EUROPE'S ENERGY FUTURE

How to reduce transport emissions and increase energy security

EDITED BY **LOVISA KÄLLMARK**

elf
European Liberal Forum

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INTRODUCTION

Building from the project 'Europe's Energy Future - How to combine energy security with reduced emissions' (2015), this report develops the aforementioned text by further delving into emissions and energy security issues in the transport sector.

This report follows-up with a close investigation of the transport sector given that this sector relies heavily on imported fossil fuels. The transport sector contributes to approximately a third of all energy consumption and a fourth of all GHG emissions in the EU. In 2014, the share of renewable energy sources for transport energy was a mere 5.9 percent. The burning of fossil fuels causes problems such as local air pollution, related health issues, and contributes towards climate change. Given the increased global demand for energy and transport, competition over energy resources in general, and fossil fuels in particular, is likely to increase.

Furthermore, if Europe is serious about reducing its emissions – 40 percent by 2030 and 80-95 percent by 2050 – then the transport sector's emissions are a key issue to solve. In order to achieve these goals, this requires a reduced use of fossil transport fuels alongside the growth of renewable energy options. Energy efficiency measures, shifts in transport modes and behavioural changes around mobility are also vital for a successful transition to a low-carbon economy.

This report consists of seven chapters written by experts in energy and transport policy and is the product of a collaboration between the European Liberal Forum (ELF) and its members: Fores (Sweden); Neos-lab (Austria); Novum (Slovenia); and the Friedrich Naumann Foundation South-east Europe (Bulgaria). Throughout 2016 the partners have organised three workshops, which brought together national actors from politics, academia and business in order to share knowledge and first-hand experiences across EU countries. Results and findings from these workshop have served as input for this report.

The second chapter provides a general overview on the state of play in the European transport sector as well as an overview of EU policy and targets. Moreover, this chapter lays out the fundamental concepts concerning energy security and provides insight into ongoing EU discussions. Chapter two also maps current EU policy and targets in the transport sector. The path leading up to the 2016 EU Strategy for Low-emission Mobility is explained and commented upon.

This report aims to contribute to the knowledge and experience sharing across EU countries regarding how to reduce emissions from the transport sector. Chapters three through seven present various debates and policies from the project partners across Bulgaria, France, Slovenia, Sweden and Austria. These five cases give a sense of what the energy and transport realities look like on the ground across Europe. It is clear that within the EU, Member States face distinct challenges and opportunities and that targets and policy measures vary.

Following the work undertaken for and present in this report, Chapter eight provides recommendations on available efficient and effect policy measures. Specifically, two main policy areas are highlighted: efficient mobility and fuel switching.

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THE EUROPEAN TRANSPORT SECTOR

Jakob Lagercrantz & Lovisa Källmark

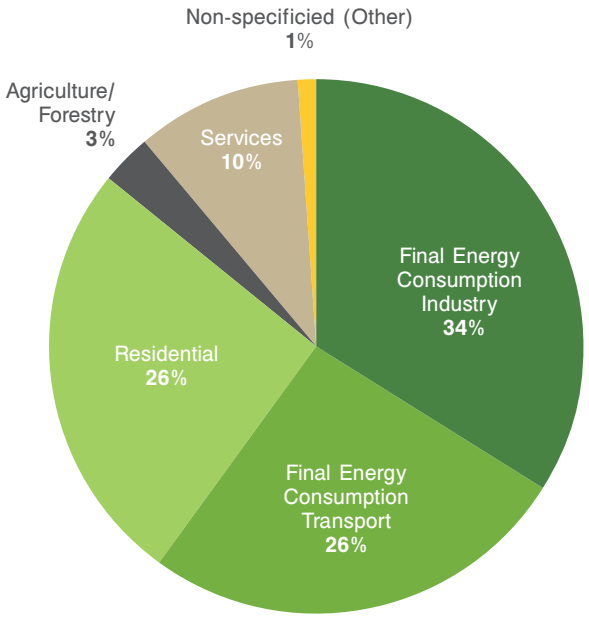
Introduction

The transport sector was one of the first common policy areas in the EU economic community and is still of crucial importance for the European Union. Transport enables the free movement of people and products, and connects Member States. An efficient infrastructure is vital for competitiveness and economic growth. The transport sector, however, contributes heavily to energy and fossil fuel consumption that results in emissions that cause local pollution and climate change. It is clear that the transition to a low-emissions transport sector is not easily achieved and will require a broad and collaborative approach.

Energy and emissions

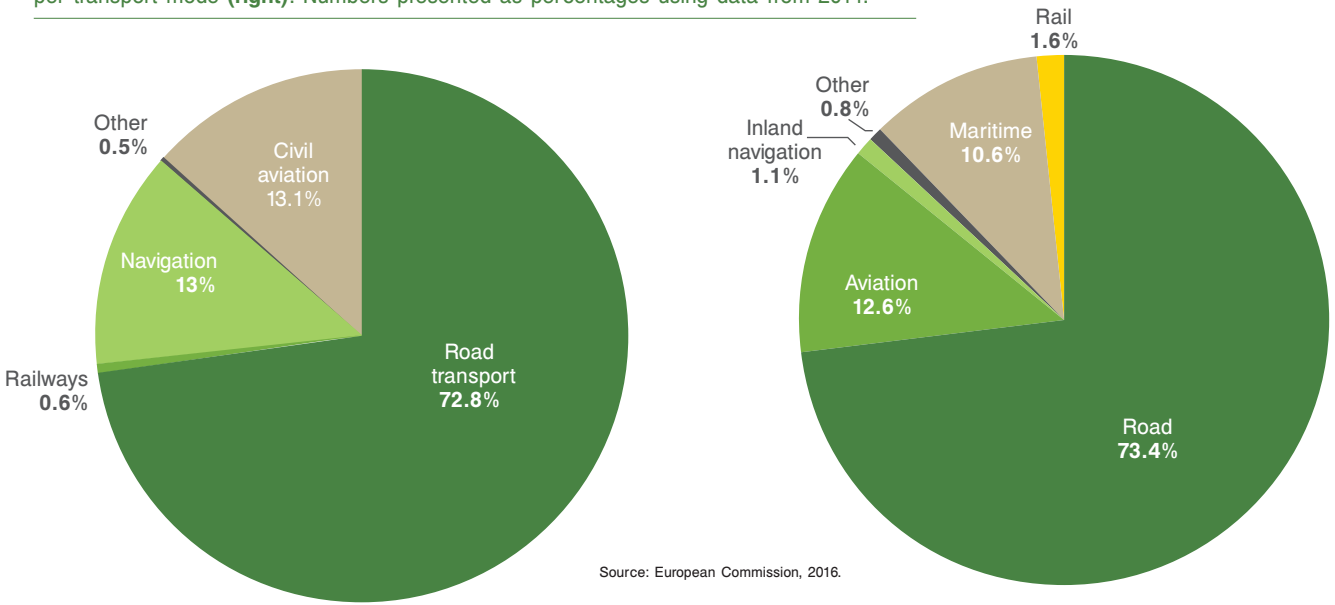
As Figure 1 illustrates, transport accounted for approximately one third of final energy consumption in the EU in 2014 (Eurostat, 2014). Moreover, the transport sector has a significant impact on climate, contributing to approximately a quarter of GHG emissions in the EU (see Figure 3). Compared to other sectors, the transport sector has not undergone the same reduction in emissions from 1990 to 2014. Transport emissions peaked around 2007-2008, and has since then come down slightly. Nonetheless, emission levels remain considerably higher than 1990 levels (European Commission, 2016). The 2007-2008 downturn in emission should also be viewed in light of the global financial crisis, which strongly affected all economic sectors. Recent upward momentum suggests that the decline in transport emissions was only temporary. Figure 2 depicts energy consumption as well as GHG emissions per transport mode. For both energy consumption and GHG emissions, road transport constitutes the largest share – almost 75 percent (European Commission, 2016).

Figure 1:
Share of final energy consumption in EU28 per sector, as of 2014.



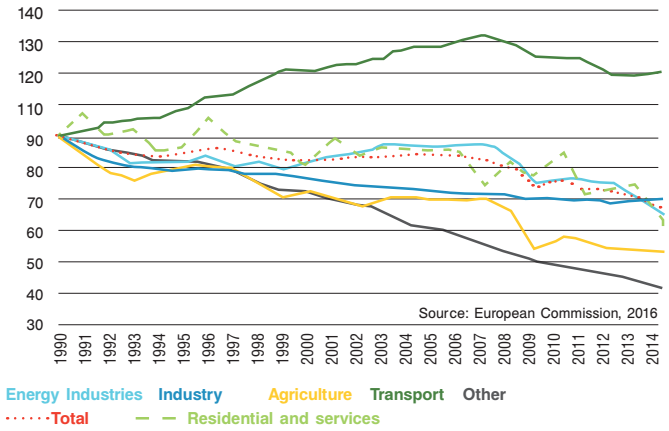
Source: Eurostat, 2014 code: tsdpc320.

Figure 2:
EU28 GHG emissions contributions per transport mode **(left)** and Final energy consumption per transport mode **(right)**. Numbers presented as percentages using data from 2014.



Source: European Commission, 2016.

Figure 3:
Emissions per sector in EU28 when compared to 1990 levels for each sector.[1] Note that the graph does not show the sectors' relative contribution to total emissions, instead comparing emission levels to baseline values for each sector separately.

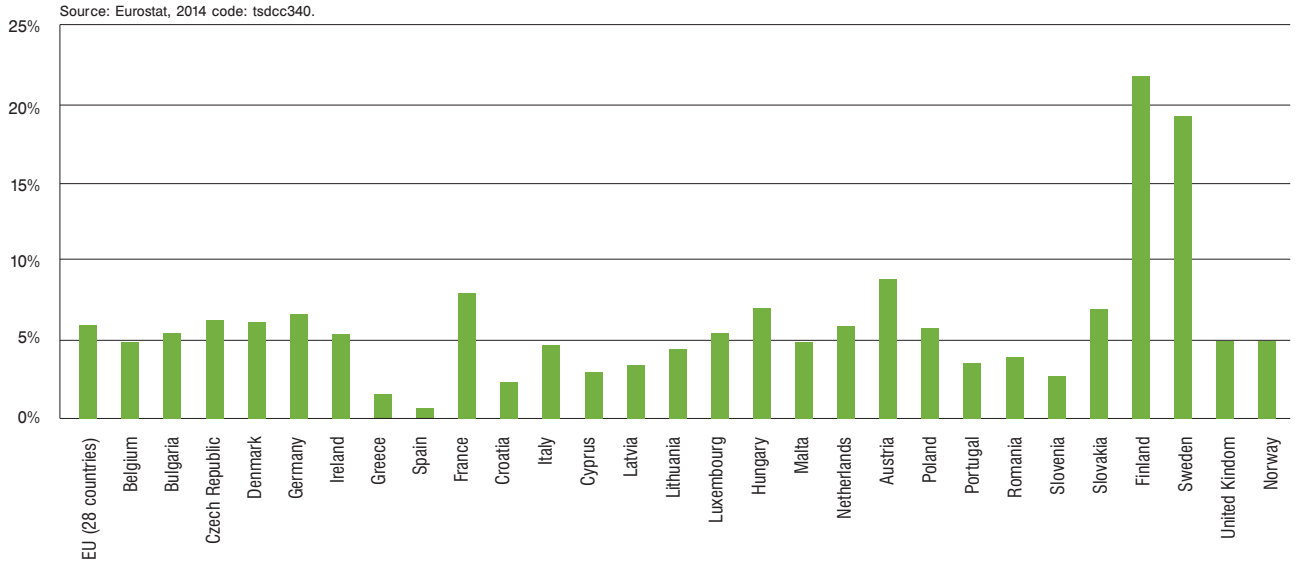


Fuel use in the transport sector

The transport sector relies heavily on fossil fuels, and this dependency has not decreased over the past few years. For 'total petroleum products', the energy dependency – defined as 'the extent to which an economy relies upon imports in order to meet its energy needs' – in EU28 was 88 percent in 2014 (Eurostat, 2014 code: tsdcc310). However, a few EU countries have ample domestic resources of fossil fuels such as Romania and Estonia.

Renewable fuels like biofuels and renewable electricity for e-mobility (including rail) have the possibility to be produced locally. This means renewable fuels do not face the same energy security problems as fossil fuels. The share of renewable energy sources for transport energy was 5.9 percent in 2014 (Eurostat, 2014 code: tsdcc340). Biofuels made up the biggest share of renewable energy sources for transport fuels in the EU, accounting for 4.9 percent of energy content in transport fuels in 2014. Among the available bio-

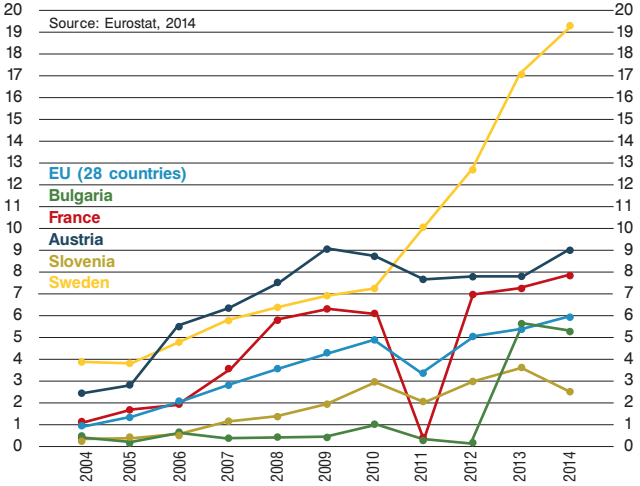
Figure 4:
Share of renewable energy used in transport in Europe, as of 2014.



fuels, bio-diesel – with 80 percent – has the highest usage. Bio-ethanol accounts for 19 percent while biogas and other biofuels account for 1 percent (EurObserv'ER, 2015). Figure 4 demonstrates the significant variation between Member States in their share of renewable fuels used in the transport sector.

It is clear that while some countries have reached beyond the EU target of 10 percent renewable energy in transport until 2020, some countries still have a long way to go in achieving this goal. Figure 5 illustrates the share of renewables in transport for the five Member States used as case studies this report (see Chapters 3-7). When compared to other EU Member States, Finland and Sweden exhibit exceptional shares of renewable energy used in the transport sector in 2014. An increased use of the bio-diesel type HVO (Hydrogenated vegetable oils), combined with a tax exemption on renewable fuels for use in the road transport sector in Sweden, has contributed greatly to this rapid increase.

Figure 5:
Share of renewable energy used in transport in the 5 selected case countries, as of 2014.[2]

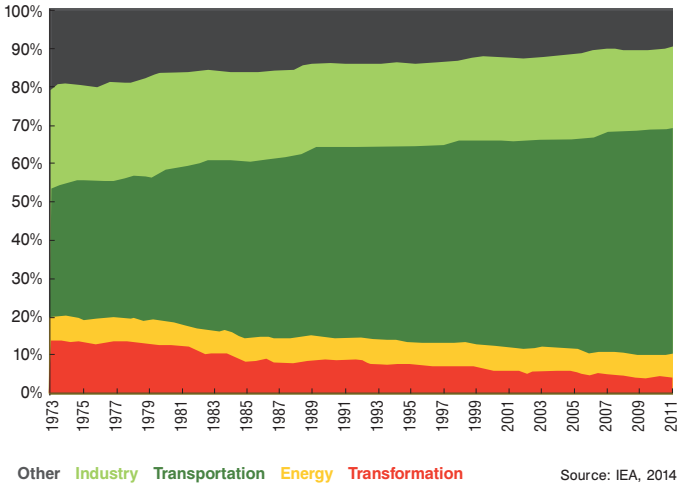


Energy security

Energy security is a significant component of the European agenda. Europe cannot meet the demand of the economy and its citizens with its own resources, and depends on imports. In 2014 the European Commission presented the European Energy Security Strategy (European Commission, 2014a). It describes a situation that is not sustainable, one in which Member States rely heavily on imported fossil fuels. Recently, these imported fossil fuels come increasingly from Russia and less from OPEC countries. Almost a third of oil imports originate from Russia alone (Eurostat, 2013 code: nrg_123a). The current concentration of supply from Russia is in itself a risk for European energy security. Energy security of supply concerns every member state, even if some are more vulnerable than others.

EU energy security should be viewed in the context of a growing global demand for energy. Global energy consumption is expected to increase by 27 percent by 2030. This will have important implications for energy supply and trade flows. In order to ensure a sufficient supply of energy, the EU and its Member States can, for example, support research and development to increase efficient energy production and consumption. Additionally, Member States can support the development and increased uptake of renewable energy. It should be noted that energy efficiency and renewable energy are both important components of EU strategies for reducing the environmental impact of transport.

Figure 6:
OECD oil consumption by sector 1973-2011.



Source: IEA, 2014

The International Energy Agency (IEA) defines energy security as 'the uninterrupted availability of energy sources at an affordable price'. One issue highlighted by the IEA is what they call the 'continuation of oil demand in transportation' (IEA, 2014). Figure 6 helps makes clear that while renewables play a progressively important role in other sectors, fossil fuel use in transportation continues to increase. Today the EU imports 53 percent of the energy it consumes. When it comes to crude oil, which is used in petroleum fuels for transport, the import dependency is considerably higher – standing at nearly 90 percent. EU dependence on a single, external supplies is an especially pressing issue concerning security of supply. This is particularly true for gas, but also applies to electricity and to some extent oil. For crude oil and oil products, the EU imports more than €300 billion worth of products annually, one third of which is from Russia (Eurostat, 2014).

Given the EU transport sector is so heavily reliant on fossil fuels, this makes it vulnerable to supply disruptions. If a major oil disruption would occur, emergency response actions would be required. First, actions can be taken to increase supply and thereby meet demand, including:

- **Stock draw** – Use regional stockpiled reserves. IEA countries are obliged to hold reserves for 90 days.

- **Production surge** – Increase production in regional sources. This tactic is limited to Member States with this capability.

Second, taking measures to reduce oil use would also be necessary. Such measures could also be undertaken as precautionary acts – to ensure energy security as well as environmental sustainability. Such measures include:

- **Demand restraint** – Involve many different aspects of society in this multifaceted tactic. Reducing demand for transport is central while also including behavioural aspects, such as: promoting eco-driving; stricter speed limits; telecommuting; carpooling; and/or restrictions on driving. Lessening the demand for transport fuel includes efficiency measures and the so-called 'modal shift' – switching to other means of transport like biking or forms of public transportation.

- **Fuel switching** – Find alternative fuels or energy production sources. Here biofuels and e-mobility play important roles.

There are good reasons to include environmental impacts when studying energy security. Environmental and climate policies are drivers for energy policies on the European and national levels, both of which are influenced by international conventions and agreements. For an example of environmental risks, one can refer to the ongoing debate about land use and environmental degradation caused by the production of biofuels (Vadrot and Pohoryles 2010). Measures to reduce petroleum-based product demand can be designed to match those that aim to reduce environmental impact from transport and improve the population's living conditions. Investing in infrastructure can both reduce demand for transport and support the development of sustainable transport options.

In the European Energy Security Strategy (European Commission, 2014a), renewables act as an important substitute for fossil fuels in the energy sector. It is estimated that increasing the use of renewables could reduce import costs by at least €30 billion per year. The World Energy Council (WEC) projects a 13-fold increase in the consumption of biofuels in Europe to from 2004 to 2030 (World Energy Council, 2011).

Along with switching fuels, efficiency plays a crucial role in policy measures. As vehicle efficiency increases, one hopes to witness a reduction in total transport emissions. However, given that demand for transport is steadily increasing, it is not certain that total emissions will actually decrease. At this time, there are no signs of a decoupling between GDP and a demand for transport. For passenger cars, efficiency achievements are projected to bring down total energy use slightly, although most benefits are likely to be set off by growth in demand. For freight transport, energy use is projected to rise steadily until 2050.

Political targets

One of the European Economic community's first common policy areas pertained to the transport sector. However, the development of concrete measures was very slow given that Member States were reluctant to reduce control over their national transport system and because of regulatory differences among Member States. Only after the European Parliament, in an unprecedented move, took the Council of the European Union to the European Court of Justice over its failure to develop a common transport policy did things begin to change. Then the European Commission published a white paper about promoting the internal market which also contained specific references to transport and related goals to be achieved by 1992.

At the beginning of the twenty-first century, amidst discussions about global warming, increasing demand for energy, uncertain energy supplies and soaring oil prices, did the call for action gain momentum. This led to the EU Energy and Climate Change Package (CCP), which aimed to address the aforementioned issues. The CCP consisted of: the Emission Trading System (ETS); the Renewable Energy Directive (RED); and the Energy Efficiency Plan (EEP). The CCP was adopted by the European Council in April 2009.

The Renewable Energy Directive (RED), a part of the larger CCP, entered into force on June 25, 2009. RED then had to be transposed into the national legislation of all Member States by December 5, 2010. RED includes the '20/20/20' target to be met by 2020 which requires a 20 percent reduction in greenhouse gas (GHG) emissions compared to 1990, a 20 percent improvement in energy efficiency compared to forecasts for 2020, and a 20 percent share of renewable energy in the EUs total energy mix (European Commission, 2009).

As part of the 20 percent share of renewables in the energy mix, a 10 percent minimum target is set for renewable energy in the transport sector. As such, the EU has set up a mandatory member state target that 10 percent of all energy used in transport should come from biofuels by 2020. A specific focus on transport is critical given that the transport sector has not followed the reduction trends in emissions witnessed in other sectors. Transport emissions only began to decline in 2007 and still remain higher than in 1990.

Aiming for 20 percent renewable energy use in the total energy mix is an overall EU target, but RED sets a different target for each member state depending on their capacity. The European Commission states that an increasing share of renewable energy will lead to positive impact on emission levels, secure energy supply and favour long-term economic growth (European Commission, 2008). The European Commission reported in the Climate Action Progress Report (EC, 2015) that the EU in 2014 was on track to reduce its GHG emissions by 24 percent by 2020 (4 percent over its original target).

The European transport sector approximately represents a quarter of all EU emissions and yet the sector is not part of the ETS. In 2011, The European Commission presented its first comprehensive strategy for meeting challenges in the transport sector with the influential white paper entitled 'Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system'.

The paper states that 'A modern transport system must be sustainable from an economic and social as well as an environmental viewpoint'. It contains a roadmap of 40 concrete initiatives to undertake in the coming decade. Furthermore, the white paper aims at dramatically reducing Europe's dependence on oil imports and cutting carbon emissions by 60 percent by 2050 (European Commission, 2011).

The Commission announced that key goals will include:

- Eliminating the use of conventionally-fuelled cars in cities.
- A 40 percent use of sustainable, low carbon fuels in aviation and a minimum cut of 40 percent in shipping emissions.
- A 50 percent shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport.
- All of which will contribute to a 60 percent cut in transport emissions by the middle of the century.

This white paper serves as a far reaching position paper, but contained few concrete measures on how to achieve these goals. As a follow-up, EU Strategy for Low-Emission Mobility was launched in the summer of 2016 (see below).

In January 2014, The EC published its Communication: A policy framework for climate and energy in the period from 2020 to 2030 (European Commission, 2014b), along with a Proposal revising the EU Emission Trading System. The Communication, which sets out the 2030 framework, includes a target for reducing GHG emissions by 40 percent compared to 1990 levels. Furthermore, the Communication includes an EU-wide, binding target of 27 percent for renewable energy share in the energy mix and a renewed commitment to energy efficiency.

The Communication (European Commission, 2014b), goes on to state that biofuels produced from food, oil or sugar-based feedstocks will not receive 'public support' after 2020. There are no specific targets set for the use of biofuels in this Communication. The EC explains this omission by stating that the future of EU transport development should be based on alternative, sustainable fuels as an integrated part of a more holistic approach to the transport sector. In other words, first generation biofuels will have a limited role in decarbonising the transport sector.

European heads of state and government confirmed the EC's Proposal by reaching a deal on the 2030 Framework for Climate and Energy, in an effort to maintain what the EU sees as its global leadership on the climate change issue.

The 2030 framework is based on three specific targets:

- Reducing greenhouse gas emissions by 40 percent.
- Increasing the share of renewable energy to 27 percent of total energy consumption.
- Improving energy efficiency by 27 percent.

The three targets outlined above will be compared to 1990 levels.

The Commission will present its Renewable Energy Package by the end of 2017, which may suggest revisions to both the Renewable Energy Directive and the Fuel Quality Directive.

The EU Strategy for Low-emission Mobility was presented in July 2016 (European Commission, 2016). This strategy outlines the future direction of what was formerly discussed as the decarbonisation of the transport sector. The focus on mobility expands efforts to also include behavioural aspects and wider perspective on transport modes. The EU Strategy for Low-emission Mobility is a positive strategy and focuses mainly on opportunities;

> *The shift towards low-emission mobility has already started globally and its pace is accelerating. It offers major opportunities. It is an opportunity for European car manufacturers to modernise, embrace new technologies more strongly and regain trust of consumers. It is also an opportunity for other industries and manufacturers to drive global standards and export their products. It is also an opportunity for innovative energy companies and service providers, as well as for investors to contribute to sustainable growth and provide new jobs.*
>
> -European Commission (2016) A European Strategy for Low-Emission Mobility.

Nevertheless, the strategy acknowledges that development is too slow. It appears that the target of 10 percent renewables in the transport sector will not be met by all Member States. Hence additional measures are proposed. For example, there is a renewed focus on energy efficiency in the transport sector, including the rapid development of digital mobility solutions and multi-modality for both people and goods.

Other points highlighted in this strategy are fair pricing and consumer awareness. Raising consumer awareness through the labelling of vehicles is discussed, which would allow for a more transparent view of the transport sector. Additionally, there is a strong focus on developing testing methods given the car industry's failure to provide relevant tailpipe emission measurements. This became increasingly relevant after the US Environmental Protection Agency in 2015 found that diesel engines in Volkswagen cars could detect when they were being tested, and adjust emissions to improve testing results (BBC, 2015). Peugeot and Citroën were the first companies to reveal personal vehicles actual emissions compared to that of the tailpipe certification test according to the New European Driving Cycle (NEDC). Real emissions were, in 2015, on average 50 percent higher than NEDC emissions data.

As stated in the EU Low Emission Mobility Strategy, the post 2020 strategy will focus on a number of key components, such as:

- Infrastructure developments for alternative fuels.
- Digital technologies.
- Better testing and information for consumers.
- Carbon dioxide standards for cars and heavy transport.
- Car labelling and public procurement rules.
- Harmonised tax incentives for low emission vehicles, including removing fossil fuel subsidies.

The EU post 2020 strategy plays an important role in global climate efforts. The 21st Conference of the Parties (COP21) – held in Paris in December 2015 – set the direction for the fight against climate change for the coming period. Before the meeting all countries submitted Intended Nationally Determined Contributions (INDCs). The European Union's INDC pledged to cut GHG emissions by at least 40 percent by 2030 (relative to 1990 levels). In the EU's INDC scenario, energy demand in end-use sectors should decline by approximately 6 percent. In the same scenario, however, oil based fuels remain a significant share of the energy mix in 2030. (IEA, 2015)

In 2015, the European Commission launched its communication on an Energy Union, highlighting five priorities:

- Supply security.
- Integrated energy market.
- Energy efficiency.
- Emissions reductions.
- Research, innovation and competitiveness.

In order to address these priorities, the European Union aims to function as an umbrella, under which different legislation processes create a reliable and transparent governance process, to make sure that energy related action on all levels, regional, national and local level, contribute to the overarching aim of the Energy Union. In that sense, the Energy Union is a set of priorities, to function as benchmarks of guideline, for policies in all areas related to energy to be measured against. Initiatives such as the European Strategy for Low-Emission Mobility, is by that measure a part of the Energy Union strategy.

EU TARGET OVERVIEW

2020

The EU Energy and Climate Change Package (CCP) adopted by the European Council April 6, 2009, lays out EU goals for 2020. The package includes the Renewable Energy Directive (RED), which states the '20/20/20' targets:

- A 20 percent reduction in greenhouse gas (GHG) emissions compared to 1990.
- A 20 percent improvement in energy efficiency compared to forecasts for 2020.
- A 20 percent share for renewable energy in the EU total energy mix.

Moreover, the RED target on the share of renewable energy in transport is formulated as:

- A 10 percent share of final energy use in transport from renewable sources by 2020.

2030

The 2030 Framework for Climate and Energy from October 2014 states the following targets:

- Reducing greenhouse gas emissions by 40 percent.
- Increasing the share of renewable energy consumption to 27 percent.
- Improving energy efficiency by 27 percent.

The three targets outlined above will be compared to 1990 levels.

In contrast to the 2020 goals, there are no specific targets set for the use of renewable energy sources in transport for 2030.

2050

In its white paper from 2011, the Commission announced the following key goals for 2050:

- Eliminating conventionally-fuelled cars in cities.
- A 40 percent use of sustainable, low carbon fuels in aviation
- At least a 40 percent cut in shipping emissions.
- A 50 percent shift from medium distance, intercity road passenger and freight journeys to rail and waterborne transport.
- All of which will contribute to a 60 percent cut in transport emissions by the middle of the century.

3

THE BULGARIAN CASE

Jordan Yankov

Introduction

The Bulgarian transport sector has a profound impact on the energy security and environmental challenges faced by the country. The import of fuels consumed by transport vehicles accounted for the major share – 47%[1] – of the import dependency index in 2013, which has come down to below 40%[2] in recent years. At the same time, road transport accounts for about 16%[3] of carbon emissions, despite the fact that carbon and energy intensity of the economy is very high.

Current fuel use in the Bulgarian transport sector

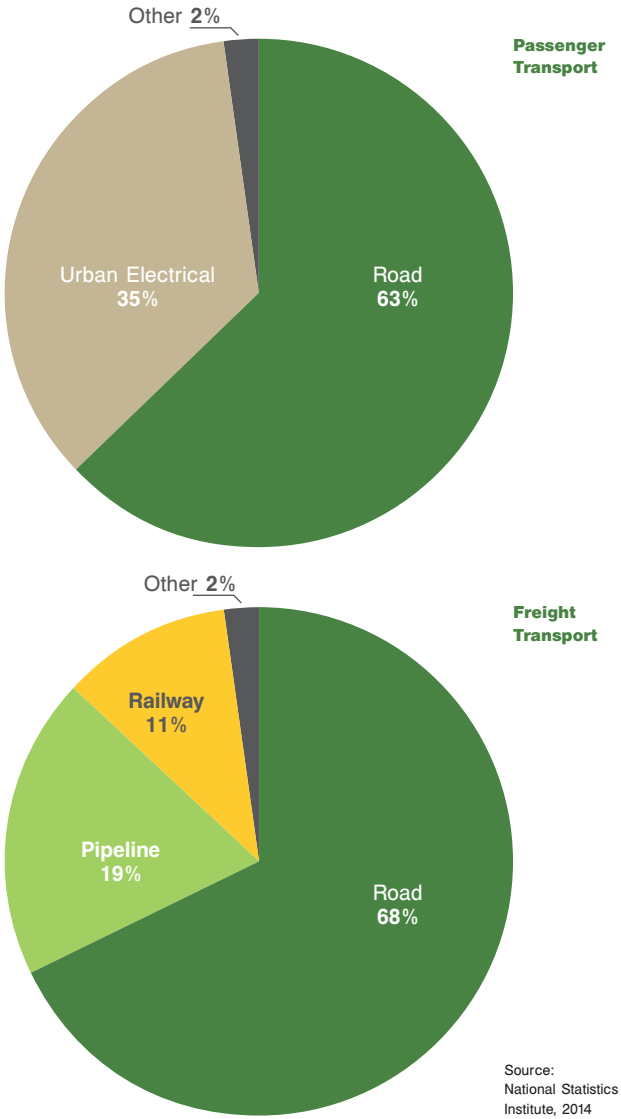
The transport sector is dominated by road transport, which carried 68% of goods and 62% of passengers in 2015.[4]

The country has a 5,435 km railway system but the share of the passenger railway transport is remarkably low. In goods freight, we can find a similar underperformance of the railways compared to road transport, although on a smaller scale. This could be regarded both as a major factor contributing to the country's energy dependence on imported oil, and at the same time as an existing potential to boost energy independence and to reduce carbon emissions.

Bulgarian statistics show a below EU average number of vehicles per capita. It can be expected that the potential increase in the passenger fleet would contribute to the import of crude oil and to an increase in carbon emissions. There are no detailed data on the age of the passenger vehicles fleet but some publications from 2011 suggested that more than 59% of the cars were 15–20 years old, contributing substantially to energy dependence on oil imports and to carbon emissions in the road transport sector. The vehicle fleet has steadily increased over the last four years along with the GDP recovery,[5] see Figure 1.

The country's entire road transport depends on crude oil imports from outside of the EU.[6] The biggest share comes from Russia, followed by a large margin from other countries.

Figure 1:
Share of transport modes in Bulgaria.

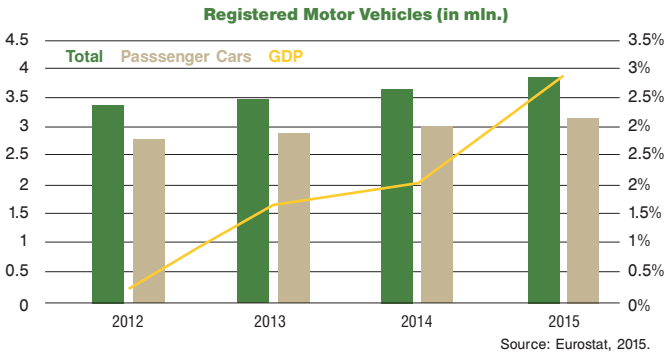


Source: National Statistics Institute, 2014

The imported crude oil is processed in the only Bulgarian petroleum refinery, owned by Russian Lukoil.

The annual consumption of oil fuels correlates with the dynamic of the global economy and with oil prices. Diesel has the largest share in transport fuel consumption, almost twice that of gasoline. There is no available official statistic for vehicles equipped with gas or methane installations, but in some media publications it is suggested that they number about 25% of all registered passenger cars. After processing in the Lukoil refinery, more than half of the imported crude oil is re-exported as petroleum fuels for transport and heating. The rest is sold to the local transport sector. In recent years, there has been an increase in imported fuels, mainly from Greece and Romania.[7]

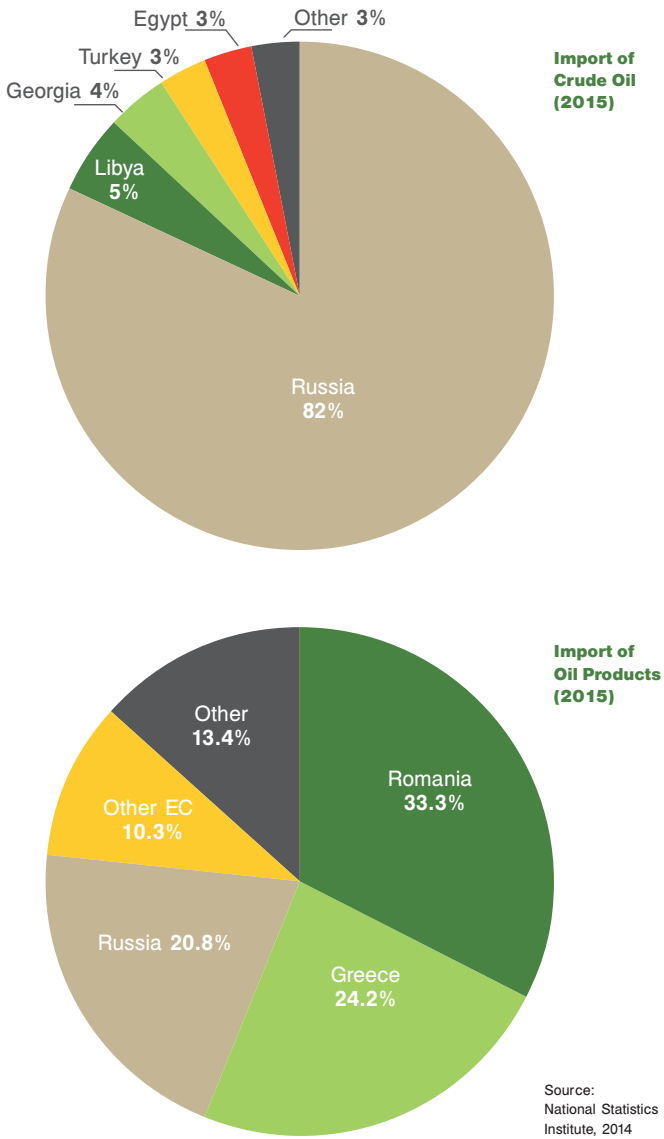
Figure 2:
The vehicle fleet steadily increased in the last four years along with the GDP recovery.



Source: Eurostat, 2015.

The Bulgarian oil fuels market is relatively small, dominated by the production of the Russian company Lukoil, which also operates one of the largest retail chains of gas stations. At the same time, the volume of sold petroleum products is affected by the purchasing power of the consumers, which is low by European standards. Both of these factors contribute to the observed levelling of consumer prices and the widespread accusations of a cartel existing between the large retailers. Such accusations are very hard to prove but most of the entire price levelling is probably due to lack of interest by

Figure 3:
The total share of imported oil products to Bulgaria from EU countries is 67.8% but most of these are processed from crude oil originating outside the EU.



Source: National Statistics Institute, 2014

large importers to compete in such small a market, as well as the high operating retail costs.

The production inefficiency of the Lukoil refinery also contributes to relatively low profit margins in the sector, and thus to an inability to offer more diverse market strategies.

According to the Energy Taxation Directive (2003/96/EC) the excise duties on diesel and gasoline are 0.330 €/l and 0.363 €/l, respectively. All fuels are subject to 20% VAT, which is the uniform rate in Bulgaria.[8]

The CO_2 emissions generated from the road transport are relatively low and stable, influenced mainly by the consumption of petroleum fuels. However, the emissions dynamic in recent years reflects the improvement in cars' efficiency and the steady introduction of new cars, which help to maintain emissions at the same or even lower level. This could also be attributed to the effects of measures in the national programme for lowering carbon emissions from the road transport sector.

Political targets in the Bulgarian transport sector

In 2012, the Council of Ministers approved the Third National Action Plan on Climate Change for the Period 2013–2020 (NAPCC).[9] The policies for the reduction of GHG emissions in the transport sector were outlined as one of the major efforts in the NAPCC's overall measures. A target was set that in 2020 the increase of GHG emission generated by the sector should not exceed 47.2% as compared to 2005 levels. This scenario includes the effects of all policies, set at the different national levels, that are aimed at tackling the GHG emissions in transport. According to this plan, which was quantitatively assessed in 2009, the CO_2 in 2015 emission should not exceed 9,390,000 t. The latest data show that this target has been overachieved, since the actual quantities of CO_2 in 2014 were 7,945,238 t, and in all previous years, including even the target for 2010, were not exceeded. NAPCC recognizes that 'One of the biggest challenges is to reduce the dependence of the transport system and the Bulgarian economy on oil'. Pursuing this goal, the following main groups of measures were set:

Priority axis 1: Reduction of transport emissions

- Rehabilitation and modernization of the existing road infrastructure to ensure optimum speed and optimum driving modes of automobile engines;
- Introduction of intelligent transport systems along the national and urban road network;
- Increasing the share of biofuels;
- Developing and promoting the use of 'hybrid' and electric vehicles.

Priority axis 2: Reduction of fuel consumption

- Reduction of the relative share of trips with private motor vehicles through improvement and development of urban public transport and development of non-motorized transport;
- Developing and promoting the use of bicycles;
- Fiscal policy to encourage economies and to limit consumption of conventional fuels through: tax incentives to manufacturers and users of electric vehicles; more efficient implementation of the 'polluter pays' and 'consumer pays' principles;
- Reduction by half (50%) of the motor vehicles using conventional fuels in urban transport.

Priority axis 3: Diversification of transport

- Increasing the share of public electric transport – rail, trolleybus, tram, metro;
- Development and construction of intermodal terminals for combined transport;
- Reduction of cargo intended for transportation by motor vehicles at a distance of more than 300 km by redirecting the cargo to more environmentally friendly types of transport, e.g. railway transport;
- Connecting the central network airports – Sofia, Varna, Burgas, Plovdiv and G. Oryahovitza – with railway lines.

Priority axis 4: Informing and training consumers

- Sustainable transport statistics;
- Informed selection of a transport vehicle;
- Instruction in economic driving.

Current and future transport and fuel policies

Some of these measures, such as the rehabilitation of the road infrastructure, have a longer time frame, and they overlap other government programmes for economic development. However, most measures are specifically directed to road transport. The execution of the NAPCC is implemented mainly by dedicated municipality action plans that are mandatory to all local communities. This is especially important for the four biggest cities, including the capital Sofia, which has the biggest share in both fuel consumption and emissions of GHG. The development of intelligent transport systems is under way, and it is expected that after their start, the reduction in city traffic would lead to significant savings in fuel consumption, lowering GHG emissions and the levels of pollution associated with passenger cars and public transport.

Since 2014 there has been a requirement for diesel fuels to include at least 5% bio-diesel. This measure is in accordance with NAPCC and EU policies but until the development of third- and fourth-generation biofuels we cannot expect further reductions of GHG emissions and a boost of local fuel supplies through this requirement.

There are existing initiatives to support electric vehicles, but their main impact will be directed to public city transport. Their introduction into the passenger cars fleet can be expected to be a slow process because of the low consumer purchasing power and the absence of the required infrastructure. It could be expected that passenger cars with hybrid engines will have a better prospect, and their number has already started to increase, although not at the desired rate.

Reduction of GHG emissions in the transport sector is also briefly mentioned in the National Energy Strategy until 2020.[10] However, in this document the transport sector is not analysed as an integral part of the national energy system. Thus, the supply of natural gas is recognized as the key issue regarding national energy security but there are no outlined policies that tackle the same issue with the supply of crude oil and petroleum products. Reducing the economy's dependence on imported oil and oil products is regarded mainly as a side effect of the measures directed to combating GHG emissions, rather than as a well-structured policy programme, which requires identification of alternative sources of supply.

Challenges for the Bulgarian transport sector

SUSTAINABLE FUNDING AND FUTURE POLICIES DEVELOPMENT

The funding of the respective projects that are in accordance with the outlined measures is coming mainly from EU funds. It should be emphasized that the NAPCC is set to expire in 2020, after which the EU funds will not be available. This raises questions about the long-term sustainability of the present active policies, and how a new programme would be set and executed after the expiry of the NAPCC. This problem is further complicated by the highly centralized model of distribution of public funds, which restricts the initiatives of municipal authorities to identify local renewable resources that can boost the security of energy supplies in the transport sector and reduce GHG emissions.

ALTERNATIVE SOURCES OF SUPPLY OF OIL AND OIL PRODUCTS

The transport sector is effectively excluded from the national energy strategy in terms of the security of energy supplies, which makes it very challenging to establish long-term projections for development of the sector under current or alternative policies. The fact that almost all of the imported oil and oil products originate from a single country is a security threat that requires the development of special policies. Energy efficiency is only one of the possible ways to tackle this problem, and this cannot eliminate the need for the identification of alternative sources of supply. In addition to this, there is no awareness of the tendency for all energy sectors – including road transport as a major consumer of energy products – to be mutually technologically interdependent. One of the possible solutions to overcome the dependency on a single source of crude oil is to boost the number of electric cars or hydrogen cars in the near future.

TRANSFER AND DEVELOPMENT OF INNOVATIONS

Long-term policies regarding the security of energy supplies and reducing GHG emission from transport sector require dedicated efforts to be made in the development of innovative technologies and the transfer of such technologies. Currently this process is managed mainly through existing EU programmes related to science and innovations but they address the general framework on a European level. We need a focused institutional mechanism on all national levels that can bring together stakeholders from business, academia and public authorities in order to identify the specific needs and the existing local and regional potential of the country to diversify the energy supplies in the transport sector and to lower GHG emissions.

Conclusion

Bulgaria energy import dependency is below the EU average and its GHG emissions are in line with targets set in national programmes and policies. However, further efforts are needed, especially in securing alternative energy supplies in the transport sector, as well as in the development of long-term sustainable policies and mechanisms for lowering the country's dependence on imported crude oil as well as lowering GHG emissions.

4

THE FRENCH CASE

Sara Kymenvaara

Introduction

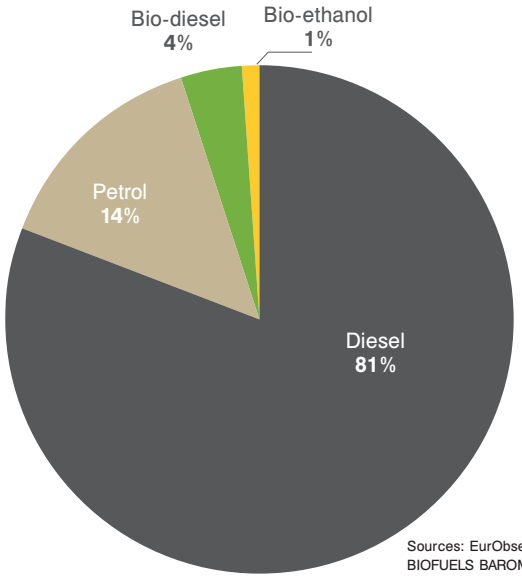
Explicit policy on climate change in France has been emerging since 2004 as a part of the development of environmental policy through a so-called 'integrated approach', the objective of which is to promote sustainability in French policy and legislation. For climate change, these 'Grenelle round table discussions' have led to the acts 'Grenelle I'[1] and 'Grenelle II'"[2] , where the former can be characterized by the setting up of objectives for the national climate change work for 2020, and the latter contains the substantive requirements. The new Energy Transition Act[3] was adopted in August 2015 and contains new, long-term objectives for general energy and climate change policy, as well as for the transport sector in particular. The Act can be deemed to implement the French commitments under the recently adopted Paris Agreement.[4] Among the EU Member States, France is a major producer and consumer of biofuels, and since 2005 has been a forerunner as to specific legislation to promote and regulate the use of biofuels.

Current fuel use in the French transport sector

In 2014, France consumed 3,227 kilotonnes (kt) of biofuels [5] for blending in motor petrol and diesel, which is the highest consumption among EU Member States (of this, 662 kt was imported). In the same year, France consumed 7,575 kt of petrol, while the figure for diesel was 45,130 kt.[6]

At a production of 2,737 kt biofuels, France is the second largest biofuel-producing country in the EU after Germany, and globally in fifth place in bio-diesel production.[7] First-generation bio-diesel accounts for 80% of the said amount and correlates with the high number of diesel vehicles in France. Biofuel production currently takes up approximately 6% of the effective arable land (mainly by oily crops such as sunflower and rapeseed), while only a small amount of biofuels are produced from recycling waste oils.[8]

Figure 1:
Fuel consumption in France in 2014.



Sources: EurObserv'ER, BIOFUELS BAROMETER 2015 and IEA, Energy Statistics of OECD Countries, 2015.

Political targets in the French transport sector

Grenelle I contains an objective to reduce GHG emissions from transport by 20% by 2020 compared to 1990 levels. The reduction objective is evaluated every 5 years, in connection with which new actions to achieve the numerical target are planned. For public transport, Grenelle I's objective is to reduce dependency on fossil fuels and strengthen energy efficiency by developing an integrated transportation system based on a variety of transport modes, particularly favouring rail and water transport. Grenelle I recognizes the following sub-areas, actions and objectives:

- Prioritized development of rail instead of road and air transport, particularly high-speed trains (Article 12);
- Sustainable transport in urban areas, and promotion of so-called 'activity area transport plans';
- State support to innovations reducing vehicles' emissions and fuel use;
- Promotion of reduced parking costs for low-emission vehicles by local authorities, and
- Development of national transport infrastructure (b-e based on Article 13);
- The Energy Transition Act contains a general target to reduce the use of fossil fuels by 30% by 2030 compared to the 2012 levels,[10] and a greenhouse gas emission reduction target of 40% by 2030 compared to 1990 levels, and 75% by 2050.[11] The Act sets out an objective of a 15% share of biofuels by 2030, and to this end the state is obliged to present a strategy to promote second-generation biofuels.[12]
- For transport, the Energy Transition Act sets up an objective to prioritize low-emitting modes, increase vehicles' energy efficiency, and the use of renewable energy in transport. The Act also obliges the state to present a 'Strategy on Clean Mobility', which should contain a proposal on, inter alia, the development of a market for alternative fuels and the deployment of related infrastructure, an optimized operation of vehicles and networks, enhancement of modal shifts, and collaborative modes of transport.[13] The Strategy is expected to be published in November 2016, at the same time implementing the Directive on Alternative Fuels Infrastructures.[14] The Energy Transition Act also sets up an objective to achieve 7 million charging points for electric vehicles by 2030.[15] Another national objective for transport is to achieve 2 million electric cars by 2020.
- Apart from these nationally formed objectives, France is bound by the 10% share of renewables in transport by 2020 as stipulated by the Renewable Energy Directive. In addition, France is, under the EU Effort Sharing Decision,[16] obliged to reduce greenhouse gas emissions by at least 14% by 2020 compared to 2005 levels from the sectors outside emissions trading to which transport belongs.

Current and future transport and fuel policies

French policy on climate change is characterized by enacting national political targets in law. These objectives are thereafter typically supported by state decrees, which stipulate the substantive obligations and concrete means by which the objectives are to be promoted.

VEHICLE TAX

French vehicle taxation is composed of a registration tax, an annual vehicle tax for privately owned cars and a tax for company cars. Since 2008, the emissions based *bonus-malus* element of the registration tax supports the purchase of low-emission cars with a bonus payment of up to 10,000 EUR, while high-emission vehicles are liable for a lump-sum tax. The cost of installing a charging point for electric cars is deductible from income tax by up to 30%. Based on the Energy Transition Act, the *bonus-malus* system should be developed to reach the nationally formed target of '2 litres of fuel per 100 kilometres.

FUEL TAX

French fuel taxation is, in addition to normal VAT, based on an excise tax for energy products called 'TICPE' (*La Taxe Intérieure de Consommation sur les Produits Énergétiques*).[19] Based on the Energy Tax Directive, the Commission has granted to France an exemption from energy tax for biofuels under the TICPE scheme, which is in force until the end of 2016. In 2015, the TICPE rates were slightly increased to finance transport infrastructure projects. The TICPE rate for petrol is higher than that for diesel.[20]

Fuel distributors, whose fuels' biomass adheres to the sustainability criteria set out by the Energy Code (*Code de l'énergie*),[21] can apply for a reduction of the TICPE tax, and these exemption permissions (*agrément*) are in force for up to 6 years. In return, the fuel distributor is obliged to place on the market a defined amount of biofuels,[22] and this mechanism is intended to increase the amount of biofuels blended into fossil fuels. The Government decided, however, to gradually remove biofuels from this tax exemption, the rate of which was zero by the end of 2015.[23] In order to further

promote bio-ethanol production, the Government has slightly decreased the E10 TICPE rate, and this is expected to further decrease in 2017. E85 is still largely exempted from the TICPE rates.[24]

A tax for polluting activities TGAP (*La Taxe Générale sur les Activités Pollutantes*) is intended to incentivize fuel distributors' compliance with the blending targets for biofuels, which are 7% for petrol and 7.7% for diesel, and are based on the lower heat value (LHV).[25] A fuel distributor who adheres to the target(s) is exempt from TGAP tax in proportion to the renewable energy share of sustainable biofuel incorporated into the fuels released for consumption. The TGAP rate is set high, which strengthens the distributors' incentive to comply with the said blending targets.

Recently, the foreign bio-diesel industry has been gaining market shares due to new hydrogenation technology and palm oil imports. To counteract this development, and to strengthen the competitiveness of the domestic bio-diesel industry, the French Parliament recently introduced a specific tax on palm oil imports that do not meet the sustainability criteria of the RES Directive.[26]

FREIGHT TRANSPORT

With regard to rail and waterways, the Grenelle I objective is to increase these transport modes for freight transport by 25% by 2022 compared to 2006 levels, and the state is obliged to prioritize these in infrastructure investments. The resources allocated to this end should increase the share of non-road and non-air transports from 14% to 25% by 2022.[27]

In 2014, France was set to introduce a kilometre tax for heavy-duty vehicles (HDVs) (*L'écotaxe kilometer pour les poids lourds*).[28] HDVs weighing over 3.5 tonnes driven on state roads would have been liable for the tax, which was based on the Eurovignette Directive.[29] In October 2014 Minister Ségolène Royal nevertheless cancelled the tax which thus did not enter into force, but a similar tax has been discussed.

OTHER POLICY INSTRUMENTS

There exist many types of policy instruments in the French transport sector with an impact on greenhouse gas emissions, and this section only mentions a few.

- Local authorities are obliged to arrange public transport, and have since 1971 the possibility of charging a transport tax (versement transport) to employers with more than 9 employees in towns or activity areas with more than 10,000 inhabitants.[30] The tax covers approximately 40% of costs for public transport (information for year 2013), and thus promotes accessibility to public transport.
- Urban transport plans are compulsory for areas with more than 100,000 inhabitants, and set up the principles for passenger and freight transport of that area and seek to ensure the balance between travel demand and the environment and human health. The plans shall, inter alia, decrease the amount of passenger cars traffic, promote the energy efficiency of public transport and prepare the necessary charging infrastructure for electric vehicles.[31]
- The urban transport plans should promote the drawing up of so-called 'mobility plans' by companies, schools and activity areas and promote the use of public transport by commuting workers.[32] Mobility plans are intended to promote the reduction of greenhouse gases, transport safety and accessibility, but have also had a positive impact on the image of those companies who draw up such a plan. For rural areas, the Energy Transition Act introduced the possibility drawing up 'rural mobility plans',[33] which are also promoted in land use planning.[34]
- The Energy Transition Act lays down a general obligation for the state to promote the increased use of public transport by shifting road transports to rail and non-motor vehicles (Article 36).

Challenges for the French transport sector

For the French transport sector, the main challenge will be achieving the ambitious sectoral and sub-sectoral targets and objectives set out by legislation (mainly Grenelle I and the Energy Transition Act). Minister Ségolène Royal has hitherto published four decrees containing substantive means

to achieve the Energy Transition Act objectives,[35] but further concrete and substantive policy action is required.

The French exemption from energy tax granted by the EU Commission poses a challenge to the French promotion of biofuels through TICPE rates because of its time limitation (current until the end of 2016), and thus faces a similar situation as Sweden in this sense. Combined with French presidential elections in spring 2017, biofuels legislation is not likely to dramatically change over the coming 1–2 years. The main apparent change would be the slow shift in TICPE rates for petrol and diesel, in an effort to balance outputs and decrease the share of diesel cars in France, as their large numbers have been connected to health problems.

Conclusion

The French system for biofuels taxation (the TICPE and TGAP schemes) takes the shape of both a carrot and a stick aimed at the fuel distributor's adherence to sustainability requirements and blending targets. The biofuel target set by the Energy Transition Act at 15% by 2030 on an LHV basis has been made without waiting for EU policy for the period between 2020 and 2030, but without a differentiation between first- and second-generation biofuel production.

France has stated ambitious climate targets for the transport sector directly into law, and these has been equipped with certain substantive policy solutions in many transport sector issue areas. It remains to be seen whether the main emission reduction objectives for 2030 and 2050 can be achieved with these instruments or if additional measures will be needed. The TGAP tax is, nevertheless, likely to remain the main instrument for the promotion of biofuels in the future, and continuous adjustments are likely.[36] The future development of French transport sector legislation is equally dependent on EU legislation, such as the Effort Sharing Decision for the period between 2020 and 2030, including an anticipated legislative package on low-carbon mobility,[37] as well as the new Renewable Energy Directive (REDII), both of which are currently being prepared by the EU Commission.

5

THE SLOVENIAN CASE

Aleksander Aristovnik

Introduction

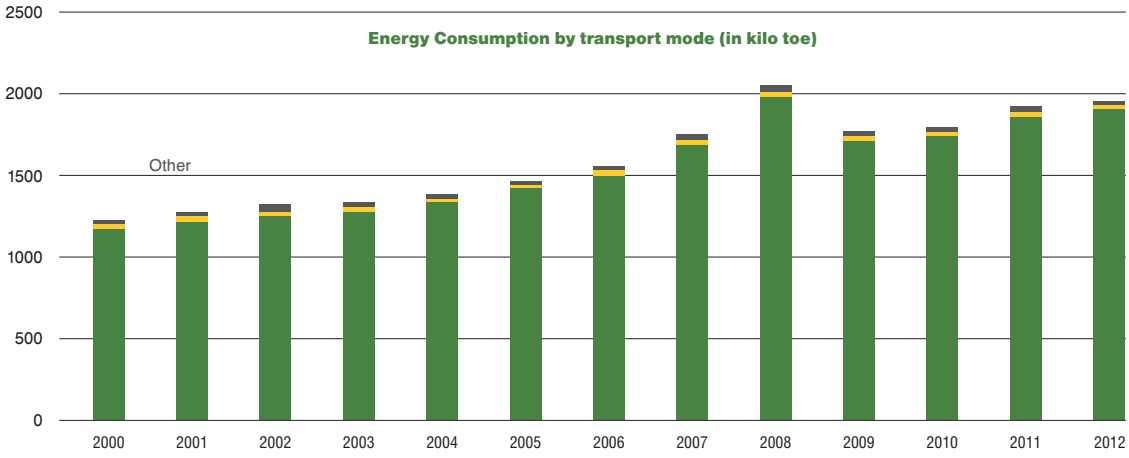
Slovenia is an emerging market economy with extensive personal and freight traffic flows. In particular, an increased volume of traffic occurred after Slovenia joined the EU and the free movement of goods and people was introduced. This has resulted in a greater volume of traffic, infrastructure wear and tear and in more pollution. This calls for policymakers to carry out certain measures in order to ensure both a better infrastructure in terms of quality and coverage as well as a pollution reduction.

As a response to these issues, the EU adopted a set of binding legislations to ensure its climate and energy efficiency objectives and strategies stretched towards the year 2020, which will be extended to 2030 (see EC, 2016). Transport is a key sector in this regard, accounting for around 40% of end-use energy in Slovenia. In particular, the government of the Republic of Slovenia finalized and published the Transport Strategy of Slovenia, in which they established certain activities in the transport sector aimed at introducing low-carbon technologies and sustainable transport, and ensuring the same or a better quality of life with fewer kilometres driven. Furthermore, the envisioned transport strategy in Slovenia to reduce energy consumption includes the modernization of and investment activities in the transport infrastructure. Those measures can ensure a reliable, secure, cost-competitive and environmentally sound transport system, which will follow the principles of sustainable and balanced regional, national and European-specific development and interests (see Official Gazette RS, št. 58/2006; Transport Development Strategy in the RS, 2015).

Current fuel use in the Slovenian transport sector

According to the most recent available statistics, the end use of energy in the transport sector of Slovenia reached 1,953 million toe in 2012. In comparison with previous years, the use of energy in this sector increased by 2%, whereas compared to the year 2000 it increased by almost 59%. As in other EU countries, the bulk of energy consumption in Slovenia is connected with the road transport sector (i.e. 97% of

Figure 1: Use of energy by modes of transport in Slovenia (2000–2012).



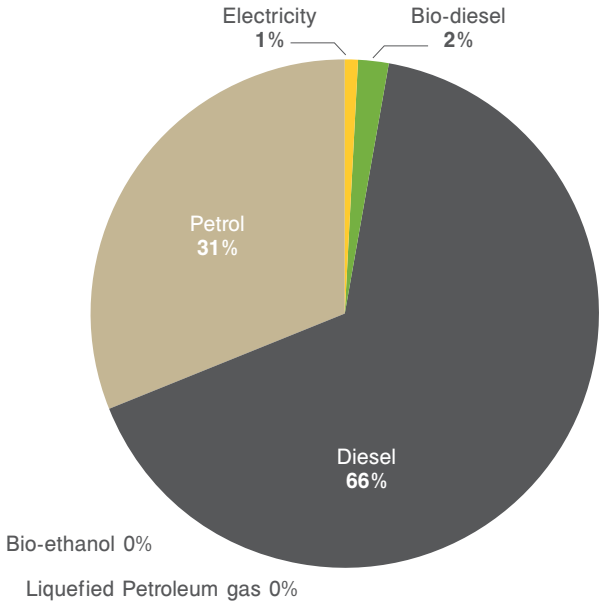
Source: SEA, 2014.

total energy consumption). The share of energy use in other sectors combined is marginal (see Figure 1). Moreover, the use of final energy in the transport sector is highly correlated with economic fluctuations, which explains the drop in energy consumption in 2009. Furthermore, the economic and financial crisis also influenced the investment efforts focused on the transport sector (SEA, 2014).

The fuel market in Slovenia is oligopolistic. The oligopolistic nature of the market is supported by the fact that there were only nine traders in 2014 that were liable to pay tax excise duty. Moreover, the market shares of the two biggest distributors, Petrol and OMW, reveal that the market of petroleum products is even duopolistic. In fact, these two distributors control approximately 87% of the Slovenian market in petroleum products. Currently, Slovenia determines margins of trades with an upward limitation and maximum limit of price before tax is determined by Decree, setting prices for petroleum products. Such a model has been in force since 2000 (Ministry of Economic Development and Technology, 2015).

The current fuel use in the road transport sector shows a high and prevailing dependency on conventional sources of energy generation (see Figure 2). This implies that the implementation of measures to change the energy demand behaviour in the road sector is sluggish and ineffective in Slovenia. Thus, it remains uncertain as to when the technological improvements in fuel efficiency and enhanced aware-

Figure 2:
The share of final energy consumption in transport in Slovenia (2014). (% of total, based on kilo toe)



Source: SEA, 2014.

Table 1:
The share of renewable energy sources in the transport sector (2005–2014).

Country/Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Bulgaria	0.3	0.6	0.4	0.5	0.5	1.0	0.4	0.3	5.6	5.3
France	1.7	2.0	3.6	5.8	6.2	6.1	0.5	7.0	7.2	7.8
Austria	2.8	5.5	6.3	7.5	9.0	8.7	7.7	7.8	7.8	8.9
Slovenia	0.3	0.6	1.1	1.4	2.0	2.8	2.1	2.9	3.5	2.6
Sweden	3.8	4.7	5.7	6.3	6.9	7.2	10.0	12.6	17.0	19.2

Source: Eurostat, 2016.

ness of environmental challenges will change the pattern of the transport sector's energy consumption in Slovenia. As noted in Figure 2, the share of diesel and petrol use combined was around 97% in 2011. This pattern slightly shifted during the recent years since there is a common objective of both the EU and Slovenia to reduce the adverse effects of fossil fuel consumption in transport. This can be achieved by focusing on the following objectives: i) to reduce the demand for transportation; ii) improve the energy efficiency in the transportation sector; iii) increase the share of non-conventional sources of energy; and iv) promote the use of other transport modes (public transport, cycling etc.). These are the main objectives to reduce energy consumption in transport that are contained in the National Energy Efficiency Action Plan 2014–2020 (henceforth AN URE 2020), adopted by the Slovenian government in May 2015.

Furthermore, the share of renewable sources of energy in transport shows a moderate increase in Slovenia (i.e. from 0.3% in 2005 to 2.6% in 2014). This indicates a slow pace in the redirection of the transport sector's energy use and a higher share of renewable energy. In particular, the common target to be reached by all countries in 2020 is for the share of renewable energy in the transport sector to be at least 10% (Directive 2009/28/EC). Slovenia has to make a significant improvement in this area in the coming years. Table 1 shows the share of renewable energy use in the transport sector in five countries subject to this case study research. In particular, Slovenia accounted for the smallest share of all other EU Member States in 2014.

Political targets in the Slovenian transport sector

The general targets in the transport sector in Slovenia are determined in the Resolution on Transport Policy of the Republic of Slovenia, which includes a development plan and an investment scheme up to 2020, with the vision stretching forward to 2030. The main objectives of the strategic document are:

- to increase mobility and accessibility;
- to improve supply to the commercial sector;
- to improve traffic safety and security;
- to reduce energy consumption;
- to reduce costs for users and operators;
- to reduce environmental pollution.

The general emphasis is on more environmentally friendly types of transport and on sustainable mobility. In particular, the basic measures aimed at reducing energy consumption in transport are:

- The updating of the existing transport infrastructure;
- New construction of optimal transport infrastructure;
- Introduction of modern means of transport;
- Implementation of sustainable mobility measures.

These incentives are an upgrade and a continuation of the envisioned measures established in various previous documents, such as the Operational Programme for Environmental and Transport Infrastructure Development 2007–2013, the Renewable Energy Action Plan 2010–2020 and the Energy Efficiency Action Plan 2008–2016. The aforementioned political targets for Slovenia are also consistent with the renewed strategic targets and requirements imposed by the European Commission (The Directive 2012/27/EU).

Current and future transport and fuel policies

The vision of transport policy in Slovenia in the next 15 years looks to secure the sustainable mobility of people and the supply of the economy, ensure transport safety, reduce energy consumption and costs for users and operators and cut environmental impact (*The Slovenia Times, 2015*). Therefore, future transport policy in Slovenia will be focused especially on investments in infrastructure, whereby investments in roads as well as investments in railways are included in order to ensure the development of the Trans-European Transport Network (hereinafter TEN-T network). The most prominent project related to the development of this network is construction of a second track of the Koper–Divača railway, since it represents an integral

part of the TEN-T network. Some progress in this direction has already been made. In fact, the building permit for this project was issued in March 2016 (Slovenian Infrastructure Agency, 2016).

A future fuel policy is under discussion in Slovenia. The discussion is about whether to support the liberalization of the fuel market or not. Slovenia is the only exception in the EU. Actually, in all other EU countries there is a free formation of retail prices of petroleum products, which means that the prices are fully liberalized and the role of the government is reduced to only determining taxes and excise duties. Prices for customers are formed on the basis of competition between existing traders (Ministry of Economic Development and Technology, 2015). Due to the increasing promotion of market competition in the EU, Slovenia should also focus on the possibility of liberalizing fuel prices in order to nullify the oligopolistic or duopolistic structure of its fuel market. Some progress in this direction has already been made. In 2016, Slovenia started with a partial deregulation of the fuel price market, since prices of 100-octane unleaded petrol and heating oil were deregulated from April to July, which represents only one step forward in the direction of full liberalization of fuel prices.

Challenges for the Slovenian transport sector

One of the most important challenges is the liberalization of fuel prices. In fact, Slovenia is the only one among the 28 EU countries that have a regulated fuel price market. Deregulation of the fuel price market would lead to higher competitiveness in the Slovenian fuel market and consequently prevent individual smaller suppliers of petroleum products from leaving the Slovenian fuel market. In 2016, Slovenia took a step toward deregulation of fuel prices with the implementation of a Decree setting prices for certain petroleum products (Official Gazette RS, no. 26/16), which came into effect on 9 April 2016 and was valid for two months. It prescribed the pricing of 95-octane unleaded petrol and diesel fuels while prices of other petroleum products (100-octane unleaded petrol and heating oil) were from that point determined by traders themselves. The aforementioned regulation (Official Gazette RS, no. 39/16) was then extended for one month and expired on 9 July 2016. Yet this is only a step towards the liberalization of the fuel market. However, in order to provide the full liberalization of fuel prices some further debates and analyses would be necessary.

Another challenge is future investments in infrastructure. When planning investments in highway infrastructure Slovenia needs to pursue the following objectives: completion of investment in highways and express roads on which construction has already started, and rational investment in existing infrastructure. The aforementioned investments would ensure the elimination of bottlenecks and contribute to the satisfaction of transport needs. This challenge is also consistent with the development of the so-called TEN-T network (Groznik & Damijan, 2013). Namely, in the European Union guidelines for the development of the TEN-T network it is emphasized that the transport network should be developed through the creation of new transport infrastructure, through the rehabilitation and upgrading of existing infrastructure and through measures promoting its resource-efficient use. In these guidelines it is also emphasized that in specific cases, due to the absence of regular maintenance in the past, the rehabilitation of rail infrastructure is necessary (Union guidelines for the development of the trans-European transport network and repealing (Decision No 661/2010/EU). However, in Slovenia not only the rehabilitation of the rail infrastructure but also the establishment of strategically important connections are needed. Currently, the most prominent project is the construction of the second track of the Koper–Diva a railway. In fact, this section is very important since it represents an integral part of the TEN-T network. The Ministry of Infrastructure has taken a step in this direction by submitting an application for a building permit to the Ministry of the Environment and Spatial Planning in December 2015. The application was issued in just over three months on 31 March 2016 (Slovenian Infrastructure Agency, 2016).

The third challenge for the transport sector in Slovenia refers to the promotion of alternative fuels for transport. This consequently leads to the decrease in the use of conventional fuels and a better impact on the environment. One

of the sub-challenges in this regard is without doubt the establishment of adequate infrastructure for electric vehicles i.e. the establishment of a sufficient number of charging stations – according to the latest available data there are only 202 charging stations in Slovenia (Elektro Ljubljana, 2016). In some more populated areas, there are enough charging stations, but some rural areas are deprived of adequate infrastructure, which is needed for electric vehicles. The aforementioned may be a reason for why the popularization of electric vehicles has not yet occurred in Slovenia. According to the Statistical Office of the Republic of Slovenia, there were only 288 electric personal vehicles (SORS, 2015). Therefore, the future challenge is to promote the usage of electric vehicles either with the appropriate infrastructure or with different subsidies. On the other hand, the second sub-challenge is to reduce pollution. The future challenge will be to pursue the environmental objectives that are set for the whole of the EU.

Conclusion

The introduction of measures in the Slovenian transport sector towards the year 2020 are oriented chiefly towards improving vehicle efficiency, promoting technologies and fuels that produce low CO_2 emissions, improving the quality and accessibility of public transport in order to increase their use, optimizing transport and promoting non-motorized forms of transport. However, the question remains as to whether the planned measures will lead to Slovenia meeting the targets and requirements imposed by the European Commission (The Directive 2012/27/EU). Eventually, it seems that Slovenia has to significantly improve its energy efficiency in the transport sector. Thus, ambitious measures have to be implemented to anchor the Slovenian transport sector and its energy use towards a more sustainable development for economy and climate.

6

THE SWEDISH CASE

Sara Kymenvaara

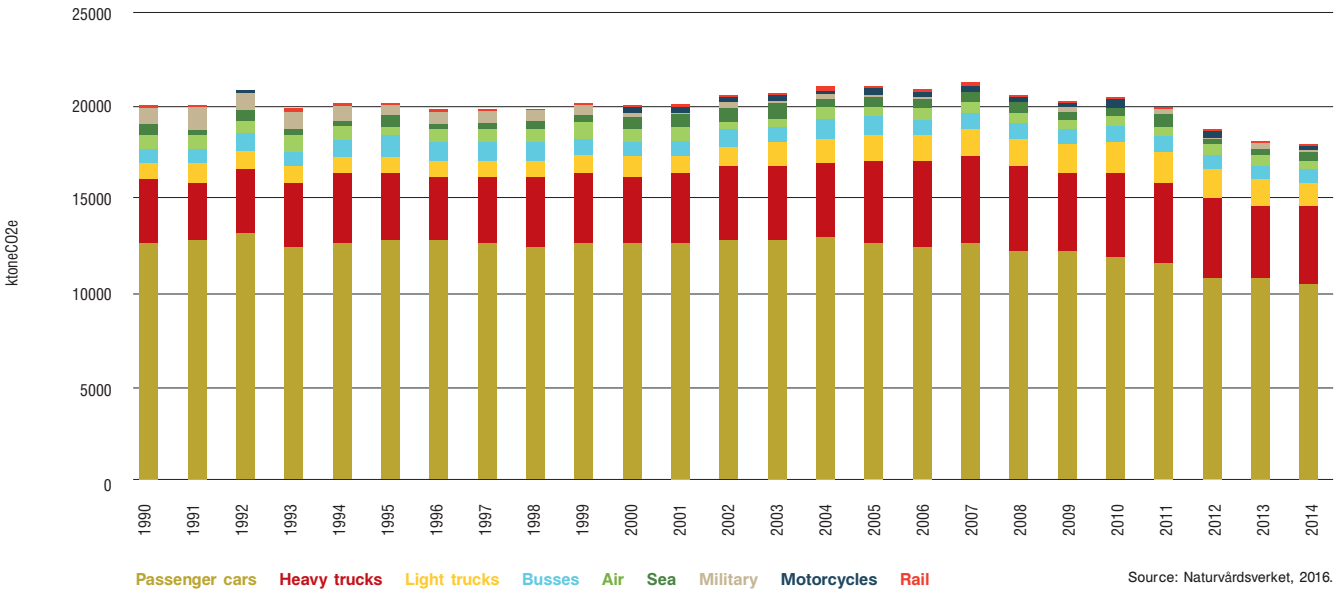
Introduction

Since 1999, the Swedish environmental objective 'limited climate impact' (Swe: *begränsad klimatpåverkan*) has been one of 16 environmental policy objectives steering the Swedish environmental policy work, which makes up the background setting for the national climate change policy strategy. In 2009, the climate change objective for transport was, politically further refined into a sectoral target formulated as a 'fossil-free vehicle fleet by 2030', hereafter referred to as 'the 2030 goal'. Examining the means by which the 2030 goal could be reached, an extensive governmental study finalized in December 2013 concluded that multiple policy instruments in various transport sector issue areas must be introduced in order to achieve the full emission reduction potential, which was estimated at 90%. Over the last few years, emissions from Swedish transport have decreased, as can be seen in Figure 1 below. The change is mostly due to the fact that emissions from passenger cars were 17% lower in 2014 compared to 1990. However, the necessity of such actions is lately strengthened by the fact that the national growth in car ownership and travelled vehicle kilometres is deemed to offset the emissions saved by improved emission performance of new passenger cars and vans.[3]

Current fuel use in the Swedish transport sector

The importance of taking action towards the 2030 goal is further underlined by recent statistics on energy use in the

Figure 1:
GHG emissions from Swedish transport have come down during the last few years. Emissions from passenger cars decreased by 17% between 1990 and 2014.



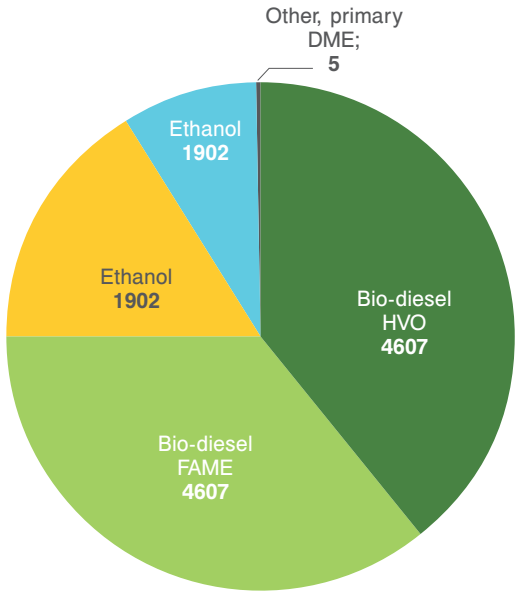
Source: Naturvårdsverket, 2016.

Swedish transport sector, which during 2015 peaked at its highest figure of the five preceding years (124.6 TWh), of which 93.6% (i.e. 94.8 TWh) is consumed by road transport. This signals a clear turn in the sector's energy use, which had been decreasing during the period 2010 to 2013. Bio-diesels represent the highest share of the said increase, of which HVO (Hydrogenated Vegetable Oils) increased the most. Renewable energy use in the transport sector is subject to the binding EU requirement[4] of 10% renewable energy in the transport sector by 2020, and already in 2013 this share was estimated at 15.6% in 2013 and 23.4% for 2015.[5] This is the highest share of all EU Member States.[6]

The use of petrol in the transport sector is decreasing, and in 2015 the amount used by road transport was 3,487,000 cubic-metres excl. ethanol blended petrol (approximately 32 TWh), whereas the corresponding figure for 2011 was 4,930,000 cubic-metres. At the same time, the market has experienced an equivalent reduction in ethanol (currently at 258,000 cubic-metres) as well as ethanol-driven vehicles.[7] In contrast to petrol, diesel consumption has increased since 2008, and is currently estimated at 5,520,000 cubic-metres (approximately 55 TWh), and reflected by a significant increase in the number of diesel passenger cars. However, a large share of the said increase is represented by bio-diesels and not their fossil equivalent.[8]

As stated above, consumption of bio-diesels in the Swedish transport sector has increased, and this is mainly caused by an increase in the blending of low amounts of bio-diesel in fossil diesels (low-blended fuel) For the year 2014 the share of respective fuels was distributed as illustrated in Figure 2 below.

Figure 2:
Biofuels consumption in Sweden 2014, GWh.



Source: 2030-sekretariatet, 2016.

BIO-DIESEL FAME AND HVO

The majority of bio-diesel FAME (fatty acid methyl ester) used in Sweden is imported from Denmark, Australia, Germany and Lithuania, and approximately 80% is used as low blends in fossil diesel. HVO (hydrogenated vegetable oils), the most common biofuel in Sweden, is mainly produced by Swedish and Finnish companies (Preem and Neste), but a small share is also imported from production units in the Netherlands and Singapore. As for the climate standard and sustainability of HVO, 15% of palm oil is used in the Swedish HVO.[9] In contrast to FAME, HVO is a synthetic diesel and therefore fully compatible with fossil diesel, which is why it can be blended into diesel in higher amounts than FAME (high-blended fuel), and obviously a reason for its increased amounts on the market.

BIOGAS

Basically all biogas consumed in Sweden is produced in Sweden by municipal sewage-treatment plants or from household waste, industrial organic waste, slaughterhouse waste and manure. Small shares are also imported from Norway and Germany.

ETHANOL

The main part of ethanol used in transport in Sweden is pro-

duced within Europe (UK, Sweden, France and Ukraine). Both low-blended fuel as well as E85 (high-blended fuel) are decreasing in use, while ED95 is increasing for use in heavy-duty vehicles (HDV), mainly buses and lorries.

HYDROGEN GAS

Hydrogen gas is a newcomer on the global fuel market, and is one of the fuels promoted by the EU Directive on Alternative Fuels' Infrastructure,[10] the use of which is thus expected to increase over a 10-year period. Sweden currently has four filling stations for hydrogen gas.[11]

FOSSIL FUELS

The Swedish transport sector is still largely dependent on fossil fuels for energy, but a decrease in this dependency can be observed; 95% of energy use in transport came from fossil fuels in 2000, while this figure was reduced to 84% in 2014.[12] The use of fossil fuels is, nevertheless, forecast to increase. Fossil fuel imports originate mainly from Russia (45%) and Norway (29%). Natural gas has successively been replaced by biogas.

Political targets in the Swedish transport sector

As mentioned above, the means to achieve the goal of a fossil-free vehicle fleet by 2030, i.e. the 2030 goal, is based on a state investigation that is broadly supported by the majority of the Swedish political parties, but the goal has not been made legally binding. The said investigation has led to certain proposals for policy and legislation amendments, but broad-based policy action is yet to be seen. The issue areas in which such action should, as prescribed by the investigation's report, be taken are the following:

- Rearrangement of community structures;
- Infrastructure changes to affect the modal shift;
- Energy-efficient vehicles and methods of transport;
- An unambiguous and consistent objective for biofuels;
- Electrification of road transports.[13]

Apart from the 2030 goal, Sweden is bound by the 10% share of renewables in transport by 2020 as stipulated by the RES Directive. In addition, Sweden is, under the EU Effort Sharing Decision,[14] legally obliged to reduce GHG emissions by at least 17% by 2020 (compared to 2005 levels) from the sectors outside emissions trading, to which transport belongs. This objective was increased nationally to 40% in 2009. Furthermore, the EU 2011 transport white paper sets a 60% emissions reduction target for the year 2050 compared to 1990 levels for the EU transport sector as a whole,[15] but this target is not allocated to individual Member States, let alone made legally binding on an EU level.

Current and future transport and fuel policies

Vehicles' emission performance is regulated entirely by EU regulations. Taxation is, on the other hand, regulated by national instruments, which are considered the most important means by which energy-efficient vehicles are promoted. Among these tax types can be found the vehicle tax, the fuel tax,[17] the premium for so-called 'super environment cars'[18] and taxation on the fringe benefit for cars.[19]

VEHICLE TAX

Swedish vehicle taxation is based on both carbon dioxide emissions and the weight of a vehicle. New, lightweight vehicles are taxed on the basis of their emissions, while older vehicles' taxation is based on their weight. The total tax effect of driving a particular vehicle is, nevertheless, impacted by the type of fuel used, its tax rate, and its possibilities to qualify for tax exemption. The base cost of the vehicle tax was increased to 360 SEK in 2015 with the intention of promoting low-emission cars. Diesel and petrol cars are subject to an add-on of 22 SEK per each gram exceeding 111 grams carbon dioxide emissions, while for ethanol and gas-powered cars the add-on is lower, at 11 SEK. So-called 'environment cars'[20] are exempted from vehicle tax for the first 5 years of use. Diesel cars have a higher vehicle tax than petrol cars, while the diesel fuel tax is lower than tax for petrol.

A recent investigation proposes the introduction of a *bo-*

nus-malus system for new passenger cars in vehicle taxation, proposed to enter into force in the foreseeable future. The malus part, i.e. the tax, would be regulated through the vehicle tax system, while the bonus would be a payment in connection with the purchase of a 'super environment car' at a maximum amount of 60,000 SEK and capped at 35% of the purchase price. The proposal would abolish the environment cars' exemption from vehicle tax.[21]

FUEL TAX

Swedish fuel taxation is largely based on the rules of the Energy Tax Directive, the starting-point of which is that biofuels are taxed with the same amount as their fossil equivalent (Article 2.3). The Swedish fuel tax is further differentiated into two tax types: energy and a carbon dioxide tax. Biofuels are, however, subject to a tax exemption, which, in turn, is dependent on the fulfilment of the sustainability requirements of the biomass under the RES Directive.[22] From 1 January, a so-called 'plant certificate' from the Swedish Energy Authority is equally required in order to benefit from the exemption (on which see more below). The exemption from fuel taxation under the Energy Tax Directive is granted by the Commission to the different Member States, and the Swedish exemption was extended in December 2015 and remains in force until the end of 2018. Sweden aims to extend this exemption even further, if possible.

For the share of the fuel produced from biomass, the different biofuels are subject to different exemption rates from both tax types, which, to a variable extent are dependent on whether they are used as high- or low-blend fuels. For example, bio-diesel at low blends is exempted at 8% from the energy tax, while it can be exempted at 100% from the carbon dioxide tax at both low and high blends. High blends of bio-diesel, on the other hand, are entitled to a higher exemption rate from the energy tax (increased from 44% to 50% on 1 January 2016). For HVO and biopetrols, the exemption rate from both fuel tax types is 100%.

PROMOTION OF BIOFUELS

Since 2006 Sweden has promoted the consumption of biofuels through an act obliging certain fuel distributors to keep available at least one type of biofuel at filling stations. Nonetheless, the Swedish Government has several times discussed the introduction of a quota obligation system for biofuels, and an Act to this end was approved by the Parliament in November 2013.[23] The said Act was later withdrawn and thus never entered into force, as it, together with certain accompanying tax amendment proposals, was deemed incompatible with EU provisions on state aid. According to these guidelines, biofuels under this type of system were considered 'overcompensated', i.e. receiving too much state aid, mainly because of the tax exemption. Due to the inconsistencies with EU law, in October 2015 the Government proposed[24] a plant certificate system. This seeks to ensure that the plant producing biofuels adheres to the sustainability requirements by receiving a certificate by the Energy Authority. This way the Government seeks to streamline the support of biofuels in line with EU requirements,[25] and to ensure a continuation of the above-mentioned exemption from the EU Energy Tax Directive awarded by the Commission.

OTHER POLICY INSTRUMENTS

There exist many types of policy instruments with impact on greenhouse gas emissions in the Swedish transport sector, and this section only mentions a few with both existing and potential impact on emissions.

- The system of congestion taxes,[26] which has a dual effect by reducing both environmental (sulphur oxide) and climate (carbon dioxide) pressures, has been in use since 2005 in Stockholm, and later in Göteborg. Low-emission vehicles are currently also liable for congestion tax, but their exemption from the tax could further promote the use of such vehicles.
- Travel costs incurred by transport between homes and workplaces can in certain situations be deducted in income taxation, for the year 2015 at a rate of 1.85 SEK per kilometre. It is deemed that the current system supports urban sprawl, which is associated with an increased travel demand, and therefore should be amended.
- Parking norms for spatial planning of urban residential areas have been in use since the 1950s, and have had

a big impact on the increased car use in the urban environment. The legislation[27] enables a flexible interpretation of parking spaces, which does not necessarily have to imply motor vehicles, but planning authorities should also adopt a different approach to change their practices in the planning process.

- Since October 2015, cities and municipalities can apply for state aid to develop sustainable urban areas by entering into 'environment agreements for cities' to support the development of public transport and other energy-efficient solutions.[28]

Challenges for the Swedish transport sector

In Sweden, the increasingly cost-effective production and subsequent growth in the consumption of biofuels is dependent on the biofuels' exemption from energy taxation, which is limited in time (current until the end of 2018). This causes a certain market instability and subsequent reluctance to invest long-term in biofuel technology. The EU Energy Tax Directive is long outdated, but the 2011 proposal on revision was recently shelved[29] because of disagreements in the Council.[30] In the current situation, this will cause Member States to adapt their rules on promotion of biofuels to avoid overcompensation under EU state aid law, but without stability and perseverance regarding biofuels promotion on a long-term basis. This is imperative not only for the promotion of biofuels, but also to achieve a balanced and long-term taxation effect (including both vehicle and fuel tax), which most effectively promotes low-carbon vehicles and the use of alternative fuels. Road-based freight transport contributes to a large share of energy use and GHG emissions in the Swedish transport sector. Moreover, this transport type is more difficult to electrify compared to passenger transport. Emissions from trucks on Swedish roads have increased since 1990, and efficiency measures are needed.

Another challenge for the transport sector is to take political actions to implement the 2030 goal. Various stakeholders in the Swedish transport sector agree that a one-eyed focus on one specific solution, such as drop-in biofuels deemed compatible with existing petroleum infrastructure, or electrification of the vehicle fleet, will not be sufficient to reach the goal. On the contrary, broad-based action on many issue areas is required. In order to achieve this, the 2030 goal must firstly be clearly rooted and anchored in the political system. Secondly, the recently investigated Climate Act[31] should be adopted and enter into force to function as an overall path of direction for decarbonization in the sectors outside emission trading. Lastly, a robust sector-specific action plan for transport, with clear goals and partial goals, combined with the allocation of sufficient resources and evaluation mechanisms, must be adopted.

Conclusion

The Swedish transport sector policies regarding climate impact are largely based on economic instruments such as tax exemptions and reductions for vehicles and fuels. Although certain proposals and amendments of existing frameworks have been made, and in the light of the current development in car ownership and use, it appears these instruments will not be sufficient to steer the Swedish transport sector towards a climate friendly direction. In 2009, an ambitious target for the decarbonization of the transport sector was formulated. Currently this target is not sufficiently anchored at a political or legal level to form a basis for the broad-based actions required to reach the prescribed goal of a fossil-free vehicle fleet by 2030.

7

THE AUSTRIAN CASE

Ronald J. Pohoryles

Introduction

Austria has a quite favourable energy production position: This is, at least in part, due to the availability of hydropower (Pohoryles, 2014b; Engström Stenson, 2015). However, Austria is a net importer of energy, particularly for the transport sector. The transport sector is the major energy user in Austria. Growing steadily since 1970, the share of transport in energy consumption has remained stable since 2005 and amounts to one-third of the total consumption.

Austria relies heavily on energy imports. In 2015, 38% of imported energy in Austria was oil, followed by combustible waste, renewables and gas. In terms of energy security, the energy import dependency poses serious concerns. Political instability in oil-exporting countries and international policy issues can be a risk to energy security.

Current fuel use in the Austrian transport sector

In 2015 the transport sector consumed 79% of all imported fossil fuels, while private households consumed 12% and the industry consumed only 6%. Performance in terms of energy security and sustainability varies across modes of transportation: toad, air transport and inland waterways transport largely depend on fossil fuels, while rail transport runs on electrical energy. Austria has a high potential for domestic and sustainable electricity production, but oil supply depends largely on imports. More than three-quarters of the freight transport is delivered by road transport, only a mere fifth by rail. For personal transportation, e-mobility could reduce the energy import dependency but has not yet reached a rele-

Figure 1:
Energetic end use by sector 2015. (Total Use =1'090.2 Petajoule)

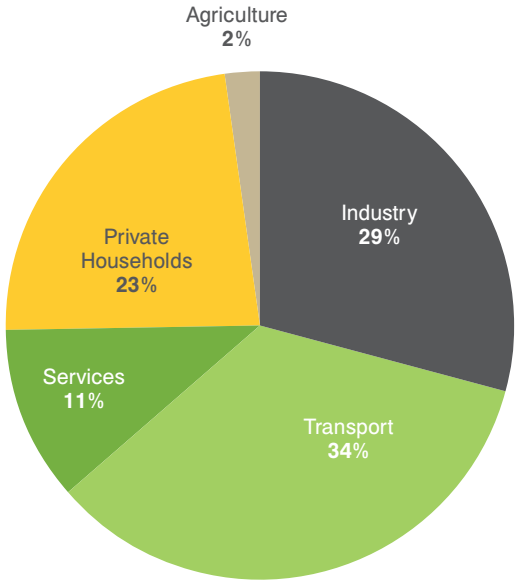
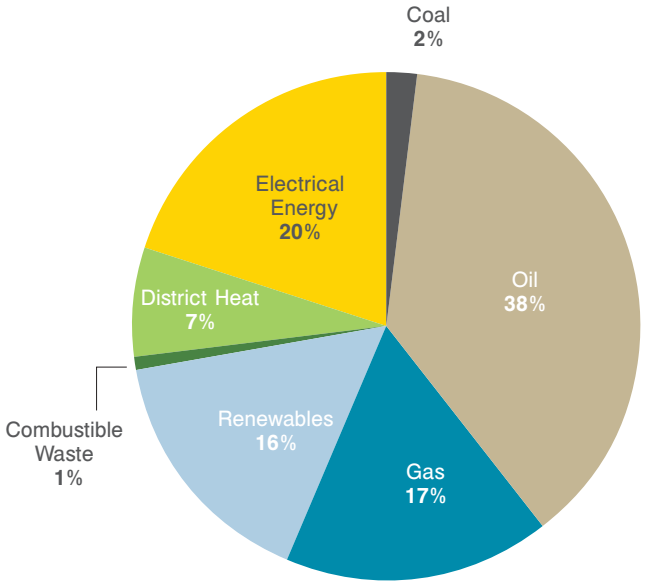


Figure 2:
Energy imports by source 2015.(Total Use =1'090.2 Petajoule)



Source: Federal Ministry of Science, Research and Economy, 2015.

vant market share.

Only an integrated transport and energy concept comprising increased energy efficiency, use of renewables, and technology development, especially with respect to e-mobility, can at the same time increase sustainability and energy security. Furthermore, behavioural changes are critical: the shift from individual transport to public transport could, for example, play an important role in reaching the policy target of reduced energy consumption.

In 2015, the goods transported by all modes amounts to a total of 475.4 million tons – 77% on road and 21% by rail (Statistik Austria, 2016). The overall amount of transport services has increased by 5.9%. However, this varies by mode of transport: whereas rail transport has increased by only 2.3%, road transport has increased by 7.8%. In terms of import dependency this means an increase of oil imports (Statistik Austria, 2016). The increase of freight transport by rail is due to the liberalization of the transport sector: the transit transport services on the railways increased, whereas the domestic freight transport decreased. The services by international competitors of the national transport service might play a role in the increase.

Air transport and inland transport play a minor role in the Austrian transport system. In air transport there was an increase in both passenger and freight transport, in inland waterways transport a sharp decrease. Inland water transport is dependent on weather conditions, and specifically on the water level. For the total energy balance in transport this has, however, only a minor influence, if any.

The current situation of the transport sector has a major impact on the environmental situation. In terms of CO_2 emissions, the transport sector produces more than one-third of the total emissions. By far the largest polluter is road transport, passenger and freight.

The European Union influences the Austrian transport policy to a large extent and has developed goals for the improvement of the environmental situation. The EU monitors the achievement of its Member States on a regular basis. As an example, in July 2016 the European Commission has threatened to sue Austria according to the Clean Air Directive. Austria did not meet the goals for the reduction of emis-

Figure 3:
Emissions from Austrian transport have increased by nearly 40% since 1990.

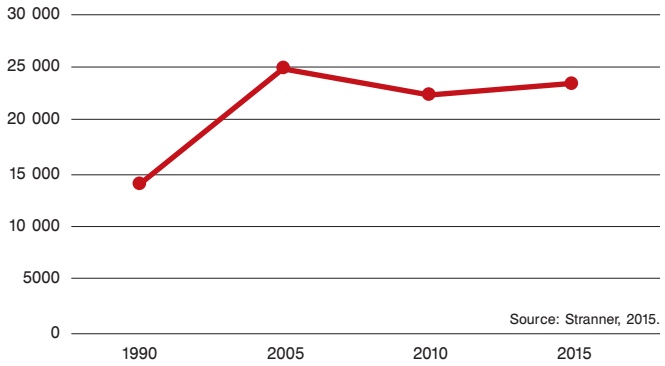
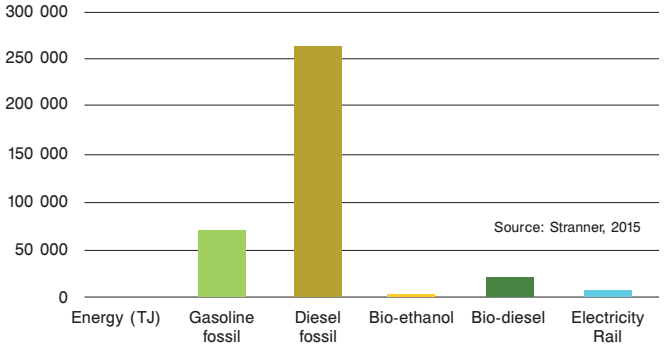


Figure 4:
Energy consumption in transport sector as per fuel/energy source in 2015, (in Tj).



sions caused by road transport. CO_2 emissions had in 2015 increased by 40 percent compared to 1990 levels, and by 3.4 percent compared to 2010. One of the major reasons for this is the steady increase in the consumption of diesel compared to other fuels. The increase can, at least in part, be explained by tax advantages still in place for diesel. Diesel has the most important share in energy consumption in the transport sector, making up approximately two-thirds of total energy consumption, and is the major contributor to transport-related GHG emissions. Gasoline accounts for approximately one-fifth of energy consumption, while the share for electric rail transport is small and contributes little to the GHG emissions.

Political targets in the Austrian transport sector

In 2010 the Austrian Government has published the energy strategy of Austria till 2020 (Federal Ministry of Economy, Family and Youth, 2010). It rests on three pillars:

- Security of supply;
- Energy efficiency;
- Renewable energy resources.

Since 1972 Austria's energy policy has been oriented towards increasing the efficiency of its energy system, and this policy orientation did not change even during decrease in the price of oil in the 1980s, nor in the price decrease in recent years. It meets the goals of the EU growth strategy, 'Europe 2020'.

The Austrian energy and transport policy is not only a national, but a multilevel agenda: the European Union impacts on the Austrian transport and energy policy with directives and regulations, and the regions (*Bundesländer*), communities and municipalities have an important role to play in their implementation. The energy strategy defines targets in the transport sector, but is not very precise regarding the timeline. The Comprehensive Transport Concept of the Transport Ministry defines the targets in terms of the EU 20/20/20 strategy. For Austria this means a reduction of GHG emissions by 17%, an increase in the consumption of renewables by 34% and at least a 10% share of renewables in the transport sector (Federal Ministry for Transport, Innovation and Technology, 2012). One of the major policy goals of the transport policy is the reduction of GHG emissions by 2025. The goal is to reduce the NOx emissions by 70% and the emissions of particulates by 50%.

With respect to national and transnational transport, the Austrian transport policy is based on six areas: infrastructure, public transport, intelligent transport systems, technology & innovation, need orientation, and energy efficiency (Federal Ministry for Transport, Innovation and Technology, 2012). Another strategical approach is the transport policies on the regional and urban level (Oblak, 2003; Hiess, 2013).

In 2012 the Ministry of Transport, Innovation and Technology published a comprehensive document on the targets till 2025 and beyond (Federal Ministry for Transport, Innovation and Technology, 2012). The general targets of the document are to ensure a social, safe, environment-friendly and efficient transport system. The document underlines the importance of cooperation between the EU, Austria and its regions (*Bundesländer*, 'federal states' in Austrian terms) for a comprehensive strategy.

The analysis offers targets and related policy measures focused on seven dimensions: infrastructures (rail, road, air transport and waterways); public transport; transport safety; intelligent integrated planning; technology & innovation; need orientation; and environment & resource efficiency. For the purpose of this case study on transport and energy security, the relevant dimensions are infrastructure; public transport; intelligent transport system; technology & innovation; and resource efficiency.

There is a clear commitment by the Ministry to support public transport, with a focus on the modernization and expansion of the existing network. The policy aim is to ensure a basic supply of public transport at affordable prices. The document Target for Networks 2025+ foresees an increase in the rail capacity of 30% by 2025. Public railway transport has been run solely by the state-owned ÖBB until 2011, when one privately owned competitor (Westbahn AG) entered the market. The Comprehensive Transport Concept does not,

however, mention the private competitor in the document.

For road transport the strategy is less ambitious and proposes to bridge the gap between the high-capacity network and rehabilitation of the existing roads under the responsibility of the state. With respect to the inland waterways the focus is on the (transnational) Danube. As the capacity depends on the water level the Ministry promises measures to optimize usability. With regard to air transport, the aim is to link all airports to the public transport network.

The Austrian Transport Ministry puts a lot of emphasis on research and development. The research programmes are administered by a specific agency, the Austrian Research Promotion Agency (*FFG, Forschungsförderungsgesellschaft*). Another relevant research and development programme is the '*klimaaktiv*' of the Federal Ministry for Agriculture, Environment & Water Management. This programme includes a specific programme on sustainable mobility (Austrian Environment Agency, 2015b). The Austrian Transport Ministry sees a high potential in the development of e-mobility, alternative drive engines and intermodality. The Comprehensive Transport Concept moreover aims at 'applying Information and Communication Technologies (ICT) to transport. These applications are being developed for different transport modes and for interaction between them (including interchange hubs)'" (European Commission, 2008).

For energy security the transport system in metropolitan areas plays a crucial role. The capital city of Austria accounts for a quarter of the total Austrian population (around 2 million inhabitants as compared to a total of around 8 million inhabitants in Austria). Vienna has developed a Masterplan for Transport in 2003 (Oblak, 2003). The Masterplan is evaluated every 5 years, the last evaluation dating from 2013 (Hiess, 2013). The Masterplan consists of five elements with related goals: sustainability; efficiency & effectiveness; public acceptance; cooperation: and innovation. In order to achieve these goals, in 2003 the City of Vienna planned to increase the attractiveness of public transport and new transport modes (underground, local railways, area management and an increase in the use of bikes). The goals for changing transport modes are set to: an increase of 70% in bike transport, of 21% in public transport and an increase in regional transport of 70% to 2030. Policy strategies on how to reach these goals are yet to be determined.

The latest evaluation report (Hiess, 2013) confirmed the general orientation of the Masterplan. However, the framework conditions since 2003 have dramatically changed, not least due to the entrance of Austria's neighbours to the European Union. Both the growth of the population and the transport of goods have increased more than expected. As far as the regulation of the incoming regional transport and the city enlargement is concerned, the planning of an integrated transport system that includes public transport and bikes has to be coordinated. Also, the further development of transport information systems and a user-friendly design of these systems is key to influencing transport behaviour. Examples are Park & Ride and Bike & Ride facilities, as well as rental and car-sharing capacities. And last but not least, awareness raising and public participation targeting specific populations will help to attain the goals.

Current and future transport and fuel policies

The recent warning of the European Commission that it would sue Austria for not meeting the standards of the Clean Air Directive is an indication that current Austrian fuel policies are not sufficient to reach the set of political targets.

In what follows we will report on the development as assessed by the Austrian Environment Agency and discuss the related policy measures. According to Regulation (EU) 525/2013 the Austrian Government has to deliver a report on the GHG emissions and a related policy evaluation. The Austrian Environment Agency is in charge of this report. The report deals with the environmental impacts of the activities of all economic actors and households. As transport is the largest polluter, the report contains an extensive chapter on transport (Stranner, 2015). The policy measures can be categorized into: energy efficiency; increased share of green energy sources; and alternative modes of transport. The Austrian Environment Agency has presented two scenarios: a business-as-usual scenario (scenario with existing measures, WEM) and a scenario with additional measures

(WAM). Based on these two scenarios, the Austrian Environment Agency has developed policy proposals for the future.

The Austrian Government has already promoted an increase in bio-diesel and alternative motor concepts (hybrid and e-mobility) since the late 1990s. Since October 2007 ethanol has been blended with petrol. Following the Directive 2009/28/EC on the promotion of the use of energy from renewable sources, Austria has amended the Austrian Fuel Ordinance (*Kraftstoffverordnung* – KVO 2012). The recommendation of the Austrian Energy Agency is to further promote biofuels, bio-diesel and e-mobility through resolute activities and a closer collaboration between the federal government, the regions and the corporations.

Some efforts have been undertaken by the Ministry to promote e-mobility, however there is still a lack of infrastructure, the cost of electric vehicles is high, and the range of vehicles is comparatively low. In 2012, the Ministry for Agriculture and Environment and the Austrian Chamber of Commerce delivered an action plan for the promotion of e-mobility. It recommends inter alia financial incentives, pilot regions with enhanced infrastructure for e-mobility, privileges for e-cars, innovative business models, and research and awareness raising. With respect to e-mobility, the development of the new car market and fleet renewal are key. The aim is an increase in the Austrian electric fleet by 3.4% and the increase in new registration of electric vehicles by 18% till 2020 (Pötscher, 2015).

An increase of energy efficiency is key for an energy strategy that aims at reducing the consumption of fuels and of pollutant emissions. The enhancement of energy efficiency is not merely a technological issue, but necessitates supporting policies with incentives, disincentives as well as

Table 1:
Schematic overview on policy goals and policy measures based on the report of the Austrian Environment Agency (Zechmeister, 2015).

Policy Measures Reduce the CO_2 emissions 2020-2015 (Austrian Environment Agency, 2015)			
"Business as usual" Scenario		**Scenario with Additional measurements**	
PaM N°8 Increase share of clean energy source in road transport	Implementation of Directive 2009/28/EC on the promotion of the use of energy from renewable source	**Pam N°11 Further enhancement of clean energy sources for transport**	Promotion of alternative and biofuels
	Implementation Plan for electric mobility		Promoting electric Vehicles
PaM N°9 Increase fuel efficiency in road transport	Fuel tax increase	**PaM N°12 Further enhancement of fuel efficiency in road transport**	Implementation of energy Efficiency Directive (2012/27/EU)
	Green the truck toll		
	Mobility management and awareness raising		Implementation of the Road Infrastructure Charging Directive 2011/76/EU
	Air quality induced speed limits		
PaM N°10 Modal shift to environmentally friendly transport modes	Mobility management and awareness	**PaM N°13: Further modal shift to environmentally friendly transport modes**	Promoting mobility management including a Bicycle Masterplan & a Walking Masterplan
	Promotion of corporate rail connections for freight transport		Incentives for an increased use of public transport
			Implementation of the National Action Plan Danube Navigation

Source: Zechmeister, 2015

mobility management and awareness raising. The Austrian Government has taken some steps towards enhanced efficiency: the taxation policy foresees increases of the fuel taxes step-by-step and intends to change their structure. With respect to the latter, the Government recently started a debate on cancelling the current tax rebate for diesel. The recent strategy combines *regulations* like air-quality-induced speed limits, fiscal measures (fuel tax increase and greening the truck toll) and mobility management and awareness raising. Furthermore, research promotion is an important element of the strategy. Additional measures to enhance energy efficiency are disincentives by increasing the energy taxes for fossil fuels gradually and by implementing the Energy Efficiency Directive (2012/27/EU) through the Austrian Law on Energy Efficiency 2014. The law aims at a major reduction of energy use, however there are no clear measures yet defined.

The notion of a modal shift mostly means the shift is to reduce road transport by combining short-distance transport of goods with long-distance rail transport. With the modernization of hubs at the railway stations and distribution centres for goods, Austria has already taken a first step. Plans for mobility management for both goods and passengers will improve the situation in the future (Heinfellner, Ibesich and Kurzwei, 2015).

The report of the Austrian Environment Agency includes a policy assessment chapter that assesses the impact of Policies and Measures (PaM). It defines a baseline scenario that assesses the future development according to the policies already in force and an optimistic scenario based on additional measures. The transport scenarios are based on studies of the University of Technology Graz, Institute for Internal Combustion and Thermodynamics (Hausberger, Schwingshackl and Rexeis 2015).

Overall, the scenarios show that Austria cannot reach the policy targets with business-as-usual policies. These might at best lead to the stabilization of the emissions between 2015 and 2030. With additional measures, however, a serious reduction could be achieved. In the baseline scenario with existing measures the total energy consumption between 2015 and 2035 increases by 7%, whereas with additional measures the total energy consumption decreases by 20%.

Policy alternatives matter. The most obvious case is fossil diesel. In the baseline scenario the consumption increases by 6.3%, whereas with additional measures the consumption decreases by 2.5%. Gasoline decreases in both scenarios, however only by 27.5% in the baseline scenario as compared to 50.2% in the scenario with additional policies (Stranner, 2015) (Austrian Environment Agency).

A comparison between the two policy models shows the importance of additional policy measures. The potential of additional measures is for all of the sources high and relevant if Austria wants to meet the goals of both the European Union and its own. Please note, however, that in both scenarios the importance of renewables is comparatively low and possibly underestimated. Neither scenario does enough in assessing the potential of technological innovation.

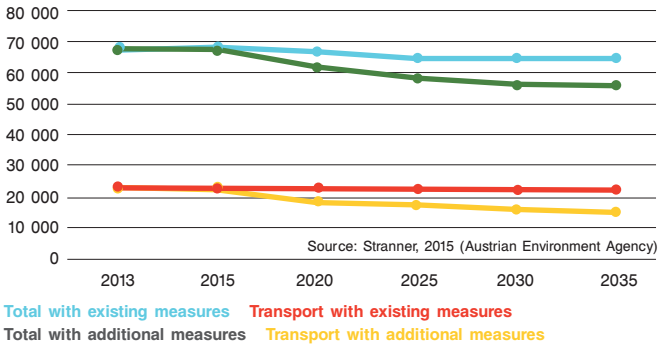
Emissions from the transport sector currently amount to one-third of all emissions. With additional measures this share could decrease to about one quarter of the total pollutant emissions. It is interesting to see that the additional policy measures influence the modes in a different way. Between 2015 and 2035 the potential of the reduction of the pollutant emissions from energy consumption is around 14%, in the transport sector it is as high as 31%. This is mostly due to road transport, which has the highest share of energy consumption in the transport sector.

Challenges for the Austrian transport sector

The Austrian *Comprehensive Transport Concept* proposes a ‘Vision Zero‘ for the transport sector. Vision Zero is supposed to ensure safety, efficiency and sustainability. Although ‘Vision Zero’ is merely a political term that is difficult to operationalize, one can identify relevant targets and the related challenges based on a SWOT analysis.

With respect to the energy security issue the relevant action areas are the increase of efficiency and measures that ensure sustainability. With respect to the *increase of efficiency* the challenge is the development of new technologies that decrease the use of energy and, more specifically, the use

Figure 5:
Pollutant emissions in 2013 and projections 2015–2035 under different transport and energy policy scenarios (in kt CO_2 eq)



of oil. With respect to *sustainability* the challenge is to substitute fossil fuels with renewables and electricity and to reduce GHG emissions. Another challenge is to change the attitudes and behaviour of the society and the economy. We can summarize the three most important challenges for the Austrian transport sector as:

- Increase of energy efficiency;
- Increase the share of renewable fuels and electricity;
- Change attitudes and behaviour;

INCREASE OF ENERGY EFFICIENCY

There is a high potential for technological innovation. Transport management and Intelligent transport systems could be further developed and will contribute to energy efficiency. Another issue is the improvement of the transport infrastructure. Policies can influence the increase of energy efficiency, however the economic sector and research have an important role to play in this development.

Strengths

The industry responds to the regulations and incentives of the policy framework that is a mix of incentives, disincentives and regulations. Of particular importance are the Energy Efficiency Directive (European Parliament & Council, 2012) and the related Austrian Law (Federal Ministry for Science, Research and Economy, 2014).

Weaknesses

According to the report of the Austrian Environment Agency (discussed in detail above) the measures in the business-as-usual model are not sufficient to meet the goals (Stranner, 2015). Up until now the additional measures as foreseen in this report remain quite weak.

Opportunities

Alternative vehicle concepts with innovative propulsion systems have a high potential to increase energy efficiency. Also, innovative vehicles like self-driving cars could influence current energy consumption not only for passenger transport, but for commercial transports as well.

Planning and enabling of innovative and cooperative mobility concepts can decrease energy consumption, for example through decreasing traffic jams and facilitating the use of public transport. Infrastructural development is of high importance to railroads and intermodal transport. Tolls serve as an important instrument for traffic management.

The concept of automated driving is one example in innovative transport concept development, however it is still t the very beginning of its implementation. Its realization requires more than mere technological solutions, but the inclusion of stakeholders and (potential) users.

Threats

Although Austria emphasizes its role in environmental technologies the development of alternative propulsion systems is both costly and risky. The market introduction of the products is mostly a medium-term and long-term process. Public support depends on the overall economic situation. Cooperative systems and other alternative concepts are currently only in an early development stage. Although Austria plays a certain role as component supplier there are no Austrian car producers, leaving Austria in a position where it is difficult to influence technology development.

INCREASE THE SHARE OF RENEWABLE FUELS AND ELECTRICITY

Austria has quite ambitious programmes for the development of alternative fuels. The basic energy alternatives to fossil

transport fuels are biofuels, hydrogen gas and electricity. Advantages and disadvantages for these fuel alternatives are treated in the SWOT below.

Strengths

In the Austrian context biofuels seem to be the most attractive solutions for alternative fuels (Austrian Environment Agency, 2015a). This is in line with the European Renewable Energy Directive (European Commission, 2009). Since May 2016 Austria is the only country that has an Agricultural Certification Scheme recognized by the European Commission fulfilling the sustainability criteria of the EU (European Commission, 2016).

E-mobility has a good record in the decarbonization of transport. Due to the availability of hydro-energy sources in Austria, the GHG emission reduction from electrification is quite high and the dependence on imports lower than in most of the other EU Member States (Pohoryles 2014b). Though only at an early stage, hydrogen fuels have a potential for Austria as well. More than 90% of hydrogen is produced from natural gas, which compared with the process of the creation of gasoline reduces CO2 emissions well-to-wheel by around 60% ('The Hydrogen Car Is Back – Again', 2014).

Weaknesses

Biofuels ensure decreasing dependence from crude oil, but this does not imply independence from imports. Furthermore, in Europe, first- and second-generation biofuels (waste or cellulose) cannot meet demand, especially if the use of biofuels is meant for more than admixtures to conventional fuels. In the medium term the volume of imports will decrease; however, as based on voluntary schemes, it is questionable whether the sustainability criteria for imports are met. This is particularly true for social standards. For Austria, however, the importance of imports from third countries outside the European Union is so far relatively low. However, this is only true for as long as biofuels are just used for admixtures to conventional fuels. Many put their hope in the 'third generation of biofuels' (algae). However, as already discovered earlier, there is a severe downside to the production of the third generation of biofuels: algae need large amounts of water, nitrogen and phosphorus. This results in more GHG emissions and higher costs than fuels from other sources (Biofuel.org.uk, 2010). Also, up until now the potential of the 'fourth generation of biofuels' (like biochemistry, or 'solar-to-fuel' methods) seems to be low as well (Kagan, 2010).

E-mobility has a high potential for the decarbonization of transport. However, experts do not believe in a dramatic increase of e-mobility in Austria the short or even medium term (Stranner, 2015). Hydrogen fuels are still at an early stage of development. As in all over Europe, in Austria there are many barriers to the market introduction of hydrogen-driven vehicles. One of the major problems is the lack of fuel infrastructure. Hence there is little consumer demand and no or little public support for the development. There are few expectations for hydrogen-driven vehicles among most experts, at least in the near future. For hydrogen cars, the only exhaust emission is water. However, in the production of hydrogen fuels carbon dioxide is still released into the atmosphere ('The Hydrogen Car Is Back – Again' 2014).

Opportunities

The future of biofuels is a quite contested issue, both for ecological and economic reasons. A slight increase of admixtures seems possible, but EU sustainability criteria set limitations. However, research might bring about some advances for the 'fourth generation' and potentially for the 'fifth generation' for increasing energy security.

Because in Austria e-mobility is at a very early stage, there is a high potential for the substitution of conventional fuels in transport. It is feasible to increase e-mobility to a much more ambitious extent than foreseen in the Austrian scenario. Norway, for instance, aims at a full ban of the sale of fossil fuel-based cars by 2025. Already now, one in four cars in Norway runs on electricity. It goes without saying that the production of electricity in Norway is based on hydropower (Staufenberg, 2016). For Austria, the domestic sustainable production of electricity will, however, have to increase by an advancement of other renewable energy production complementing the existing hydropower. Wind and solar power still have a low share in the production of energy and account for a mere 5.8% share of the production of

electricity. There are good reasons for the future prospects of e-mobility (Wentland, 2016)

Though not yet popular in Austria, hydrogen fuels might have an unforeseen upswing. Major Asian car producers are pioneers in the field and already offer a full range of vehicles. The cars on the market promise a 300-mile range and fast refuelling, of course dependent on the available infrastructure. This was even pushed by the transport policies of California, which is the world leader in the field and whose experience serves as a blueprint for the USA. California provides a full range of benefits for the users of hydrogen-driven vehicles and invests a serious amount of money into building a reasonable infrastructure. The California Fuel Cell partnership will add 100 state wide refuelling stations across the country. The potential of a major increase in the demand for hydrogen-driven vehicles has led to major car producers forming competitive research and development alliances, such as Ford/Daimler/Renault-Nissan, BMW/Toyota, and GM/Honda ('The Hydrogen Car Is Back – Again' 2014). As Austria is an important supplier to the car industry it will contribute to this development.

Threats

In general, oil price fluctuations influence efforts to develop alternative solutions. Biofuels might have a certain potential to increase energy security, however there are reasons to believe that there are serious limitations for their weight in the total European and Austrian energy balances. Both the natural limitations and the disappointment about the development might lead to a disinvestment in the sector.

As the domestic sustainable production of electricity has a high share in total energy production, in Austria e-mobility probably has the highest potential of enhancing energy security. However, due to the low capacity of batteries, the lack of a satisfying infrastructure, the price of the vehicles and the small range of cars, consumer demand might not increase and may stay at the level foreseen in the report by the Austrian Environment Agency. The share of hybrid vehicles might increase, which has of course less impact on Austria's import dependency of.

Hydrogen mobility has a high potential as well, but is in its early stages. Not only in Austria, but in Europe as a whole, there is little awareness of what this technology has to offer, and hence not much demand for vehicles driven by hydrogen. This in turn means a quite limited offer in terms of range from car producers. As far as the Austrian energy and transport concepts are concerned they pay little attention to this innovation pathway. However, an increase in the share of this source necessitates not only awareness raising, but public investment as well.

USER ATTITUDES AND BEHAVIOUR

Strengths

In recent years, measures to reduce the use of individual cars at the city, regional and national levels have developed. Car sharing, the reduction of the vehicle fleet of companies by using various offers of car and truck rentals, e-mobility, bikes and walking are examples. Intermodality both for cargo and passengers has a high potential and the infrastructure for using intermodal solutions has increased at a reasonable rate.

Weaknesses

One can observe the change of attitudes and behaviour of the population, which is, however, still slow. For instance, there are specific trainings to increase energy and environmental awareness. However, alternative fuels like hybrids and gas play a very minor role, even over time, and amount to less than 0.5%. Overall, the total number of vehicles in Austria increased from 6.2 million in 2010 to 6.6 million vehicles in 2015. During this period, in terms of passenger cars per inhabitant, the share remained stable at around 55%.

Opportunities

The increase in the share of vehicles run by diesel is much too high and does not seem to decrease at a substantial rate *(Statistik Austria, 2016)*. Furthermore, there is the high potential of e-mobility. Car sharing and continuous improvement of public transport can contribute to the change in attitudes and behaviour. Intelligent traffic management could help to decrease road transport. Awareness-raising campaigns could change the attitudes of the users of passenger cars as well as those of commercial users.

Threats

There is a certain gap between attitudes and behaviour. Awareness raising on its own does not help change behaviour. In this respect there is a clear relation between this topic and the two other challenges mentioned above.

Conclusion

The Austrian energy security policy cannot be understood without the European context. The Austrian Comprehensive Transport Policy Concept (Federal Ministry for Transport, Innovation and Technology, 2012) refers explicitly to European directives and, indeed, to European regulations, as does most of the Austrian energy legislation and the related transport legislation. The main security threat to energy security is the dependency on fossil fuels. Most of the crude oil has to be imported from regions that are unstable, furthermore the world market prices are fluctuating, depending on political developments and technological insecurities.

There are different measures to increase energy security: the *increase of energy efficiency* and the *substitution of fossil fuels* with alternative fuels, which strengthens domestic production at the European level. Biofuels and e-mobility offer opportunities to increase energy efficiency, combined with further infrastructure improvements and R&D efforts. Recent studies show that with currently existing policy measures, Austria will not meet its goals on energy efficiency and climate. The Austrian Energy Agency calls for additional measures, but when it comes to alternatives and pathways, actual suggestions remain quite vague (Stranner, 2015).

For Austria, the most viable way forward is the *increase of e-mobility*, provided that electricity is produced in a sustainable manner. Due to safety concerns, neither the Austrian population nor any Austrian political party would accept nuclear energy production as a sustainable alternative to electricity production. Rather, *hydropower* and *solar energy* show high potential. For an increase in e-mobility, however, major investments have to take place, mostly in the infrastructure and the development of electrically driven vehicles.

The importance of attitudes and behaviour of both the people at large and the economic sector is not negligible. As consumers of personal transport and freight transport, the impact of society and of the economic sector on energy security should not be underestimated: an increase in energy efficiency and the decision on modes of transport on the one side, and the efficient use of energy on the other, influence demand. However, even if attitudes change, user behaviour depends on the transport and energy policies. If infrastructure is lacking, alternatives will not be attractive. Incentives and disincentives play an important role for influencing consumer behaviour. The rise in the number of diesel-driven vehicles in the 1980s was encouraged by the reduction of taxes levied on diesel fuels until today.

Although this is a contested issue, the authors of this study hold that by mere incremental steps the situation will not improve. As the energy used in the transport sector is mostly based on fossil fuels, thus making it responsible for the highest share of energy imports of fossil fuels, the transport sector poses the most important challenge to energy security. However, even with additional measures to current policies, the shift towards e-mobility is too slow by far to impact on the structure of energy consumption. The use of hydrogen-driven vehicles negligible. There is a clear need for a pathway that accelerates the implementation of e-mobility far beyond the current Action Plan, or at least more resolute activities to implement it (Federal Ministry for Agriculture, Forestry and the Environment & Austrian Chamber of Commerce, 2012). The pathway towards an energy revolution in the transport sector includes infrastructure improvement, incentives and disincentives, as well as research and development.

For a shift towards the development of alternatives, research, development and innovation are key. Research collaboration on the European level is progressing and is a prerequisite for efficient and effective research. Also, transdisciplinary research with the inclusion of stakeholders is progressing. If we are looking for a pathway to a decarbonized society and economy, however, mere applied research does not suffice. Only continuous activities, a patchwork of various activities with a medium- and a long-term perspective can bring such an energy revolution to reality.

8

POLICY RECOMMENDATIONS

Jakob Lagercrantz

Increased energy security in the transport sector

As this report demonstrates, increased European energy security in the transport sector entails reducing dependence on fossil fuels. Most of the fossil fuels used for transport are produced outside of the European Union, with Russia being the largest exporter of both natural gas and petroleum. History has taught us that depending on just a few countries can lead to a scenario where changes in policy can mean a rapid decline in energy security. It is problematic that so little action has been taken over recent years to rectify this dependency situation, and high time to systematically deal with the issue.

This report outlines several ways to reduce the dependency on fossil fuels in the transport sector. Of the many available measures, the most fruitful in terms of a broad European approach may be to reduce energy intensity in the transport sector through more efficient mobility. This should be coupled with a switch from fossil fuels to electrification and sustainable biofuels. Focusing on these two areas specifically, the sections below outline several policy recommendations at the European and national levels.

Efficient Mobility

The IEA's first recommendation is to increasing the transport sector's efficiency in order to decrease dependency on imported fuels. Energy efficiency is also at the core of the EU Renewable Energy Directive for transport fuels. The Directive states:

> *In particular, increasing technological improvements, incentives for the use and expansion of public transport, the use of energy efficiency technologies and the use of energy from renewable sources in transport are some of the most effective tools by which the Community* can reduce its dependence on imported oil in the transport sector, in which the security of energy supply problem is most acute, and influence the fuel market for transport.
>
> *In order to reduce greenhouse gas emissions within the Community and reduce its dependence on energy imports, the development of energy from renewable sources should be closely linked to increased energy efficiency.*
>
> -European Commission (2009) Renewable Energy Directive.

More recently, the EU Strategy for Low-Emission Mobility (July, 2016) sets priorities for more efficient transportation with a strong focus on mobility and initiatives to measure car and truck emissions.

In more general terms, the EU Energy Union has a strong energy efficiency component. They target a 27 percent reduction in energy intensity for the year 2030 applicable for the entire European Union. This is a follow-up on the 20 percent improvement in energy efficiency by 2020 target set out in the 2006 Commission Action Plan for Energy Efficiency: Realising the Potential, which was endorsed by the European Council in 2007, and the European Parliament in 2008.

FIVE KEY RECOMMENDATIONS FOR EFFICIENT MOBILITY AT THE EU LEVEL

1 **Set the target.** The EU energy efficiency target should include clear references to the transport sector, with targets linked to the EU strategy for Low Emission Mobility. Such targets should be reviewed on a regular basis and take into account technological developments and changes in behaviour.

2 **Support non-transport.** While the EU is increasingly supportive of more efficient modes of transport, the backing for transport alternatives has been more limited. This leaves ample room to develop 'non-transport' support.

3 **Moving from strategy to regulation.** The Low-Emission Mobility strategy is a positive step, but Member States, local authorities and the private sector need stronger guidance on what is to be prioritised concerning future mobility. This prioritisation would ideally be developed through a wide public participation process.

4 **Get the numbers right.** Several areas of efficient mobility either do not have correct figures (e.g., new cars' fuel consumption) or no official figures at all (e.g., the fuel consumption of heavy duty vehicles). Ensuring real and comparable figures is a basic must for the future.

5 **Procure innovation.** The EU should clarify and further stimulate functional procurement, wherein tenders include various means of solving a problem. Procuring innovation may mean asking for a service rather than an exactly defined product - opening up for different and innovative ways of meeting the transport needs of e.g. a municipality. This could open up for Mobility as a Service (MAAS) solutions, with strong possible efficiency gains.

Fuel switching

The EU Renewable Energy Directive clarifies why a switch from fossil to renewable fuels is vital. The Directive states:

> *The control of European energy consumption and the increased use of energy from renewable sources, together with energy savings and increased energy efficiency, constitute important parts of the package of measures needed to reduce greenhouse gas emissions and comply with the Kyoto Protocol to the United Nations Framework Convention on Climate Change, and with further Community and international greenhouse gas emission reduction commitments beyond 2012. Those factors also have an important part to play in promoting the security of energy supply, promoting technological development and innovation and providing opportunities for employment and regional development, especially in rural and isolated areas.*
>
> - European Commission (2009) Renewable Energy Directive

The Directive sets a mandatory 10% target for renewable fuels in the transport sector by 2020. It is now clear that this target will not be reached. In fact, only three countries – Finland, Sweden and Austria – are likely to achieve this target by 2020. This can be partially attributed to the fact that different parts of Europe face distinct realities when it comes to renewable energy production potential, policy readiness and public acceptance. This has, in theory, been recognized in the EU Commission Renewable Energy Directive where it states the need for 'exchange of best practices in production of energy from renewable sources between local and regional development initiatives and promote the use of structural funding in this area' (European Commission, 2009). Yet in practise, this target has been approached as one size fits all.

The EU Commission is currently calculating an 8.7 percent share of renewables in the transport sector at the EU level by 2020; a shortfall that would be much more pronounced if Sweden and Finland did not surpass the target by a wide margin. Failure to meet this target is a setback not only from a climate and energy security point of view, but it also reinforces a widely held belief that EU climate and energy targets are not necessarily as binding as they are presented to be.

In order to increase efforts, the EU commission has launched the Alternative Fuels Directive. Through this Directive, Member States will present a roadmap for alternative fuels, focusing on natural gas (LNG/CNG), hydrogen and electrification. While this is a welcome move away from traditional fossil fuels, it does not go far enough from an energy security standpoint. In fact, it just shifts the dependence from imported oil (primarily from Russia) to a future dependence on imported natural gas (primarily from Russia). It is also disappointing that following the agreements at COP21 in Paris, there are no climate or environmental requirements on the fuels used.

Concrete, tough and measurable demands on fuels are nothing new for the EU – they were introduced years ago in the Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD) – and have been strengthened over time. These demands, however, are not used for fossil fuels which can enter the market under less stringent requirements than renewable fuels. In addition, fossil fuels receive monetary subsidies of some 200 billion USD annually, according to OECD.

Recently, the EU has launched the Energy Union, with a target to reduce greenhouse gas emissions by at least 40 percent domestically by 2030. This is in line with the 2030 climate and energy policy framework, and as part of EU's con-

tribution to the Paris Agreement[1]. On the pan-EU level, renewable energy is to reach 27 percent of energy mix by 2030. This will be easier and less expensive to achieve if fossil fuel subsidies are reduced. Government support for fossil fuel consumption and production in OECD countries, along with key emerging economies, remains high: 160-200 USD billion annually (OECD, 2015). Even though several countries around the world have reduced subsidies for fossil transport fuels, there is no clear downward trend in the EU or globally.

While the EU has been supporting the European production of renewable fuels and energy – through tariffs and other trade regulations directed against biofuels from non-EU countries – it has not done much to bolster the localised production of biofuels. This may be understandable given the EU's focus on free trade within the European Union, but a move towards more decentralised energy production has many benefits which merit exploration. Such benefits include: the utilisation of local energy sources; increased local security of the energy supply; shorter transport distances; and reduced energy transmission losses. Decentralising the production of renewable fuels may also foster community development and cohesion by providing income sources and creating local jobs.

The EU Commission is currently developing the Renewable Energy Package for adoption in late 2016 or 2017, which is well before the current RED and FQD directives reach their final year (2020). The authors of this report hope the new Package will:

- Review the division of different generations of biofuels and sustainably produced electricity. This could help recognise that a first generation biofuel can be more energy efficient, and have a lower climate footprint, than what is defined as a second generation fuel.
- Ensure that all (bio)fuels have a large climate reduction potential, are energy efficient from well to wheel and are sustainably produced.
- Address the direct and indirect effects of biofuel production, both the positive and negative aspects.
- Ensure a level playing field between fossil and renewable sources of energy. At present there are far more stringent demands on renewables, which gives fossil fuels an unfair competitive advantage.

FIVE KEY RECOMMENDATIONS FOR AN EU FUEL SWITCH

1 **Recognize country differences.** EU-level policies should be developed with the recognition of country-to-country variations. Policies need to recognize both the potential to test distinctive policies, and the need to differentiate targets.

2 **Establish the same rules for every fuel.** The future regulation of transport fuels should uphold the same requirements for all fuel types, and these should be based on quantifiable sustainability requirements with actual climate impact indicators. This excludes the current arbitrary division of biofuels into first, second and third generations, and necessitates a better understanding and quantification of the overall environmental impact of fossil fuels from the well to the wheel.

3 **Demonstrate and decentralise.** The demonstration and early commercialisation phase of renewable energy technologies needs public support. This is particularly true for decentralised, small-scale solutions. To date, the latter has received scant EU attention. The EU should refrain from an overly narrow focus when it comes to this support, instead recognising the difficulties in picking institutional winners.

4 **Prioritise.** Europe is a world leader in innovative technologies for sustainable biofuels and electro-fuels. This should be recognised as one of the key industrial development areas within the European Community and necessitate changes to the EU budget for research and development.

5 **Phase out fossil fuel subsidies.** The current low oil prices, coupled with an increased competitiveness for renewable energy, means that it is entirely possible to phase out fossil fuel subsidies. This would be beneficial for the switch to renewables while at the same time reducing financial strains on member state and EU budgets. The EU should be a frontrunner in this area, both in its own actions and in its trade relations with other countries and organisations.

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EUROPE'S ENERGY FUTURE

How to reduce transport emissions and increase energy security

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This project was motivated by the observation that many of Europe's long-term challenges are connected to the supply of energy. The EU is currently heavily dependent of imported fossil fuels with the transport sector being the most prominent example. Simultaneously, the EU and its member states have set up ambitious climate targets, for which a decarbonization of the transport sector will be of key importance. Throughout 2016, the European Liberal Forum and its members Fores (Sweden); Neos-lab (Austria); Novum (Slovenia); and the Friedrich Naumann Foundation Sofia (Bulgaria) have organised three workshops, which brought together national actors from politics, academia and business in order to share knowledge and first-hand experiences across EU countries. Results and findings from these workshop have served as input for this report. The report provides a summary of European transport policy and targets, five case studies from member states, as well as synthesized policy recommendations for a secure and low emission transport sector in Europe.

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