics industries. One of the major areas of research focus will be the structuring of goods transport and goods logistics in population centres. I believe that we will see a renaissance of electricity-based city logistics based on e-mobility, in other words with electric drives. Subsidies are required here to implement this in practice as well as for research. Naturally, we cannot forget the remote rural regions. The challenges and need for subsidisation are even greater there. Even more basic research is probably required here in order to develop new concepts for rural regions. Another area will definitely be telematics. We have already seen that much can be done for the environment with telematics solutions. This makes telematics a very broad and interesting field of research for the Climate and Energy Fund.



Climate and Energy Fund Transportation Programme

2012 Annual Programme, Subsidies in Million EUR



Model regions of e-mobility

Lighthouse projects in e-mobility

Innovations for green and efficient mobility

Micro public transport systems

In the Transportation programme, the Climate and Energy Fund is investing in many different aspects of this field.



Theresia Vogel
Managing Director
of the Austrian
Climate and
Energy Fund

“We are striving not only for a shift in awareness; we also want to demonstrate new approaches to solutions. Our innovative subsidisation projects prove every day that multimodal transportation works – specifically that it is climate-compatible, flexible and user-friendly.”

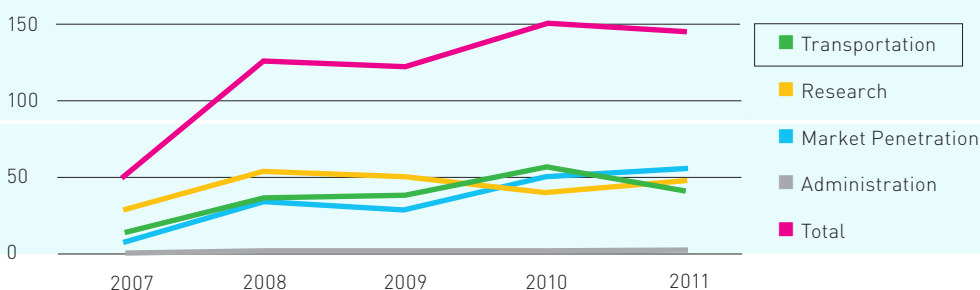


Ingmar Höbarth
Managing Director
of the Austrian
Climate and Energy
Fund

“In model regions, we are testing how e-mobility can be introduced to the market successfully and in a way suitable for the general public. The Vorarlberg company Vlotte is among Europe’s pioneers in ‘Zero Emission Mobility’. Once you drive emission-free, you will never want to go back.”

After starting with 14.17 million euros in subsidies in 2007, the total investments in the Transportation programme line during 2011 already amounted to 42.03 million euros.

Programmes / Subsidies Multi-Year Comparison, in Million Euros



8.25

1

**Multimodal
transportation
systems**

**Smart Urban
Logistics**



Wolfgang Malik
CEO Holding Graz

“In the establishment of systematic mobility solutions, electromobility depends on equal commitment and cooperation among the necessary players. Working together to create even stronger incentives here is an important cooperative aspect for the future.”



Josef Czako
Vice President
International
Business
Development,
Kapsch
TrafficCom AG

“To reduce the environmental impact of transportation, it is necessary to establish corresponding conditions in the form of integrated, holistic concepts on motorways and in cities. The Climate and Energy Fund can promote the implementation of intelligent transportation policy measures and framework plans with start-up funding.”



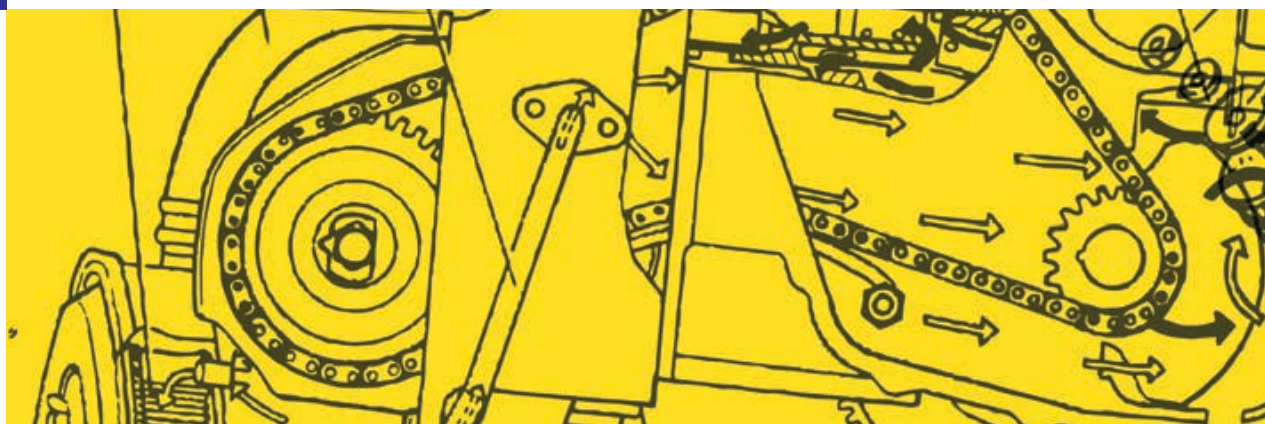
**Prof. Dr.
Barbara Lenz**
Head of Institute
Transport
Research,
German Aerospace
Center

“With intelligent transportation systems, it is possible to use existing infrastructure more efficiently in order to conserve resources in particular. However, the intelligence must also include linkages between transportation types; in other words, it must be implemented in an intermodal fashion.”



**Dr. Gabriele
Domschitz**
Management Board
Chairwoman,
Wiener Stadtwerke
Holding AG

“Research projects are often not very simple to carry out because they differ significantly from operational projects. They require a deep sense of innovation, flexibility and also endurance. As a subsidy recipient, this is something we had to get accustomed to. But I believe we have overcome the challenges well and the cooperation is functioning exceptionally well.”



Overview of Requirements for New Drive Technologies

Sufficient
range

Effective
Technology

SHORTCUT

The Key Points in Brief

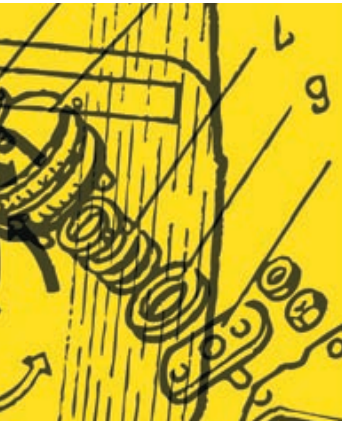
1 As an alternative to typical fossil-powered vehicles, a number of low-emission drives are now available on the market. These are being developed based on the specific user requirements and therefore differ in terms of technology, performance, energy source and consumption.

2 Depending on the various end customer needs, the Climate and Energy Fund supports a variety of research projects in the area of vehicle drives, such as EVARE and EMPORA.

Hybrid vehicles, electric cars, vehicles with fuel cells, combustion engines based on hydrogen or modified, low-consumption classic combustion engines – the spectrum of alternative drive technologies is very broad today. Depending on the respective technology, however, these drive types occupy a variety of development stages. Their common feature is lower environmental impact – whether via complete elimination of fossil fuels or significantly reduced consumption.

■ Austrian companies are particularly innovative when it comes to developing new drive concepts. Leading Austrian suppliers to the automotive industry enjoy great success on a very competitive market thanks to innovative and high-quality products and solutions. In this way, they create jobs and drive innovation. World market leaders such as Magna Steyr and AVL List are pioneering the development of new, low-emission drive concepts.

hnologies



Austrian companies succeed on the competitive world market with innovative drive concepts.



Stable and constant energy source

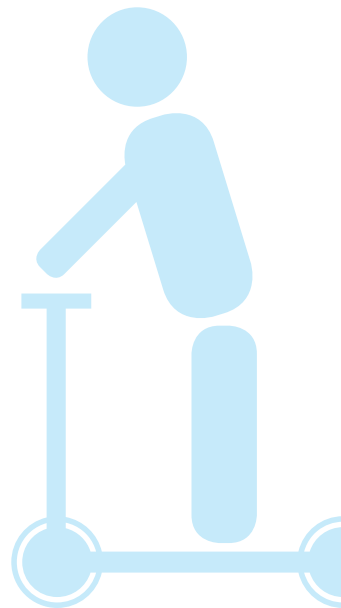
Simple fuelling process

Extensive Safety

The challenges in this discipline are as diverse as they are complex. In order to compete against classic combustion engines as marketable alternatives, the new drive technologies must satisfy numerous criteria. For one thing, alternatively driven vehicles must still have a sufficient range. Particularly in the area of electric cars, the focus therefore lies on developing powerful batteries and range extenders that increase the available driving distance. Another key criterion is ensuring maximum performance to enable accurate acceleration as well as hill climbing. Stable storage of the energy used by the drive is also required, and this energy must be made available in a constant fashion. Filling up with electricity, hydrogen or biofuels must be as simple and quick as possible. Last but certainly not least, alternative

drive forms must be safe both for passengers and the environment.

If a drive technology satisfies all of these criteria, it can be introduced to the market as a viable alternative to traditional engines. Parallel research and development work is currently under way on the various alternative drive concepts. The drive technology that will eventually win out has not yet been determined. It is more the case that a variety of concepts coexist and also compete with each other to a certain extent. Each of these drives has its advantages and disadvantages, which vary according to the technology and fuel used.



A Broad Array of Drive Technologies

■ In view of the varying potential and technical possibilities of the various drive technologies, we still cannot say for certain what the mobility of the future will look like. So far, none of the different alternative technologies has yet won out over the other concepts. It is much more likely that the various vehicle types will continue to exist in parallel for a time and find their own applications based on the needs of the users.

The Climate and Energy Fun initiates and supports user-oriented and needs-based development of a broad spectrum of alternative drive technologies, from the development of a high-performance range extender as in the EVARE project to complex mobility projects like EMPORA, which encompasses the vehicle, user and infrastructure.

The various drive technologies are highly focused on customer requirements. They are as diverse as the needs of the customers themselves.

Hybrid

- Hybrid cars combine a classic combustion engine with a battery.
- The battery is charged either through the recovery of braking energy and a dynamo or via charging from a power socket.
- In the classic hybrid car, the combustion engine is only used when the battery is empty.
- In a mild hybrid, the electric operation takes place in parallel with combustion to reduce fuel consumption.
- Plug-in hybrids are also available for urban transportation.



Combustion Engine

- Mature and proven technology.
- With optimised combustion techniques, the efficiency of diesel can be increased to as much as 40 per cent.
- Technological capabilities are not yet exhausted.
- Additional CO₂ reductions are possible through the use of biofuels and further improvement of the combustion process.

Fuel Cell Drive

- Liquid hydrogen is converted into electrical energy with the help of a chemical reaction.
- This use of hydrogen as a fuel allows for ranges of up to 450 kilometres.
- However, the market penetration of fuel cell drives is currently limited by the lack of infrastructure as well as the high costs.

Hydrogen Drive

- With only a few alterations, classic petrol engines can run on hydrogen.
- The problem of storing the fuel in pressure vessels has now been largely solved.
- However, the limited thermodynamic efficiency and the energy-intensive production are major challenges to the hydrogen car.

Electric Drive

- No traditional drive train.
- Purely battery-based electrical propulsion offers an efficiency of roughly 66 per cent.
- Energy originates from the battery, which can generally be charged from a socket.
- Restricted driving distance due to the limited storage capacity of the battery.
- A range extender is a small generator based on combustion engine technology that can supply the empty battery with energy.

Natural Gas

- Improved emissions and CO₂ characteristics compared with typical drives.
- Climate-relevant emissions are decreased by about 25 per cent.
- Biomethane can be obtained partially from climate-neutral biomass, lowering dependence on fossil fuels.
- Drives are based on mature engine technology. Natural gas cars are therefore mature and reliable.

EMPORA and EVARE, from Range Extenders to a Complex Mobility Structure

A sunny late summer day in Styria. Gerald Pöllmann stands on the test route of Magna Steyr south of Graz. In the background, a silver van travels the test route, completes braking and swerving manoeuvres. Astonishingly, it does so nearly silently. Only the tires squeak, but the engine purrs practically inaudibly.



This car is a prototype from the EMPORA research project supported by the Climate and Energy Fund. The vehicle can be operated entirely as an electric car, powered by an installed battery. In addition, it is equipped with a range extender in the form of a two-cylinder piston engine. The combustion engine itself is designed to allow fuelling with biofuels or biofuel mixtures.

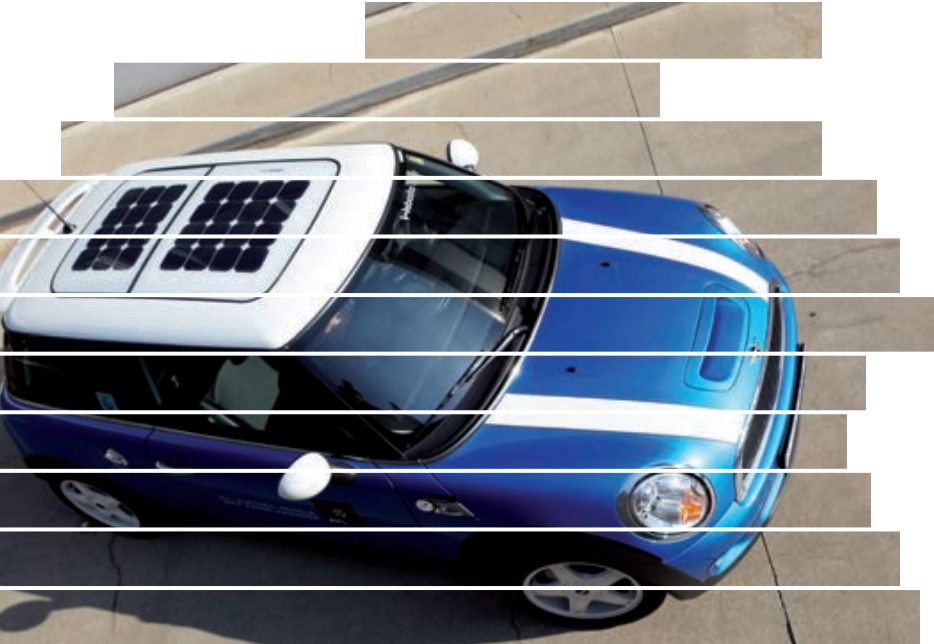
The EMPORA demonstration vehicle is just one part of the research project, which has been conceived as a comprehensive system. Alongside development of a high-performance vehicle, the project also covers the organisation of the entire value creation chain of electromobility. As such, it also focuses on mobility offerings for end customers, the provision of energy from renewable sources and the creation of an intelligent charging infrastructure. In total, 21 project partners are involved in EMPORA, ranging from a multinational energy group to telecommunication companies and public transportation providers. With a total project volume of 26 million euros, EMPORA is the largest R&D project in

Austria. The project participation of the Climate and Energy fund amounts to 12 million euros. The project was begun in January 2010 and will finish in March 2014.

Of particular importance in a project of this magnitude is the creation of an overarching system architecture that ensures smooth cooperation between the various project partners. In creating a platform for the various EMPORA participants, the Climate and Energy Fund took on a key interface function, one that Gerald Pöllmann has explicitly highlighted. The cooperation and networking approach of EMPORA entirely corresponds to the philosophy of the Climate and Energy Fund: Technological accomplishments in the area of alternative drive technologies should be integrated into a complete system in a way that achieves the maximum level of synergistic effects.

As with EMPORA, the EVARE project, which was also supported by the Climate and Energy Fund, researched range extender technology that is not far from becoming market-ready.

ALTERNATIVE DRIVE TECHNOLOGIES



A battery-powered electric vehicle specially suited for urban driving was developed in the EVARE project.

From 2010 to 2011, the Climate and Energy Fund supported AVL List, a globally leading engine manufacturer, in developing a holistic vehicle concept for an electric battery vehicle with a range extender. The goal of the research project was to optimise the existing yet complex electrical energy storage systems for the requirements of driving. In cooperation with Joanneum Graz, Fronius, the Vienna University of Technology and Miba, the project succeeded in improving

the storage and conversion technologies in particular in order to finally extend the maximum distance of the vehicle. The range extender was installed in an urban vehicle (see photo above) and led to a number of relevant improvements. It was possible, for instance, to increase the maximum range to 250 km. In addition, the weight of the test vehicle could be reduced compared with typical battery-driven vehicles thanks to the range extender. All in all, a significant optimisation of the energy storage costs was possible. Such progress is essential for increasing the practical suitability of electrically driven vehicles and will eventually determine their success in penetrating the market.



Gerald Pöhlmann
General Manager
Corporate
Strategy, Ad-
vanced Technol-
ogy & Diversified
Industries,
Magna Steyr

“To achieve technology leadership in certain segments requires collaboration between business, science and research. Our cooperation with the Climate and Energy Fund has been very successful in this regard. For the EMPORA project, the Climate and Energy Fund also provided an important networking platform that contributes to the development of low-CO₂ technologies.”

At the Heart of Elect



SHORTCUT

The Key Points in Brief

1 High-performance battery systems are critical to success in developing competitive electric cars.

2 With NeuLIBE and EHEV, the Climate and Energy Fund is supporting two outstanding projects in the area of battery research.

■ A high-tech strategy paper on the topic of electromobility published by the German Ministry of Education and Research establishes the following fact: the **battery will determine the future of e-mobility**. The paper makes this clear already in its title: Future Electric Mobility – Battery Research Is the Key. New, high-performance batteries are expected above all to deliver an increased maximum range for electric cars because the effective range plays a central role in determining future public acceptance of electric cars. According to a survey by the Society for Consumer Research, consumer acceptance of electric vehicles is bounded by a **minimum range of 400 kilometres**. Other critical factors that will influence widespread adoption of electric vehicles in the future include the still very high costs and improvement of the life expectancy and reliability of the batteries used. In addition to battery research, the victory march of electromobility also depends on the availability of a standardised infrastructure for charging the batteries.

Battery research is the key
to the electromobility
of the future.

Many automobile manufacturers are currently intensifying cooperation with research institutions and companies in the chemical industry in order to further improve the functional capabilities of batteries. The development of a new generation of batteries is being advanced through joint research initiatives. Alongside expansion of the storage

capacity, the weight in particular should be reduced, and shorter charging times must also be achieved. Because the density of the electrolyte also increases as the ambient temperature falls, the electrochemical processes inside the batteries slow down in winter. This increases the internal resistance, decreasing the electricity output, and the capacity of the battery cell is eventually reduced. Researchers are currently working on **developing new electrolytes** that can reduce the susceptibility of batteries to temperature fluctuations.

romobility: The Battery

The future success of e-mobility will rise or fall with the battery. Batteries store the necessary energy for forward motion, they determine the maximum range and thereby also the performance of electric cars. Numerous scientists and research teams are currently dedicated to developing new batteries for sustainable mobility.



The high-performance batteries of the future should impress with short charging times, high output and maximum range.

The focus of many automobile manufacturers lies on lithium-ion batteries. Over the last 20 years, these have been used primarily as the standard battery for small electrical devices and tools. Lithium-ion batteries are appealing for electric cars, as well as hybrid vehicles, due to their favourable relationships between volume, weight and storage capacity. They currently possess the highest energy density of all electrochemical electricity storage technologies. In addition, they only slowly lose power to self-discharging. Other technologies receiving increasing research interest **in addition to lithium-ion batteries include metal-air and lithium-air batteries.** These technologies have a higher energy density and could yield further reductions in the weight and cost of the batteries.

The Climate and Energy Fund actively supports R&D projects and multiple research initiatives covering all aspects of battery technology. Characteristic of all supported projects is the close cooperation between producers and researchers. Only this way is it possible to ensure that new battery concepts will be capable of living up to real world applications.

EHEV – Eco Drive for Hybrid Electric Vehicles

One very striking example for close cooperation between production and research in the area of batteries can be seen in the EHEV project supported by the Climate and Energy Fund. EHEV is a research project of the Graz University of Technology together with Magna E-Car Systems and Graz Holding.

The goal of the project is to study the effects of driving behaviour and driving dynamics on the charging cycles and life expectancy of batteries in hybrid vehicles. The project should identify the principles for optimised, environmentally friendly driving techniques with hybrid vehicles. Stefan Hausberger, Director of the Emissions Department at the Institute for Combustion Engines and Thermodynamics at the Graz University of Technology, emphasises the environmental significance of driving technique: “The potential for lowering CO₂ emissions much less expensively than new engine and car technology can accomplish lies in the hands (and feet) of drivers. In the future, we must make better use of this potential.”



Dr. Stefan Hausberger
Director of the
Emissions Department, IVT, Graz
University of
Technology

“The potential for lowering CO₂ emissions much less expensively than new engine and car technology can accomplish lies in the hands (and feet) of drivers. In the future, we must make better use of this potential.”

AT THE HEART OF ELECTROMOBILITY: THE BATTERY

The relevance of EHEV is therefore self-explanatory. This project also illustrates that research in the field of mobility must be structured with many layers. The isolated inventor behind closed doors cannot produce results that will stand up to market demands. Instead, as proven by EHEV, it is essential to unite the technical expertise of universities with the customer experience of manufacturers in the industry. They know the needs of customers and are able to contribute experience accumulated over the course of many years. However, establishing a link between science and industry requires central intermediaries. In Austria, this function is realised by the Climate and Energy Fund. With its years of experience in subsidisation and project support, it has developed a far-reaching network in the area of mobility research as well as production, enabling it to provide ideal interfaces.

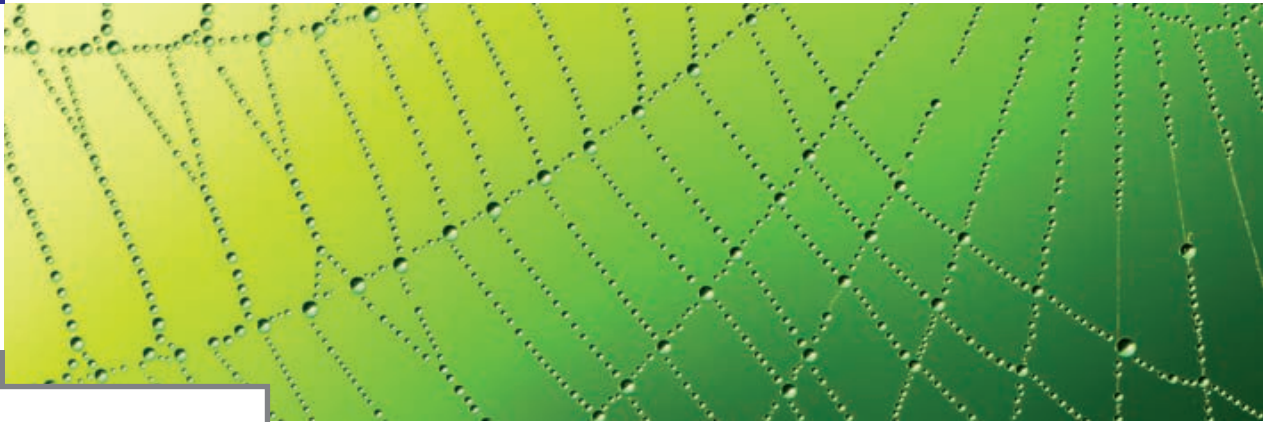


The effects of driving style on CO₂ emissions are measured at the exhaust extension.

The measurement vehicle was used by drivers of Holding Graz Linien for regular operations.



The Rise of Lightweight



SHORTCUT

The Key Points in Brief

1 The trend toward lightweight construction in the vehicle industry is increasing.

2 The CULT Cars project subsidised by the Climate and Energy Fund demonstrates the emissions reduction potential of lightweight construction. Wolfgang Fritz, project director of CULT, attests to the collaboration with the Climate and Energy Fund.

Cars have recently gone on a diet. They have to slim down – in terms of weight, size and thereby also fuel consumption. The reasons are clear. New construction methods and materials should help achieve significant efficiency improvements and lower the impact on the environment. As a general rule of thumb: 100 fewer kilogrammes of weight saves between 0.3 and 0.4 litres of fuel under normal consumption. The development of new lightweight construction concepts is therefore of great importance in the automotive industry in addition to researching new drive technologies and increasing the efficiency of engines.

■ A clear trend toward lightweight construction methods can be seen in the automotive industry. By 2020, vehicle manufacturers must lower the CO₂ emissions of their vehicles to below 95 grammes per kilometre, according to requirements of the European Union. With the optimisation of conventional engines as well as lightweight construction measures, automobile manufacturers are trying to avoid the fines they would otherwise have to pay.

Weight can be saved in almost all parts of a car. In the body, the weight can be reduced through the use of aluminium, carbon, high-strength steels or new lightweight materials. Windows of polycarbonate weigh significantly less than glass, and rims of plastic save roughly three kilogrammes compared to aluminium versions.

Another important step is engine downsizing. Here, almost every part is currently on the test bench. In some cases, the same performance can be achieved with four cylinders as with six, which

yields a savings of up to 30 kilogrammes.

Another option is downsizing of the entire vehicle. As a result, a trend toward smaller types of vehicles is clearly discernible on the car market.

Although the average weight of a new cars has increased in the past by about ten kilogrammes per year due to higher safety requirements and comfort expectations, car makers are now clearly changing the way they think. **New vehicles are now often shorter, narrower and even lower than previous models.**

In the vehicle industry, lightweight construction is also a measure to counter the increasing weight of new drive technologies. In order to meet the prescribed CO₂ values, mid-range and luxury class manufacturers must make more use of alternative drive technologies in the future. However, these alternatives to conventional

ht Construction

“Reducing CO₂ emissions is a central mission of our age. To meet the G7 climate goal, road transportation must contribute. This requires the development of new concepts and technologies.”

Wolfgang Fritz
CULT project director,
Magna Steyr

(pictured with
component of
CULT lightweight
construction concept)



engines often lead to significant increases in weight. Even just the fuel-efficient optimisation of combustion engines with automatic start/stop features or the use of turbochargers can increase the weight by an average of 50 kilogrammes. Batteries in hybrid and range extender vehicles gain up to 150 kilogrammes in extra weight, while pure battery operation adds as much as 250 kilogrammes. Moreover, this weight increase raises the overall costs for car makers since heavy vehicles can result in higher demands on the vehicle dynamics or the braking behaviour.

The industry is therefore very interested in reducing the weight of its vehicles. Lighter vehicles are a focus for the Climate and Energy Fund due to the associated energy savings during operation of the vehicles. The Climate and Energy Fund is working very closely with industry manufacturers and is also paying special attention to low energy consumption during the production phase because producing many lightweight materials is often more energy-intensive than producing conventional materials. The lower energy consumption during vehicle operation can only compensate through many years of use for the original high energy intensity during production.

CULT Cars

Both the importance of lightweight concepts and the subsidisation strategy of the Climate and Energy Fund can be clearly seen in the CULT project (Cars' Ultra-Light Technologies). CULT involves a lightweight construction concept developed in cooperation with Magna Steyr for a low-CO₂ vehicle.

However, this vehicle is not intended to be just a futuristic prototype. It should be a capable and user-oriented vehicle for everyday use. The aspect of lightweight construction is central to the desired CO₂ reduction. The use of innovative lightweight materials should result in a significant reduction in the weight of the vehicle. Based on this weight reduction, additional emissions-lowering vehicle modifications can be undertaken. In total, a weight reduction of 300 kilogrammes should be achieved.

This requires a number of measures. One such measure is the use of certain parts for multiple functions. This allows other parts to be eliminated entirely. In addition, originally heavy materials will be replaced with lightweight components of carbon fibre or magnesium, although these must still satisfy the same standards of functionality and quality.

CULT is based on the predecessor project MILA Electric Vehicle of Magna Steyr. This research project, also subsidised by the Climate and Energy Fund, developed a fully integrated electric vehicle platform. This platform can be used by various OEMs to realise their own optimisation measures for vehicles. MILA was therefore a holistic concept that enabled clear improvements for electrically driven vehicles. In addition to the installation of a range extender, measures were also implemented in the areas of acoustics, gearbox input shaft, cooling, climate control and heat protection for parts in order to optimise the vehicle overall.

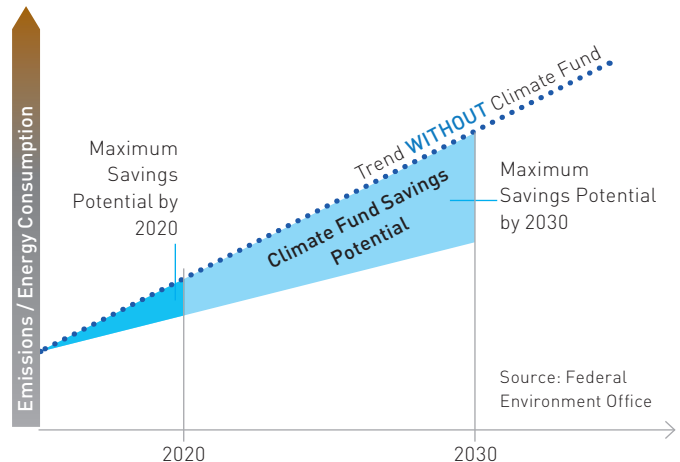
The Climate and Energy Fund Makes a Difference – Over the Short, Medium and Long Term

The work of the Climate and Energy Fund is bearing fruit. This has been confirmed by a recent study by the Federal Environment Office on the contribution toward achieving the short-, medium- and long-term goals of Austria.

The study by the Federal Environment Office confirms that the Climate and Energy Fund is making a difference in all time frames thanks to its broad subsidisation portfolio. With support for environmentally friendly technologies that are already available on the market or conceived for a rapid market introduction, the Climate and Energy Fund achieves fast and direct effects. On the other hand, the programmes and initiatives supported in the area of research as well as light-house projects and model regions of the Climate and Energy Fund exert their influence over a medium- to long-term dimension. Their effects on the market must be evaluated from a longer-term perspective since they must still be tested after the basic development work is finished before they are ready for broader use.

For the Federal Environment Office, the comprehensive subsidisation package with its short-, medium- and long-term effects represents a clear strength of the Climate and Energy Fund. After all, achieving the established climate and energy goals requires both measures that lead quickly and directly to emissions reduction and lower fuel consumption as well as initiatives that lay the groundwork for structural, long-term changes.

Of central importance here is the combination of research, demonstration and market introduction. With its demonstration and market introduction programmes, the Climate and Energy Fund achieves immediate and medium-term savings. Via the research programme, on the other hand, the Climate and Energy Fund ensures that energy-reducing effects will also be possible in the future.



According to the THG study of the Federal Environment Agency, the comprehensive subsidisation package of the Climate and Energy Fund exhibits significant emissions reduction potential by the years 2020 and 2030.

Concrete figures detailing the effects of the Climate and Energy Fund in the areas of energy efficiency and renewable energy are already available thanks to a study by the Federal Environment Office. With its programmes in research and transportation, the Fund exhibits a savings potential of 80,000 GWh over the period up to the year 2030. The numbers from the focus area of renewable energy are also impressive. Here, the Climate and Energy Fund is able to support a total potential of 46,000 GWh in the generation of renewable energy via research and market penetration.

These examples are proof that the Climate and Energy Fund is accomplishing its mission in an effective way. With a coordinated and complementary programme framework that combines the various stages and key aspects of subsidisation work from development to market introduction, the Fund makes a central contribution to achieving the climate and energy goals of Austria.

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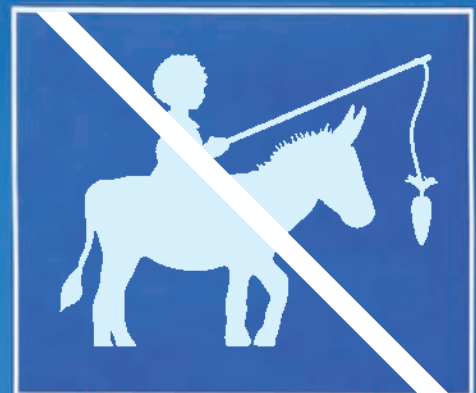
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Environment-friendly
is not enough for us.



Truly intelligent
projects let facts do
the talking.