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Transport Statistical Data and Projections in The Baltic States

Nordic Energy Research

Transport Statistical Data and Projections in The Baltic States

Nordic Energy Research, Stensberggata 27, NO-0170 Oslo, Norway

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Karla Lainez Amaya
Mercedes Jul
Tomas Garcia

Nordic Energy Research
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Nordic Energy Research team
Kevin Johnsen, Svend Søyland and Christian Kjær

ABB team
Karla Lainez Amaya, Mercedes Jul and Tomas Garcia

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Foreword

"By cooperating in areas where the Nordic and the Baltic countries can both reap added value, I believe that a low-carbon society is achievable"

Klaus Skytte
CEO, Nordic Energy Research

Nordic Energy Research has a long history of cooperation with the Baltic States. We are proud to be able to build on the initiative taken in 1999 by the Nordic Council of Ministers, when Nordic Energy Research was granted additional funding to embark on projects in the Baltic States and North-western Russia.

In 2018, this cooperation resulted in the publication of the Baltic Energy Technology Scenarios 2018 (BENTE) report, and the establishment of a joint Baltic-Nordic Energy Research programme. The BENTE report highlighted the need for a study comparing the statistical transport data and future transport projections in the Baltic States, to ensure that future reports can accurately assess transport energy demand.

I hope that this report will inspire greater action within sustainable transportation, one of the areas where both the Baltic and Nordic countries see the need for greater efforts.

As this report clearly shows, greater action will be necessary to curb rising emissions in the transport sector. By cooperating in areas where the Nordic and the Baltic countries can both reap added value, I believe that a low-carbon society is achievable.

Klaus Skytte
CEO, Nordic Energy Research

Transport Statistical Data and Projections in The Baltic States

Executive summary

Transport Statistical Data and Projections in The Baltic States

Executive summary - English

Several policies, measures and initiatives have been introduced in Europe and in the Baltic States in order to decarbonise the transport sector. The purpose of this study is to provide a complete analysis and assessment of the historical, actual and future outlook of the road transport sector in the three Baltic States from an individual and regional perspective.

The first section of the study presents a **historical characterisation of the transport sector** in the Baltic States, analysing the evolution of the transport demand, energy consumption, GHG emissions production and other key performance indicators that will provide the reader a better understanding of the transport sector's *status-quo*. Subsequently, an **overview of the actual policy framework** is described and how these policies/measures have mobilised development in technologies and alternative fuels towards the Baltics' "EU Climate Action" fulfilment.

An **evaluation of the alternative energy sources** that can be adopted by the Baltic States to decarbonise the transport sector is covered from a theoretical approach in the next section. Solutions such as: (i) electric vehicles, (ii) Hydrogen vehicles, (iii) Biofuels, (iv) autonomous vehicles and (iv) Mobility as service are described and estimates of the current presence in the Baltic States is included.

Based on the historical data collected and the National Energy and Climate Plans submitted to the European Commission on December 2018, the **Baltic road transport sector has been modelled** and a quantitative analysis reveals that the three states have a complex pathway towards the decarbonisation of the transport sector as the transport demand and energy consumption is likely to increase by 2030. Finally, a basis for policy recommendation to the Baltic Governments is offered, these policies are oriented to the alternative fuels promotion, modal shifting, among other successful international practices within the transport sector.

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Sammanfattning - Svenska

Flera policyer, åtgärder och initiativ har införts i Europa och i de baltiska länderna för göra transportsektorn fossilfri. Syftet med denna studie är att tillhandahålla en fullständig analys och bedömning av de historiska, verkliga och framtida panoramana över vägtransportsektorn i de tre baltiska staterna ur ett individuellt och regionalt perspektiv.

Studiens första avsnitt presenterar en **historisk karaktärisering av transportsektorn** i de baltiska länderna, med analys av utvecklingen av transportbehov, energiförbrukning, produktion av växthusgaser och andra viktiga resultatindikatorer som ger läsaren en bättre förståelse av transportsektorns status quo. Därefter ges en **översikt av den faktiska politiska ramen** och hur denna politik / dessa åtgärder har drivit på utvecklingen inom teknik och alternativa bränslen för att uppfylla Baltikums ”EU Climate Action”.

En **utvärdering av de alternativa energikällorna** som kan utnyttjas av de baltiska staterna för att göra transportsektorn fossilfri beskrivs teoretiskt i nästa avsnitt. Lösningar som: (i) elektriska fordon, (ii) vätefordon, (iii) biobränslen, (iv) autonoma fordon och (iv) ”rörlighet som tjänst” beskrivs och uppskattningar av den nuvarande implementationsnivån i de baltiska staterna ingår.

Baserat på de insamlade historiska uppgifterna och de nationella energi- och klimatplanerna (National Energy and Climate Plans) som lämnades in till Europeiska kommissionen i december 2018 har den **baltiska vägtransportsektorn modellerats** och en kvantitativ analys visar att de tre staterna har en komplex väg mot att göra transportsektorn fossilfri eftersom transportbehovet och energiförbrukningen sannolikt kommer att öka fram till 2030. Slutligen ges en grund för politisk rekommendation till de baltiska regeringarna, som är riktad mot att främja alternativa bränslen och alternativa transportslag, bland andra internationellt framgångsrika metoder inom transportsektorn.

Transport Statistical Data and Projections in The Baltic States

Chapter I: Introduction

Transport Statistical Data and Projections in The Baltic States

Background

Historically, the **transport sector** has **accounted for** around **30%** of **final energy consumption** (FEC) and around **25%** of **greenhouse gas emissions** (GHG) in the **European Union** (EU), with more than **93%** and **81%** respectively, of these amounts deriving from **road transport**.
The **shift towards low-emission transport** is an important objective for Europe and the Baltic States, which is **promoted through the European Commission's 2020** and **2030 Energy and Climate Packages**, which focus on the following challenges:

- **Share of renewables** in the transport sector
- **GHG emissions reduction**

However, the **Baltic States** are dominated by a **carbon-intensive** and **inefficient transport sector** compared to the EU average. In 2017, the sector accounted for **34% of FEC** and **23% of total GHG emissions** in the region. In recent years, **several policies and initiatives** have been introduced in Europe and the Baltic States to **improve the transport sector**. Unfortunately, these measures have been **largely ineffective** in **the Baltic States** and left the region further away from its long-term targets. The three Baltic States are among the EU's most under-performing countries when it comes to transport.

Transport Statistical Data and Projections in The Baltic States

Purpose of the study

This study focuses on road transport and its **purpose** is to **provide deep insight in the Baltic transport sector**. More specifically, this study aims to:

- Provide a **statistical** and a **policy overview** of the **transport sector** in the Baltic States
- **Analyse** and **assess** the **transport sector through KPIs**
- **Evaluate** the impact of **new technologies** and their role in the actual and future outlook
- **Forecast** the **transport demand by 2030**
- **Recommend policy** and **regulatory measures** to improve the transport sector by 2020 and 2030

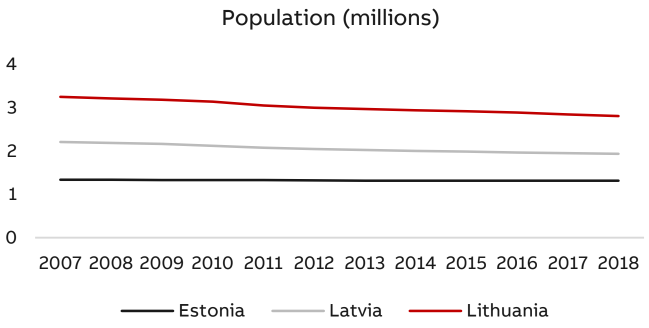
Transport Statistical Data and Projections in The Baltic States

Chapter II: Statistical overview

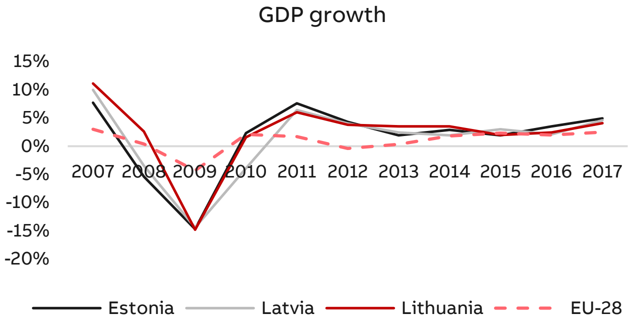
Transport Statistical Data and Projections in The Baltic States

Macroeconomic overview

The **Baltic States**, Estonia, Latvia, and Lithuania, are located on the east coast of the Baltic Sea. In 2018, the three countries had a total population of 6.06 million and a combined GDP of 100.45 billion euros, which correspond to **1.2% and 0.6% of the EU's population and GDP**, respectively.
The **population** of the **Baltic States** has **decreased** from 6.8 million in 2007 to 6.1 million in 2018 (11%), with Lithuania experiencing the highest population reduction of 14%.
Despite this, in real terms **GDP increased** from 68.11 billion euros in **2007** to 100.45 billion euros in **2018**, which represents **47% growth in the period**. However, the **Baltic States** were **the worst-hit economies** in Europe during **the financial crisis**, suffering an average year-on-year GBP reduction of 14.4% in 2009.



Source: Eurostat



Source: Eurostat

Estonia

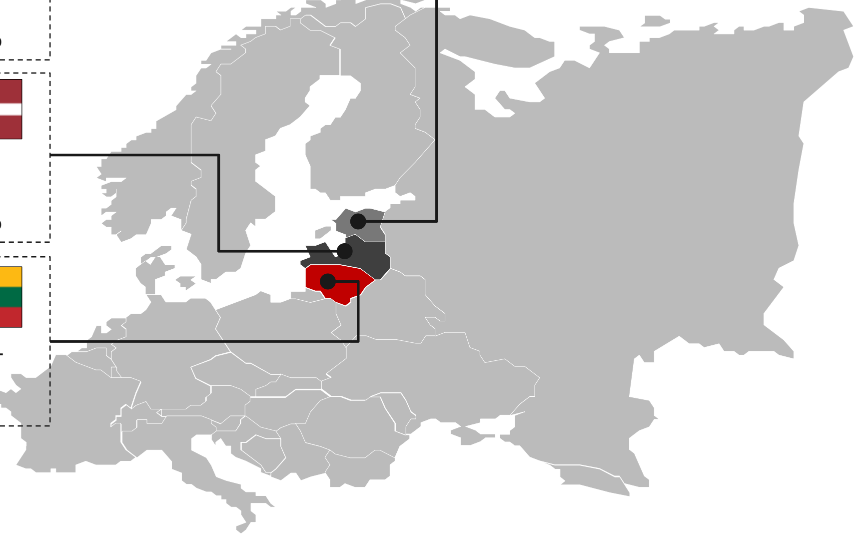
Population (2018): 1,319,133
GDP (2018): 26,036 M€
GDP change (17/18 %): 4,8%

Latvia

Population (2018): 1,934,379
GDP (2018): 29,151 M€
GDP change (17/18 %): 4,6%

Lithuania

Population (2018): 2,808,901
GDP (2018): 45,264 M€
GDP change (17/18 %): 3,6%



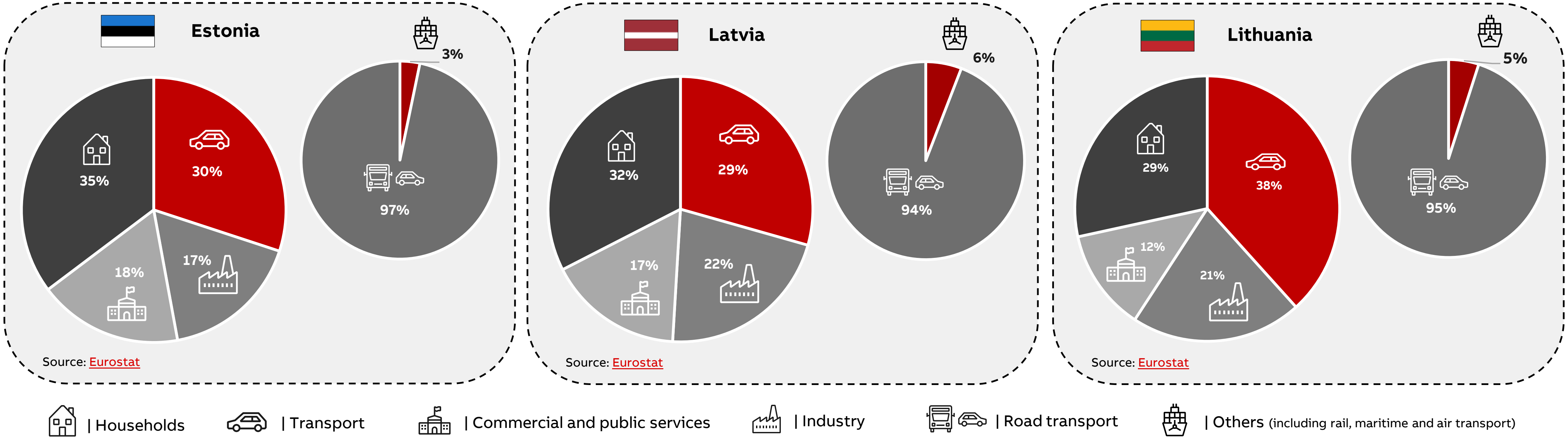
In 2018, the Baltic States represented 1.2% and 0.6% of the EU's population and GDP, respectively.

Transport Statistical Data and Projections in The Baltic States

The Baltic transport sector

In 2017, the **transport sector** was responsible for the **largest share** of **final energy consumption (FEC) in Lithuania (38%),** and the **second-largest** in **Estonia (30%) and Latvia (29%)**. The same year, **road transport** accounted for **more than 94% of the transport share** in the Baltic States, with **Estonia** the **highest at 97%** and Latvia the **lowest** at **94%.**

Final Energy Consumption by sector in 2017

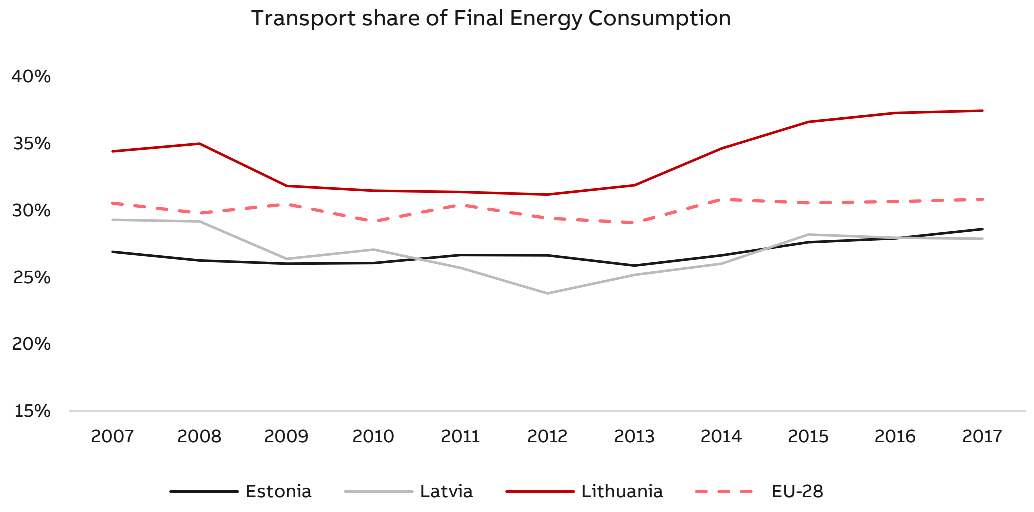


In 2017, the transport sector covered 32% of the total Baltic FEC of which 95% was road transport.

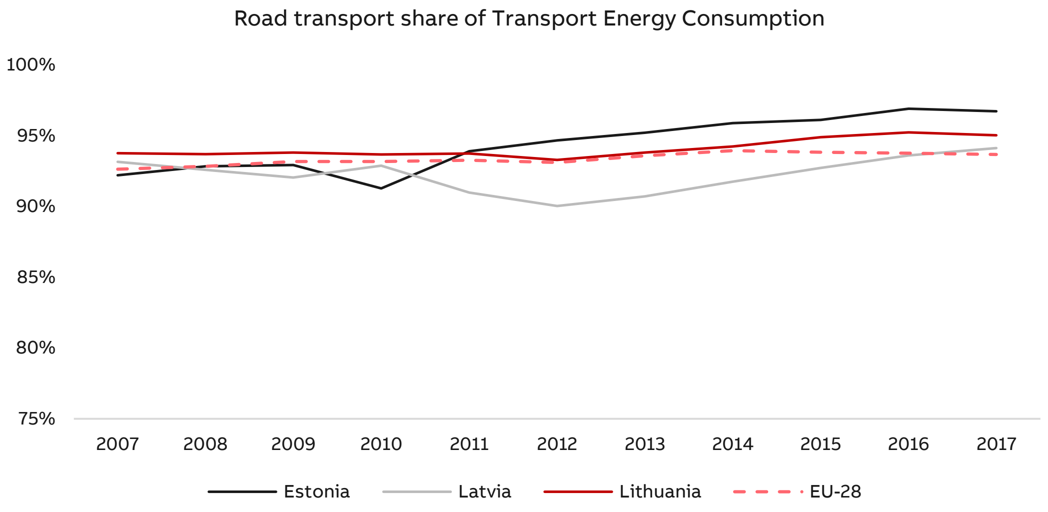
Transport Statistical Data and Projections in The Baltic States

The Baltic transport sector

The transport share of FEC has **historically fluctuated** in the Baltic States, particularly in Latvia and Lithuania. In the period **2009–2012**, the **transport sector stagnated,** largely due to the slowdown in the three countries' economies; however, **since 2012** the sector has **expanded,** predominantly due to developments in Lithuania, which has produced the highest share of **transport energy consumption.** The **Estonian** and **Latvian transport share of FEC** has remained **below** the **EU-28 average** since 2007, while the **Lithuanian** share was **higher** during the same period. Since 2010, **the transport share of energy consumption** has been **stable in Lithuania**, but has **increased** in **Estonia**.



Source: Eurostat



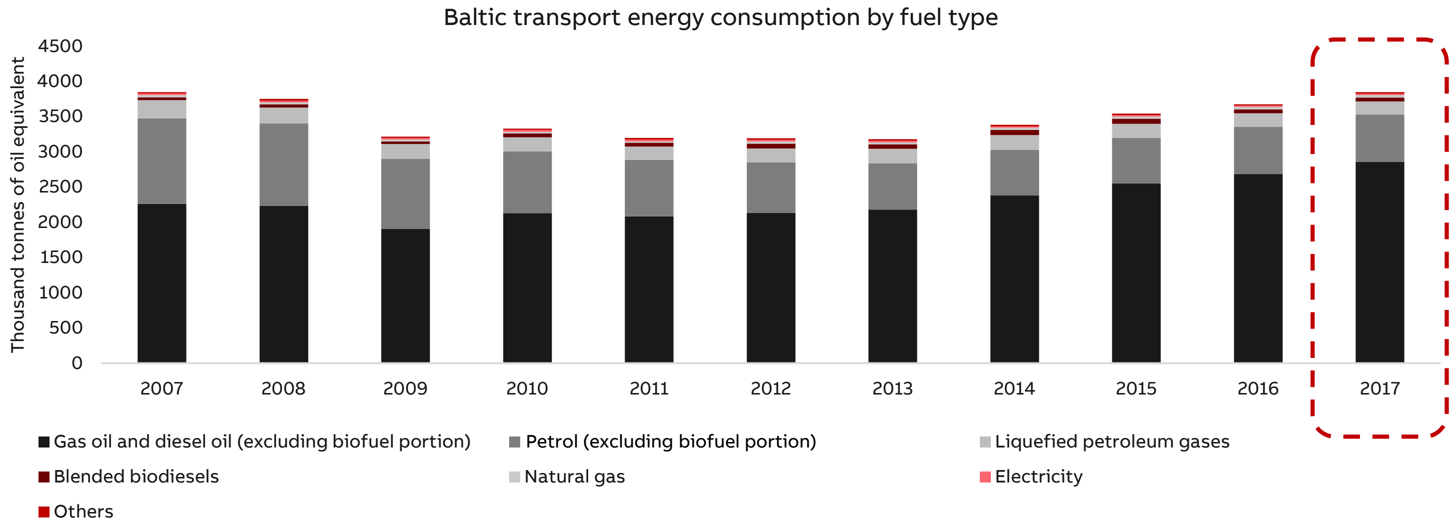
Source: Eurostat

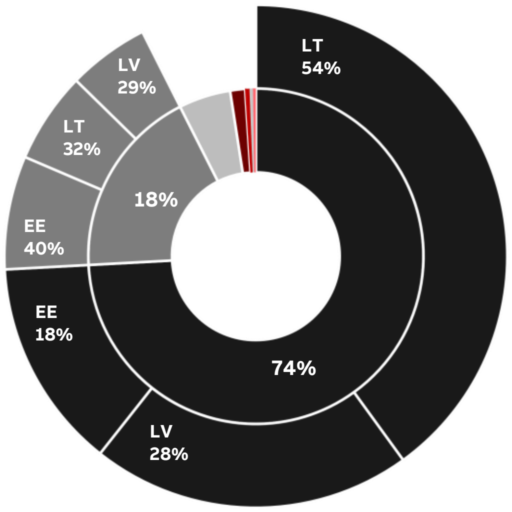
By 2017, Lithuania was 5% above the EU-28 transport share of FEC average of which 95% was covered by road transport.

Transport Statistical Data and Projections in The Baltic States

The Baltic transport sector

The main **fuel source** used to satisfy energy demand **in the transport sector** in the Baltic States has traditionally been **gas oil and diesel oil (diesel).** In 2017, these fuels accounted for **74%** of total transport energy consumption, followed by petrol on 17%, with electricity claiming one of the lowest shares at 0.5%. The differences in the total amount of energy used for transport in the individual Baltic States are largely population-driven. **Lithuania,** which is home to half the region's population, accounts for nearly **half** of this consumption and Estonia around 20%.
Energy use within the transport sector **decreased** by an average of **3% per year** between **2007** and **2012,** while **petrol decreased by** an annual average of **10%.** From **2012 to 2017, energy consumption** grew by an average of **4% per year,** while **diesel growth** was **6% per year**.





Source: Eurostat
Others includes blended bio-petrol and kerosene-type jet fuel (excluding biofuel portion)

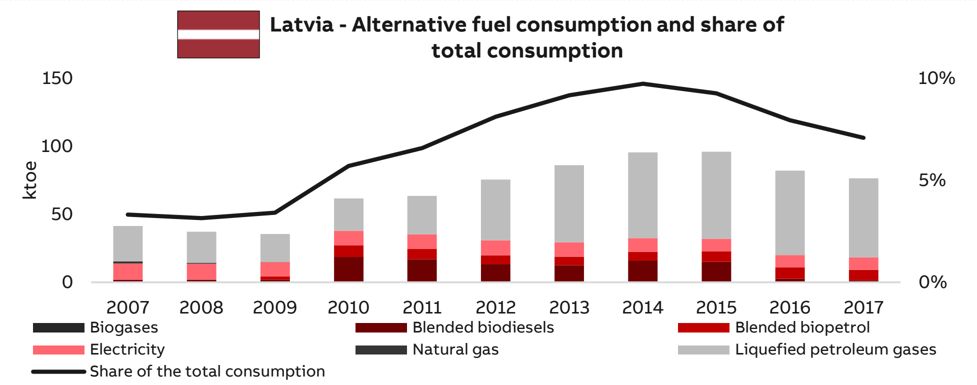
Historically, gas and diesel oil have been the main fuel source for the transport sector while biofuels and electricity are insignificants.

Transport Statistical Data and Projections in The Baltic States

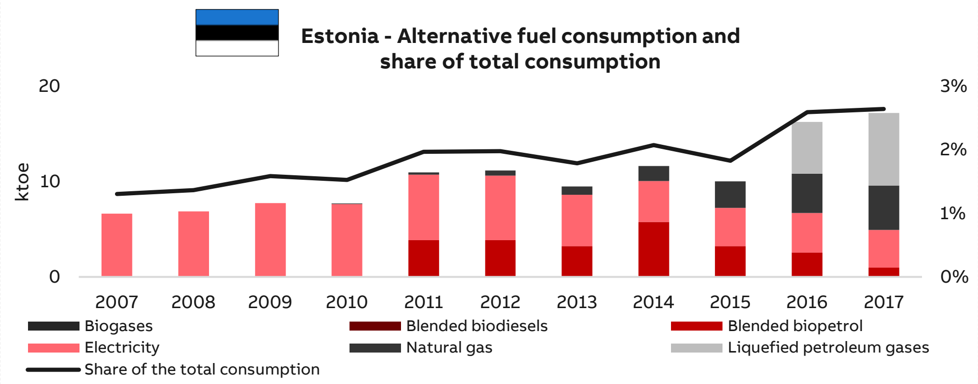
The Baltic transport sector

Alternative fuel consumption in the transport sector in the Baltic States varies between countries, with **Estonia** historically **preferring electricity** as an alternative fuel, and **Lithuania** and **Latvia** favouring **LPG** and **biofuels**.

Changes in alternative consumption and these fuels' respective shares of total transport energy consumption are shown in the following graphs. **Estonia** demonstrates an appreciable increase in alternative fuels consumption during the period, while **Latvia** experienced an increase between 2007 and 2014, but subsequently a considerable decrease. In **Lithuania** however, **biofuel and natural gas consumption remained constant** during the period, while LPG consumption varied, resulting in a net decrease in alternative fuel consumption.



Source: Eurostat



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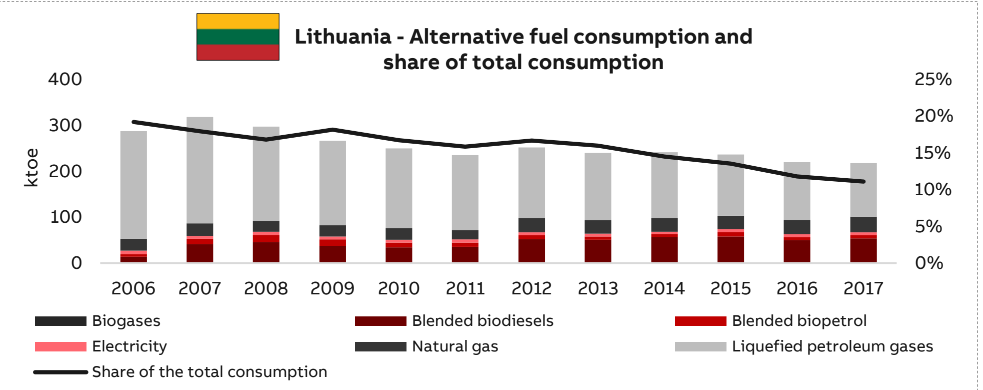


Source: Eurostat

Alternative fuels preferences vary between the Baltic States, electricity mainly preferred by Estonia while LPG and biofuels more popular in Lithuania and Latvia.

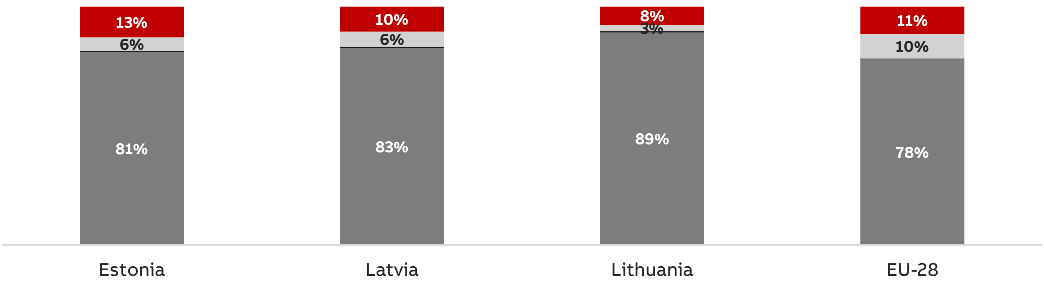
Transport Statistical Data and Projections in The Baltic States

Road transport sector overview

The **modal split** of **road transport** shows that **passengers cars** dominate the fleet in all the Baltic States. With a share of 89% in 2017, **Lithuania** comes in above the EU average of 78%. **Motorcycles** were the third-most popular transport mode with values **below the EU average of 10%** in all three Baltic States, ranging from **6%** in **Estonia** and **Latvia** to **3%** in **Lithuania**. However, at an average of 10%, **freight transport** is almost **on a par with the EU 2017 share** of 11%, thanks to a strong presence in Estonia but a weaker presence in Lithuania.

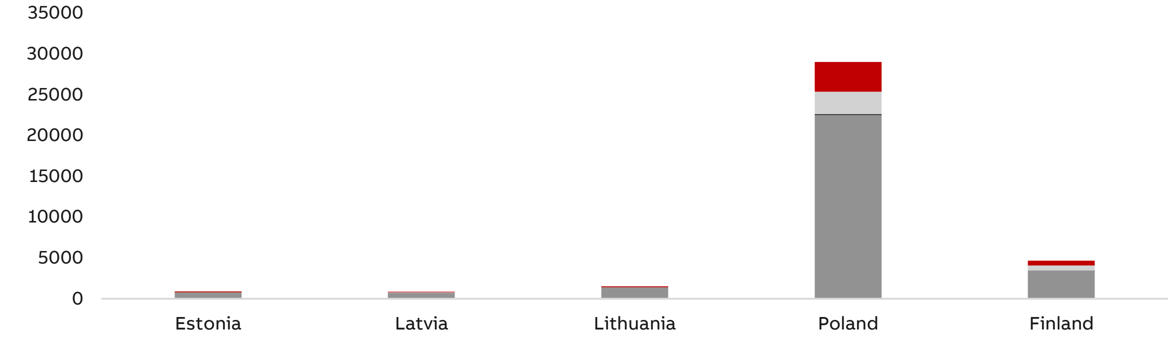
When it comes to EU neighbours **Poland and Finland**, the **size** of the **Baltic States' combined fleet is comparable** to the **Finnish fleet** but smaller than the **Polish fleet**.

Modal split road transport in 2017



Source: EC, 2019

Road transport fleet size in 2017 (thousand units)



Source: EC, 2019

Passenger cars and freight transport account for 95% of the total road fleet in the Baltic States.

Transport Statistical Data and Projections in The Baltic States

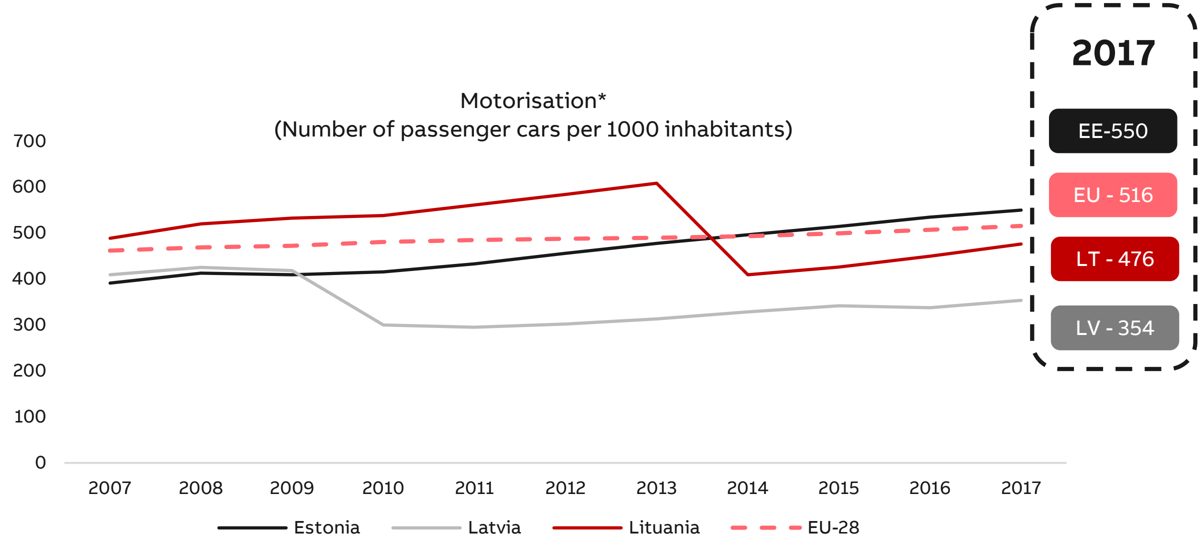
Road transport sector overview

Despite the above, at **473 passenger cars per 1,000 inhabitants, motorisation** in the Baltic States was **in line with the EU-28 average** in 2017. Fluctuations between 2007 and 2017 are mainly attributable to the **withdrawal of old passenger cars** from the vehicle fleet in **Latvia (2010)** and **Lithuania (2014)**. **Estonian motorisation**, on the other hand, posted a marked increase of **41%** between 2007 and 2017, closing above the EU average in 2017.
Even with the withdrawal of these old passenger cars, the average age of the fleet in the Baltic States exceeds the EU average. According to the *European Automobile Manufacturers Association's (ACEA) "Automobile Industry Pocket Guide 2019/2020"*, in 2017 the Baltic road transport fleet was considerably **older** than the **EU average** and slightly younger than the Polish fleet.

Nonetheless, from an air quality perspective, the Baltic States have acceptable levels of fine particulate matter, ozone and nitrogen dioxide concentration (to mention a few) and attributable premature deaths are among the lowest annual means in the EU-28, where the former is due to relatively low transport density in these countries[1].

Passenger cars age in 2017			
Estonia	15.4	Finland	11.2
Latvia	16.1	Poland	17.3
Lithuania	16.9	EU-28	11.11

Source: ACEA, 2018



* Passenger car stock at end of year n divided by the population on 1 January of year n+1
Source: Eurostat

In 2017, the Baltic States had one of the oldest passenger car fleets in EU.

1. Air quality in Europe, EEA, 2019.

Transport Statistical Data and Projections in The Baltic States

Road transport sector overview

As indicated in the previous slide, **Latvia** and **Lithuania** experienced a **decrease** in their **registered road fleets** in both 2010 and 2014. This situation was driven by the implementation of a new **"Vehicle Registration Regulation"** in **Latvia (2010)** and **Lithuania (2014),** which impacted the stock of vehicles registered in each country. The changes and impacts of the regulation are summarised below:

Regulatory framework

In accordance with the regulatory changes in **Latvia**[1], a vehicle must be **removed from the vehicle register** in the following cases:

1. If the **vehicle** is **permanently registered** in a **foreign country** and this is confirmed by an equivalent foreign authority.
2. If the vehicle has **not** undergone a **national roadworthiness test** for five years and the vehicle has not been registered.

In the case of **Lithuania**[2], the new regulation facilitated the deregistration of **end-of-life vehicles** and the sale of vehicles abroad.

Vehicles are automatically deregistered (without the applicant being contacted) 90 days after **expiry of the mandatory roadworthiness test** or compulsory third-party vehicle insurance, 90 days after they have been **decommissioned**, for example.

Impacts on transport sector and this study

- In **Latvia**, there is **no** regulatory **connection** between **deregistration** and **physical decommissioning of vehicles**. From this perspective, is clear that the withdrawal of vehicles was a purely **statistical measure** in **Latvia.**
- While there is a **regulatory** connection between **deregistration** and **physical decommissioning** in **Lithuania**, there are no registers of decommissioned units during the regulation's implementation period. For the reasons above, this measure is also considered **statistical**.
- These types of **vehicle withdrawals** from the fleet **will impact future performance indicators** and analyses in the Baltic States, as they **reduce the fleet size**. The most affected performance indicators will be those linking sector performance and energy consumption with the total stock of vehicles, such as:
  - **Passenger-km/vehicle**
  - **Tonne-km/vehicle**
  - **Vehicle/person**
  - **Energy consumed (TJ)/passenger vehicle**
  - **Energy consumed (TJ)/passenger vehicle**

1. Regulations of the Cabinet of Ministers No. 1610. Vehicle registration rules, 2010.
2. Minister of the Interior of the Republic of Lithuania, Order No. V-445, 2014.

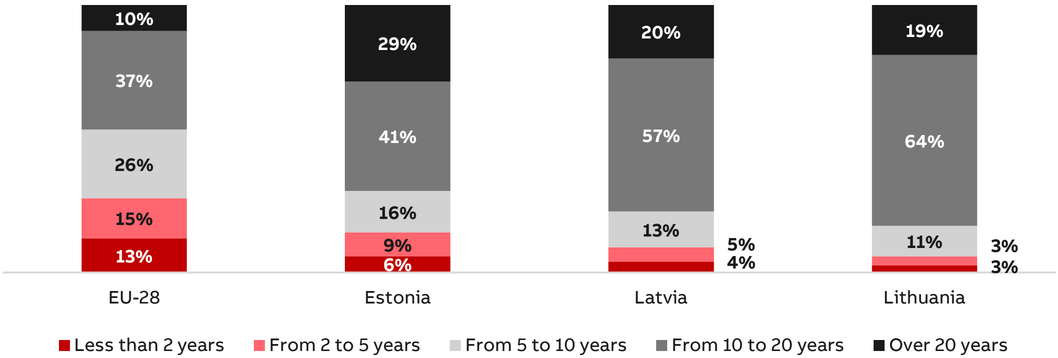
Transport Statistical Data and Projections in The Baltic States

Road transport sector overview

The graph below shows **the share of the passenger cars fleet by age** in 2017. The Baltic States show a majority of old cars with a range between **10 and 20 years** but also with an important presence of **“over 20 years” cars**, which impacts the **energy intensity** and **GHG emissions** in the sector as will be evaluated in this report.

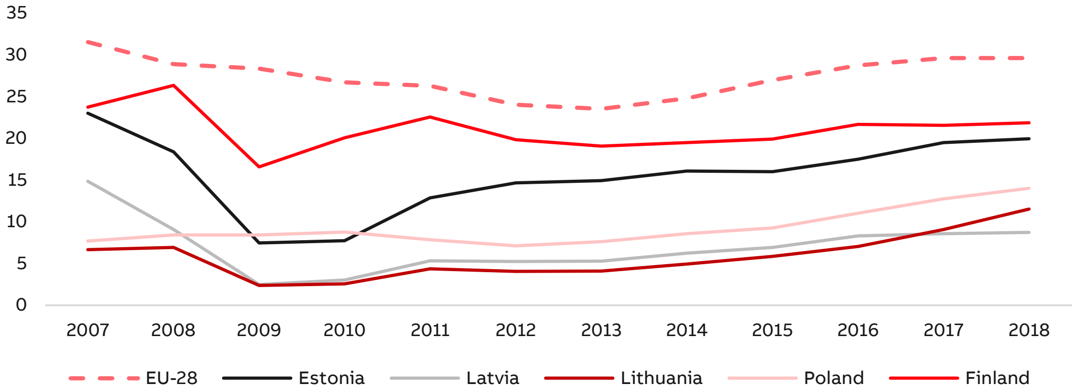
The old age of the fleet also is a result of the low number of **new registered passenger cars,** during the economic crisis the incorporation of new vehicles shrunk strongly in the Baltic States and it was until 2011 that they started to increase the registrations. In 2018, **Latvia** and **Lithuania** accounted **9 and 12 new cars registered** per 1,000 inhabitants, respectively, average that are much **below the EU-28 average** and their neighbour **Poland**. **Estonia**, on its side, continues below the EU-28 average but is **close to** the **Finnish** average.

Passenger cars by age - 2017



Source: Eurostat

Evolution of the new passenger car registrations*
(per 1,000 inhabitants)



* New passenger car registered divided by the population on 1 January of year n
Source: Eurostat

The financial crisis slowed the registration of new vehicles in the late 2000s in the Baltic States, as a result of which these fleets are now the oldest in the EU.

Transport Statistical Data and Projections in The Baltic States

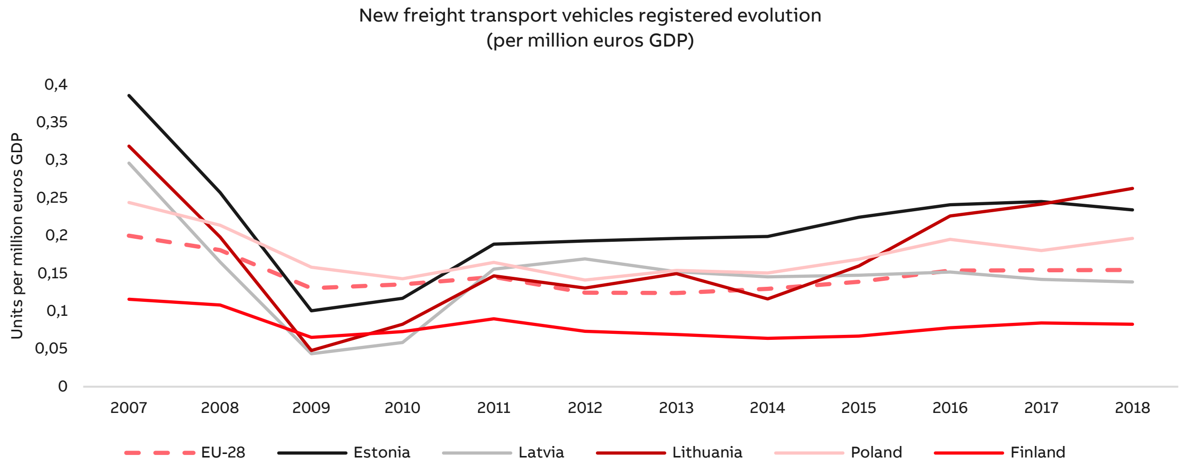
Road transport sector overview

In **freight transport,** the situation is a bit more encouraging for the three Baltic States. In 2017, at 11.6 years, **Lithuania** had a **younger fleet** than the EU-28 and Finnish average. **Estonia**, however, had the **third-oldest (16.3 years)** freight transport fleet in Europe after Poland (second-oldest – 16.4 years) and Greece (oldest – 18.9 years).

The graph on the right shows the relationship between new freight vehicles registered and the GDP for both the Baltic States and their neighbouring countries. The **impact of the financial crisis** can be seen in the three Baltic States **during the late 2000s**; however, from **2010**, **registrations of new freight vehicles** started to **rise.** By **2018, Estonia** and **Lithuania** were **above** the **EU-28 average and Latvia** was **below**.

Freight transport age in 2017			
Estonia	16.3	Finland	12.0
Latvia	13.9	Poland	16.4
Lithuania	11.6	EU-28	12.0

Source: ACEA, 2018



* New freight vehicles registered divided by the GDP of year n
Source: Eurostat

At 11.6 years, Lithuania has the youngest freight transport fleet in the Baltic States, and Estonia the oldest at 16.3 years.

Transport Statistical Data and Projections in The Baltic States

Historical and actual assessment

As shown in the previous section, the **Baltic road sector** has some **special characteristics** that position it among **under-performing** countries. To describe and categorise these in more detail, we first need to define some KPIs [1]:

Performance

Passenger car performance (passenger-km): Measures the transport of one passenger by road over one kilometre

Freight transport performance (tonne-km): Measures the transport of one tonne of goods over a distance of one kilometre

Population and fleet

Passenger-km/person: Measures passenger car performance per person

Tonne-km/person: Measures freight transport performance per person

Passenger-km/vehicle: Measures passenger car performance per vehicle

Tonne-km/vehicle: Measures freight transport performance per vehicle

Vehicle/person: Measures the ratio between passengers and vehicles

Energy consumption

MJ/passenger-km: Measures the energy required to transport one passenger by road over one kilometre

MJ/tonne-km: Measures the energy required to transport one tonne of goods over a distance of one kilometre

1. Glossary for transport statistics, 2019

Transport Statistical Data and Projections in The Baltic States

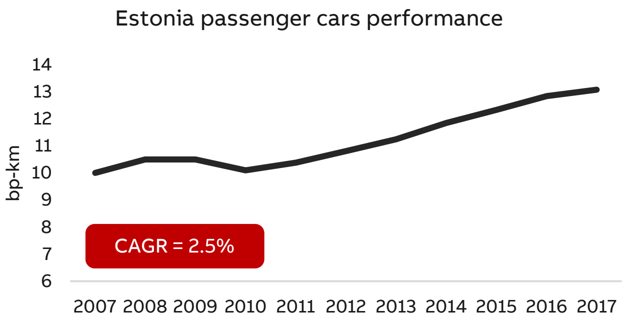
Historical and actual assessment

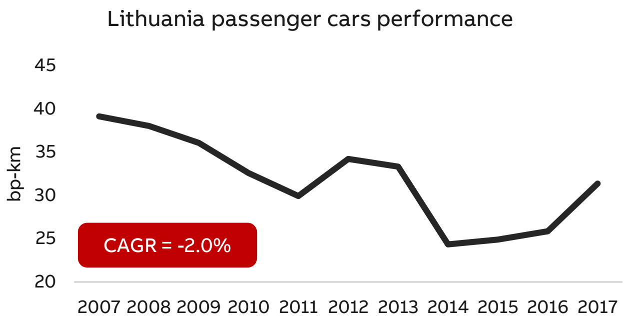
Performance

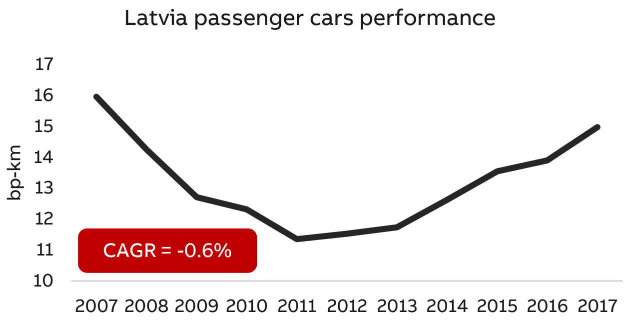
Population and fleet

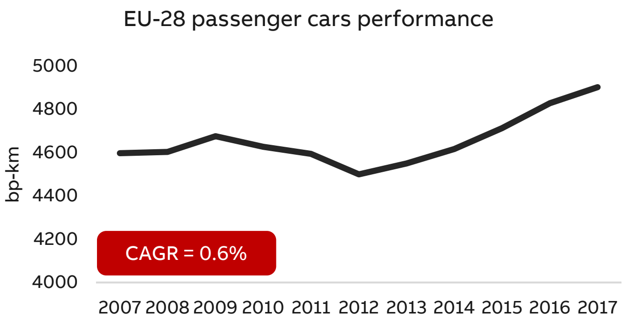
Energy consumption

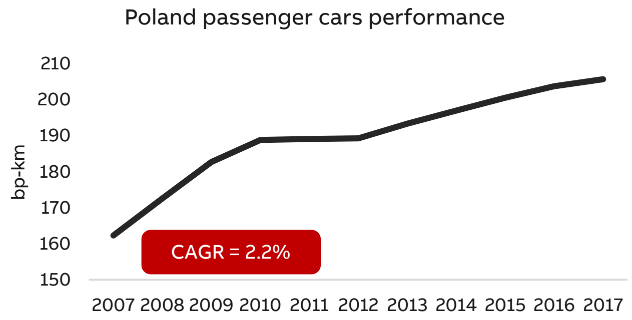
Changes in passenger car performance are considered one of the most reliable measures for analysing the transport sector across countries, as these reflect the extent to which the transport means in question are used. The graphs below reveal an upwards trend in Estonia, Poland and the EU-28, but a downwards trend in Lithuania and Latvia. This KPI applies a **Compound Annual Growth Rate (CAGR),** which represents the **rate of growth** of the analysed variable over the study period.

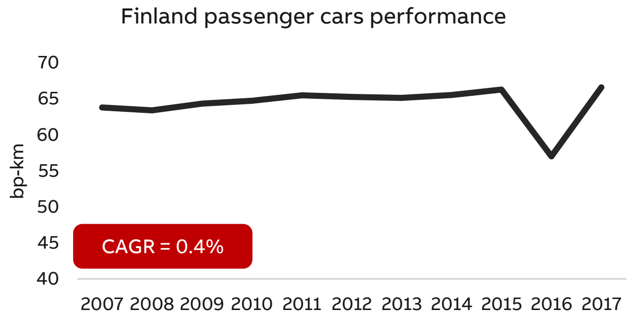












Estonia is the only Baltic country to have increased its passenger car performance by more than the EU-28 average.

Transport Statistical Data and Projections in The Baltic States

Historical and actual assessment

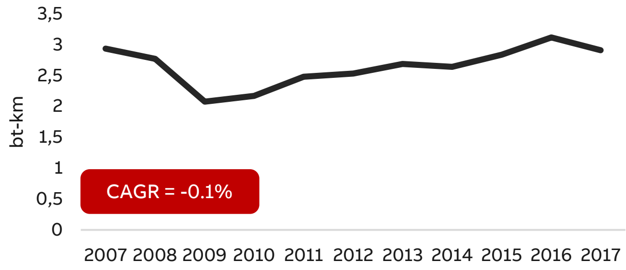
Performance

Population and fleet

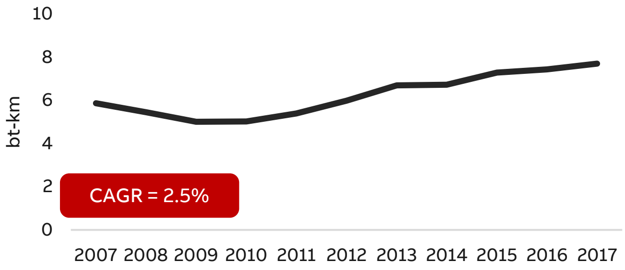
Energy consumption

In terms of **changes in freight transport performance,** we have considered the **haulage performed by all vehicles within the territory of the study countries.** This is important since the **Baltic States** have a **high share of international road freight transport** and this affects many of the KPIs presented, more details are on the next slide. The KPI provides a measure of the "popularity" of the freight transport in each country. The graphs below show that road freight transport is increasing in Baltic States and the other study countries.

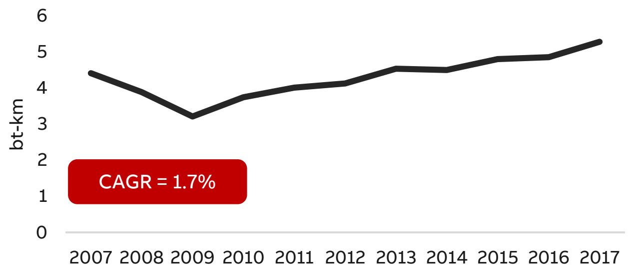
Estonia freight transport performance



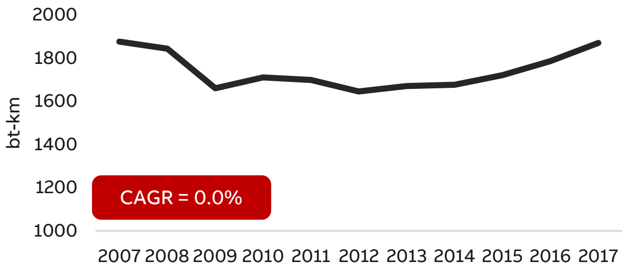
Lithuania freight transport performance



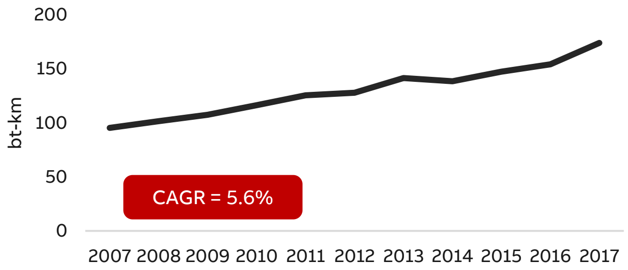
Latvia freight transport performance



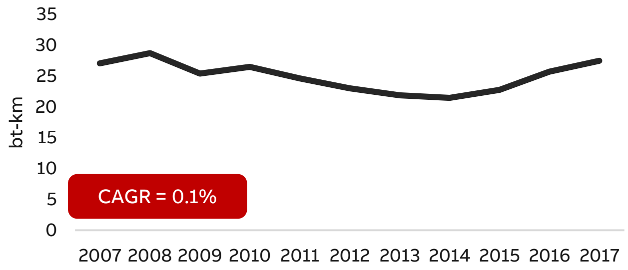
EU-28 freight transport performance



Poland freight transport performance



Finland freight transport performance



Lithuania and Latvia have returned considerable growth in freight transport performance in recent years.

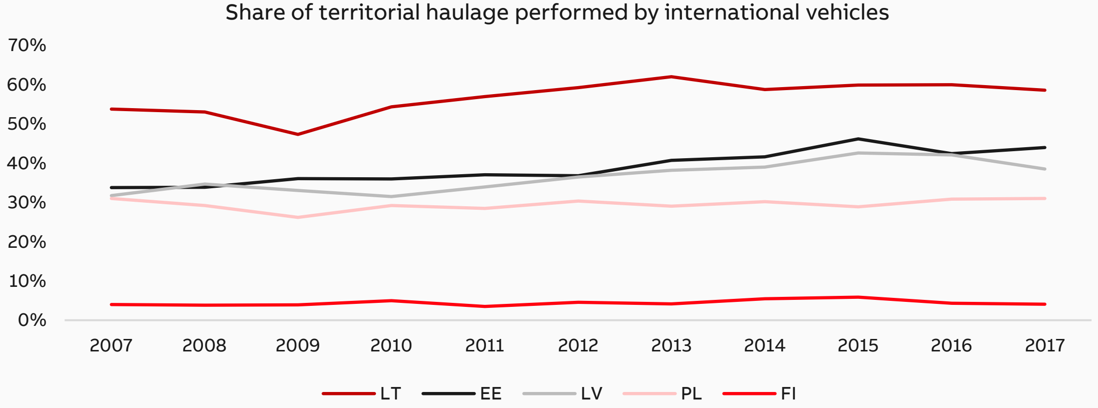
Transport Statistical Data and Projections in The Baltic States

Insight: International transport

As shown in the previous slide, the Baltic States have a **high share of international road freight transport** due to the fact the region forms a corridor between Central and Northern Europe. There are a number of characteristics to consider here:

Characteristic 1

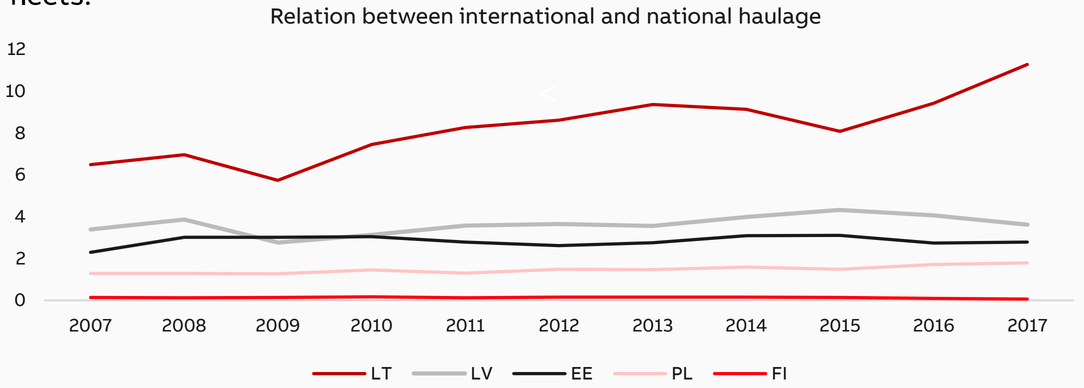
As the Baltic States are small countries, **the relative share of international haulage performed by foreign vehicles is considerable**. The share of territorial haulage performed by the international fleet is shown below:



Source: EC, 2019

Characteristic 2

The **haulage performed by national fleets in countries other than the vehicle's country of registration** reveals that at any one time **most of the fleet** in the Baltic States comes **from non-Baltic states**. The graph below shows the relationship between international haulage and national haulage, both performed by national fleets.



* International haulage as a percentage of national haulage
Source: EC, 2019

Transport Statistical Data and Projections in The Baltic States

Historical and actual assessment

Performance

Population and fleet

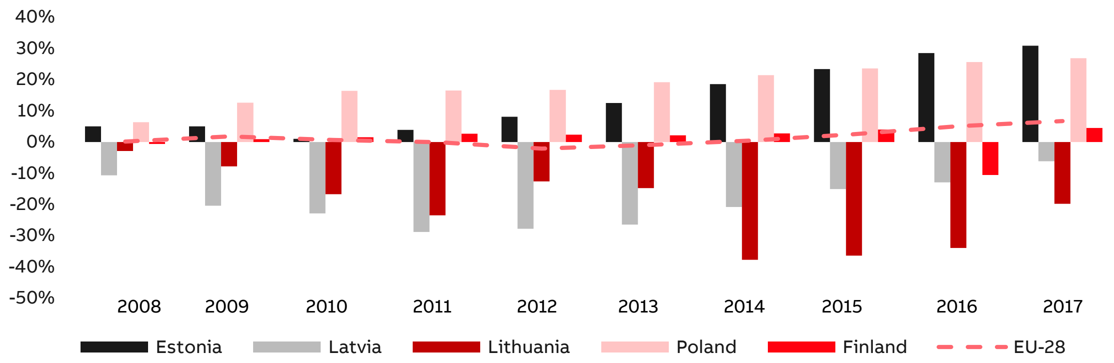
Energy consumption

The **performance of passenger cars** in the Baltic States has historically varied. While **Estonia** was the only Baltic Stare to have **increased** its **2007 levels by 2017 (31%), Latvia** and **Lithuania** had returned **decreases** of 6% and 20%, respectively. Compared with the rest of the **EU**, the change in performance was largely **insignificant**.

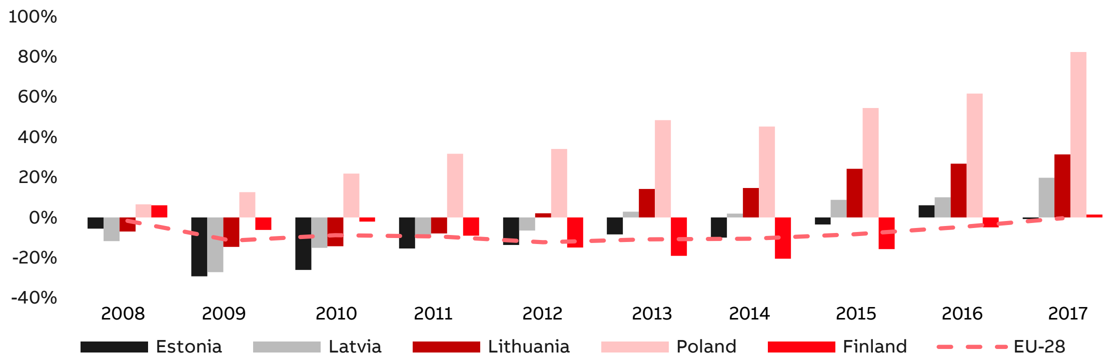
In terms of changes in **freight transport performance**, **Lithuania** is the Baltic country with the most **notable growth**, improving its **2007 levels** by **31%** by **2017**. Estonia experienced an increase of 20% and Latvia a decrease of 1% during the same period. Among the region's neighbours, **Poland** almost **doubled its 2007** levels with 88% growth by 2017. However, from an **EU perspective** there was **no change** in **freight transport performance** during the study period.

Freight transport performance has continuously improved in recent years in the Baltic States.

Passenger cars performance change (base year 2007)



Freight transport performance change (base year 2007)



Transport Statistical Data and Projections in The Baltic States

Historical and actual assessment

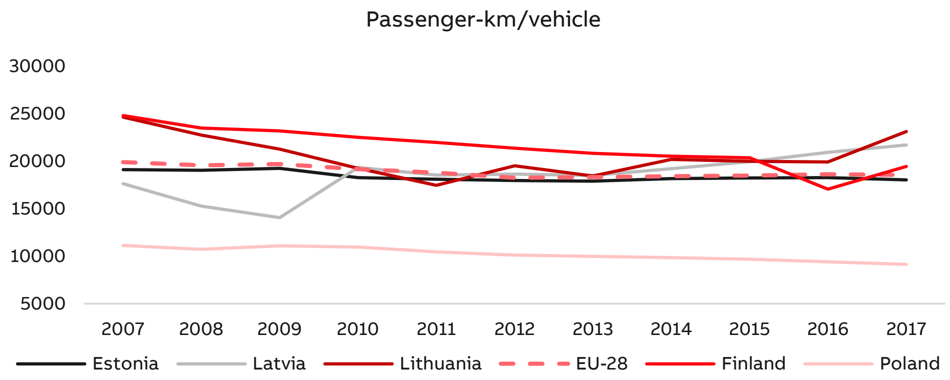
Performance

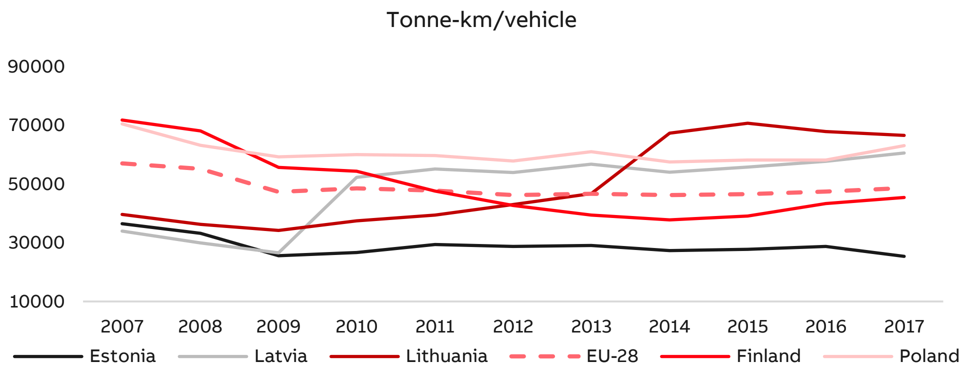
Population and fleet

Energy consumption

Linking the **performance of the fleet with demographic measures** enables us to examine performance by both **passenger** and **vehicle**. From this perspective, **Lithuania** and **Latvia** appear to be **over-performing** in terms of the passenger car performance of the **vehicle stock.**

The relationship between performance and the number of goods vehicles for **freight transport** clearly shows this sector's importance in individual Baltic States. In 2017, **Lithuania** had the **highest tonne-km** per vehicle at **66,671,** which represents an increase of 68% compared to 2007. **Latvia** closely follows with **60,582 tonne-km/vehicle** for the same year but with a **bearish trend since 2013**. **Estonia is the Baltic outlier** with **half** of the **EU-28 average** in 2017 (**25,371 tonne-km/vehicle)**.





Latvia and Lithuania show a higher passenger and freight transport performance per vehicle.

Transport Statistical Data and Projections in The Baltic States

Historical and actual assessment

Performance

Population and fleet

Energy consumption

The previous KPI can also be translated into the ratios **passenger cars per inhabitant** and **volume of freight transport relative to GDP (in MM€).** Here, **Estonia** has increased its **passenger car density,** moving from the lowest to **highest density** in the Baltics between 2007 and 2017. **By 2017,** as a result of **passenger car withdrawals, Latvia** and **Lithuania** had the **lowest density** within the comparison landscape.

However, the **ratio** between **freight transport vehicles and GDP** shows that **Lithuania** and **Latvia –** the countries with **younger fleets –** are **on a par with** the **EU-28 average** and **Finland,** where the improvement is partly attributable to old vehicle withdrawals.

Change in passenger car stock per 1,000 inhabitants

Year	Estonia	Latvia	Lithuania	EU-28	Finland	Poland
2007	390.02	409.66	488.59	463.62	487.09	382.65
2008	412.29	425.60	520.16	470.48	509.48	421.86
2009	408.54	418.11	532.46	473.17	521.31	432.53
2010	414.54	300.24	538.47	480.27	537.70	453.41
2011	431.69	295.15	561.26	486.11	554.15	476.19
2012	454.34	302.36	583.76	488.85	566.07	492.44
2013	476.07	313.57	608.69	491.84	576.30	509.41
2014	496.27	328.66	409.61	494.51	586.09	526.17
2015	514.58	341.90	425.86	500.93	595.35	545.26
2016	534.29	337.32	449.61	508.62	609.77	570.90
2017	551.75	353.83	476.49	516.68	621.99	592.61

Change in volume of freight transport relative to GDP (in MM€)

Year	Estonia	Latvia	Lithuania	EU-28	Finland	Poland
2007	4.90	5.72	5.08	2.53	2.01	4.30
2008	5.01	5.32	4.59	2.55	2.17	4.39
2009	5.71	6.41	5.43	2.84	2.51	5.70
2010	5.46	4.02	4.79	2.74	2.59	5.35
2011	5.01	3.59	4.38	2.69	2.61	5.53
2012	4.88	3.45	4.17	2.64	2.68	5.67
2013	4.84	3.50	4.09	2.63	2.71	5.87
2014	4.79	3.52	2.73	2.57	2.75	5.85
2015	4.90	3.52	2.76	2.48	2.75	5.88
2016	4.99	3.35	2.81	2.51	2.72	6.21
2017	4.83	3.25	2.73	2.49	2.67	5.90

By 2017, Estonia had the highest passenger car density in the Baltics, and was on a par with the EU-28 average. Lithuania and Latvia have increased their share of freight transport vehicles per GDP as a result of withdrawals in respectively 2010 and 2014.

Transport Statistical Data and Projections in The Baltic States

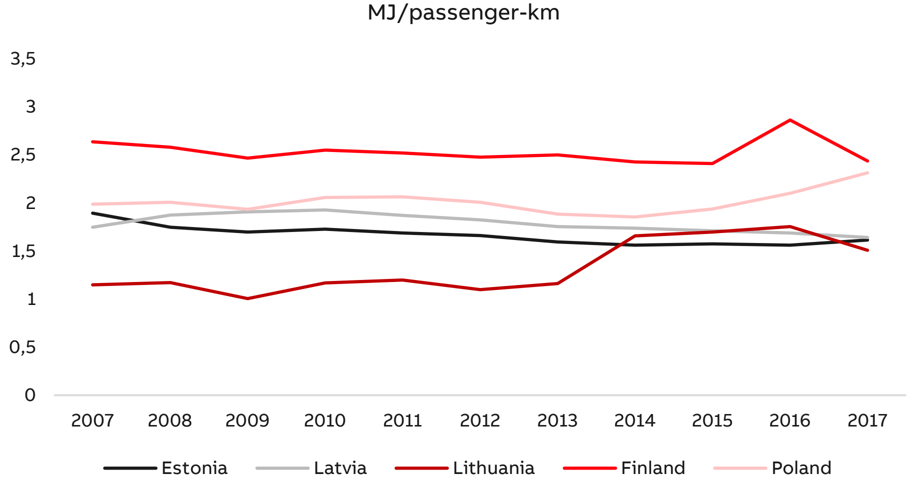
Historical and actual assessment

Performance

Population and fleet

Energy consumption

The **energy consumption of passenger cars** in the Baltic States **can be misleading** due to the fact that the MJ/passenger-km indicator does not reflect the amount of energy required to facilitate the total performance (bp-km) in each country. However, the table on the right shows the **average energy consumed (TJ) per each passenger car**. This KPI clearly demonstrates that **energy consumption per vehicle** is **increasing** in **Latvia** and **Lithuania** – prior to the withdrawal of old cars the countries appear to be performing well in terms of energy consumed per passenger car; however, the withdrawals were implemented to remove inoperative and inefficient vehicles – while **energy consumption per vehicle** in **Estonia** is **falling** sharply.



Energy consumed (TJ) per passenger car

Year	Estonia	Latvia	Lithuania	Poland	Finland
2007	36.19	30.84	28.32	22.11	65.45
2008	33.25	28.66	26.64	21.56	60.61
2009	32.68	26.81	21.40	21.43	57.20
2010	31.57	37.32	22.48	22.53	57.44
2011	30.51	34.72	20.95	21.54	55.44
2012	29.87	34.01	21.40	20.30	52.92
2013	28.55	32.47	21.39	18.81	52.11
2014	28.34	33.35	33.48	18.28	49.82
2015	28.72	34.17	33.97	18.75	49.07
2016	28.56	35.37	34.92	19.75	48.78
2017	29.09	35.64	34.91	21.16	47.45

The black line represents the years of old cars withdrawal

Latvia and Lithuania have higher energy consumption per passenger car, but lower energy consumption than Finland.

Transport Statistical Data and Projections in The Baltic States

Historical and actual assessment

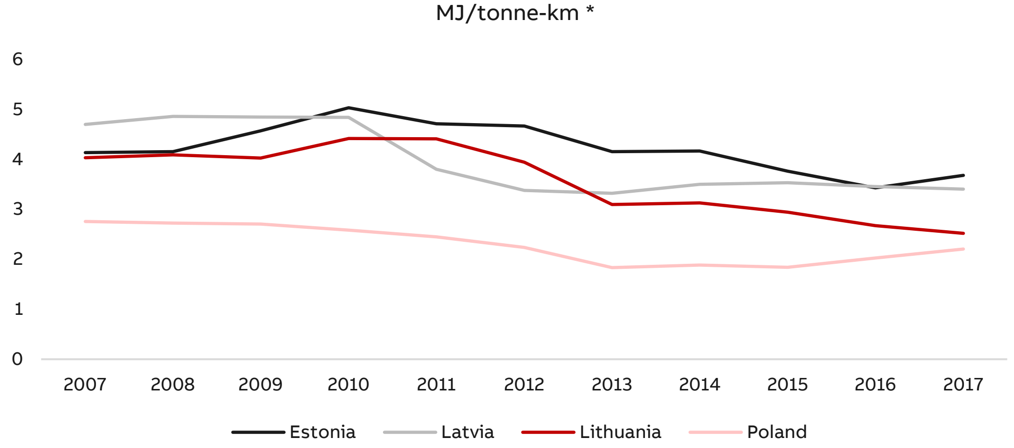
Performance

Population and fleet

Energy consumption

Freight transport energy efficiency (MJ/tonne-km) **reflects** the **age of the fleet**. As shown in in the graph below, the **Lithuanian fleet** is the **most efficient** performer requiring just **2.5MJ/tonne-km**, while the **Estonian** fleet is the **least efficient** with **3.5**

However, the energy intensity per vehicle shows a different picture. **Latvian** and **Lithuanian** vehicles have **increased their consumption** during the period, partly due to the **increase in the performance** of their fleets and the **withdrawal of old vehicles** in 2010 and 2014, respectively.



* Finnish freight transport energy consumption is not consider as the information is unavailable

Energy consumed (TJ) per freight transport vehicle *

Year	Estonia	Latvia	Lithuania	Poland
2007	151.23	159.71	160.03	104.23
2008	138.02	145.54	148.57	102.04
2009	117.07	128.98	137.63	103.86
2010	134.45	253.15	165.63	100.58
2011	138.69	209.87	173.93	98.28
2012	134.16	182.65	169.85	89.93
2013	121.14	188.37	144.90	79.86
2014	113.96	189.06	210.55	78.12
2015	104.83	196.89	207.98	79.01
2016	98.76	199.56	181.60	88.17
2017	93.40	206.09	167.70	105.33

The black line represents the years of old cars withdrawal

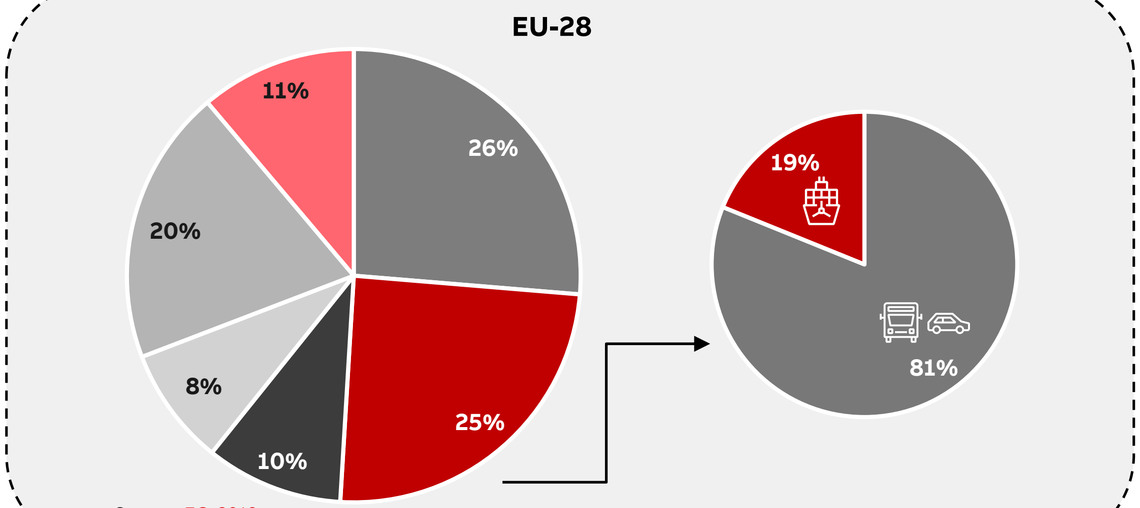
Latvia and Lithuania have increased the energy consumption of their fleets due to an improvement in performance and the withdrawal of old vehicles.

Transport Statistical Data and Projections in The Baltic States

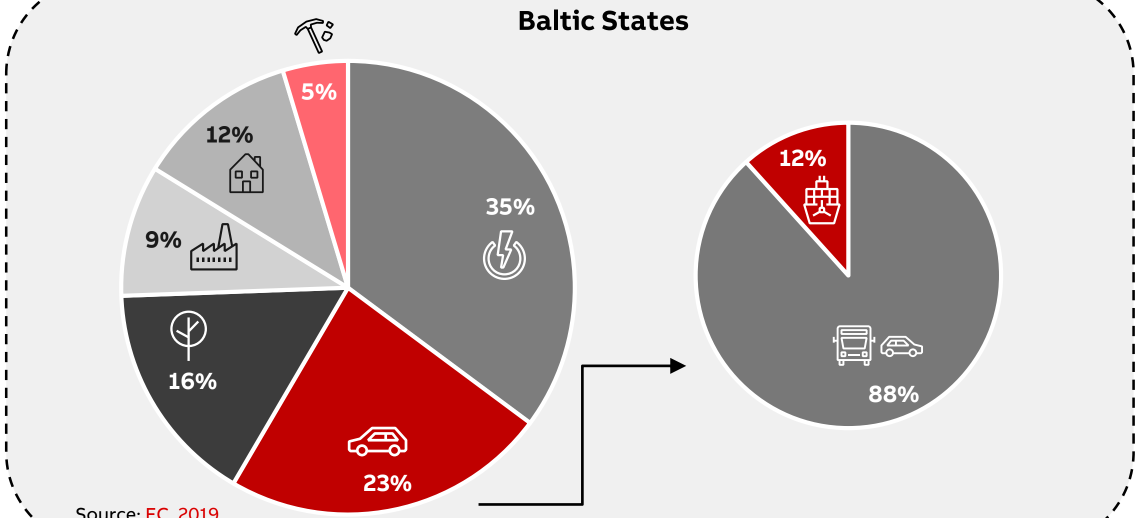
GHG emissions

The transformation of the transport sector, which accounts for one third of FEC in the region, represents not only a major **energy challenge**, but also an **environmental challenge** in the **Baltic States**. In 2017, **transport greenhouse gas (GHG) emissions were the second-largest source of emissions – after power and heat –** representing **23% of total emissions** in the **Baltic States** and **25%** in the **EU-28**. Furthermore, **road transport** is of more **relevance** in the **Baltic States** since it accounts for **88%** of these emissions, compared with **81%** in the **EU-28**.

GHG emissions by sector in 2017



Source: EC, 2019



Source: EC, 2019

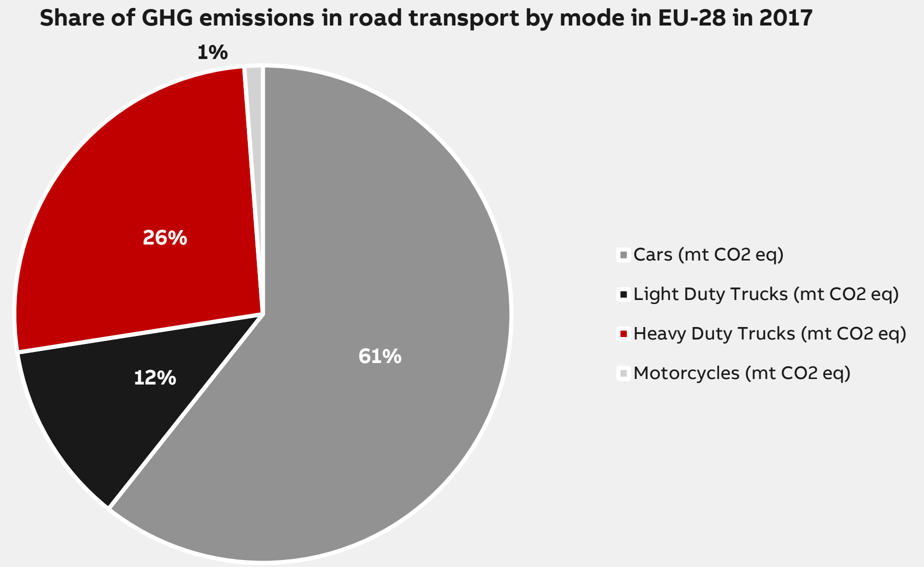
| Power and heat | Transport | Agriculture | Industrial processes | Commercial, residential, waste and others | Construction and manufacturing | Road transport | Others (including rail, maritime and air transport)

The transport sector is the second-largest GHG emissions producer in the Baltic States, accounting for 23% of total emissions.

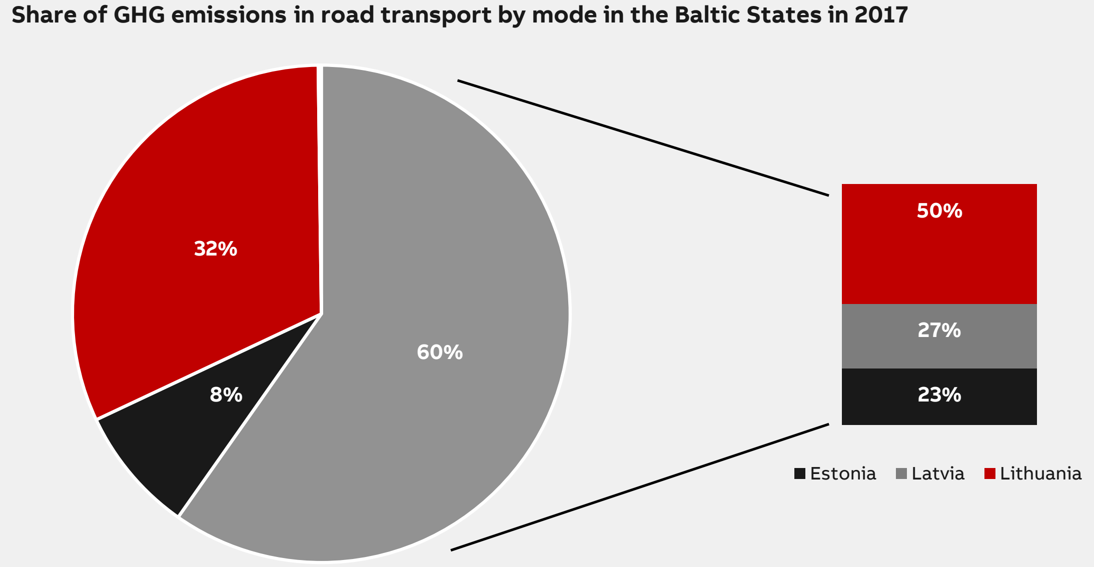
Transport Statistical Data and Projections in The Baltic States

GHG emissions

As expected, **passenger cars** are the road transport mode that produces the highest GHG emissions, accounting for **60%** of **total EU-28 road emissions in 2017** and the **same share** in the **Baltic States**. The second-largest GHG emissions emitters are **"heavy duty trucks",** which as shown in the previous sections, represent a very important road transport mode. In **2017**, these accounted for **32%** of total **Baltic road transport emissions**, compared to **26% in the EU-28**.



Source: UNFCCC, 2018



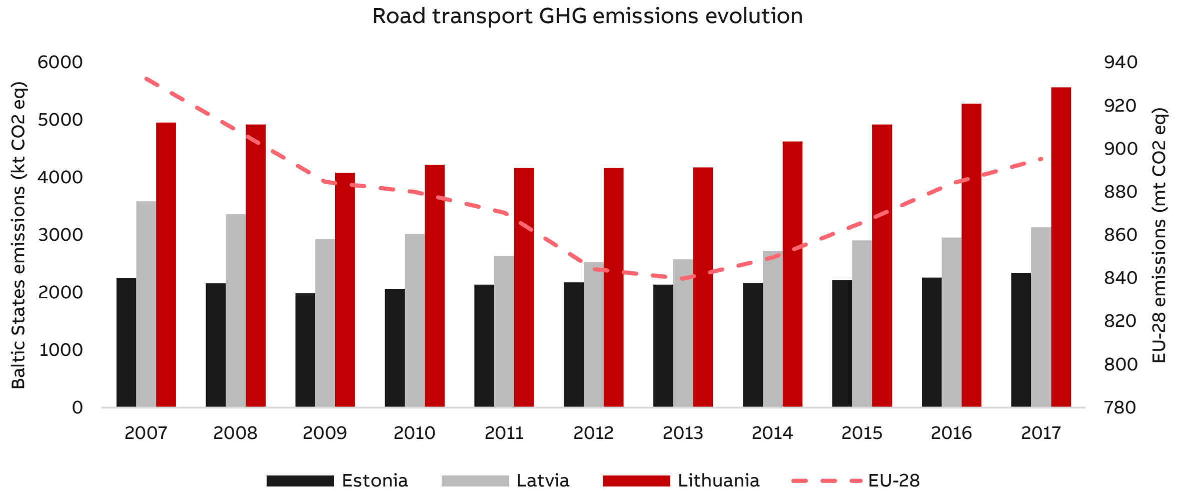
Source: UNFCCC, 2018

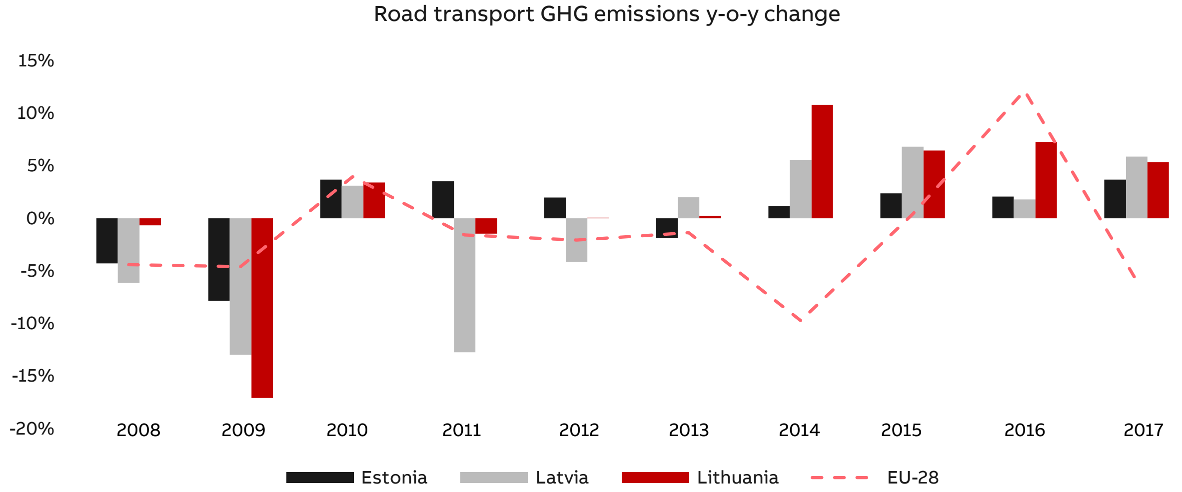
In 2017, passenger cars and freight transport accounted for 92% of total GHG emissions in the Baltic States.

Transport Statistical Data and Projections in The Baltic States

GHG emissions

As illustrated by the performance KPIs, the past decade has seen **a rapid increase in demand for passenger and goods transport**, and the **road transport sector depends** – almost exclusively – on **fossil fuels**. From a **European perspective**, by **2017** the levels of road transport GHG emissions **have nearly returned to their 2007 levels,** which represents a decrease of just 5%. **Emission changes** in the **three Baltic States were close to the EU-28 average** until 2013, since when they have **consistently decreased**. However, since 2014 the **decrease** in emissions **in Lithuania** and **Estonia has slowed down,** with the result that these countries actually **finished** with **higher levels in 2017**. **Latvia** followed the EU-28 trend until 2017, but with **stronger emission reductions** throughout the period, including an exceptional y-o-y reduction in 2011, which was partly driven by a decrease in passenger car performance from 2010 to 2011 and energy consumption improvements for both passenger and freight transport. **By 2017, Latvia** had **reduced** its **2007 levels** by **13%**.





Source: UNFCCC, 2018

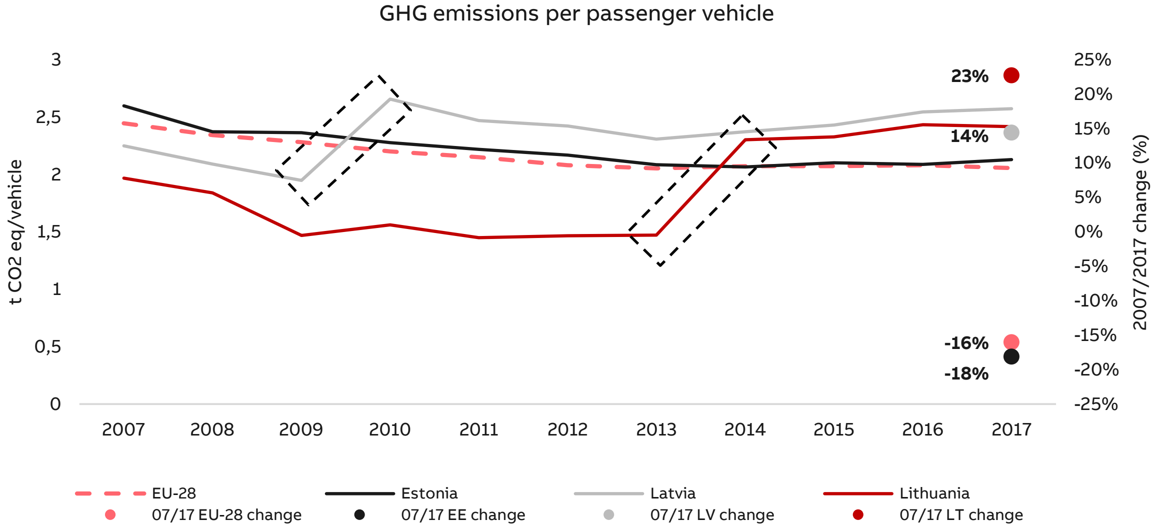
Until 2013, the Baltic States continuously reduced their road transport GHG emissions. Subsequently, the rate of decrease slowed and even increased in Lithuania and Estonia in 2017

Transport Statistical Data and Projections in The Baltic States

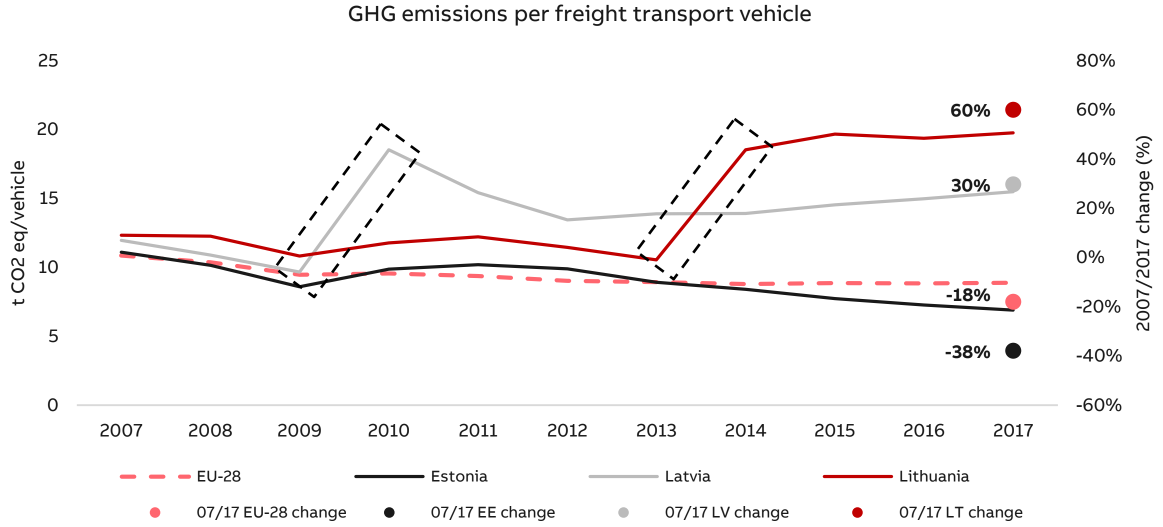
GHG emissions

The **Baltic States** are also **dominated** by a **carbon-intensive fleet**, which means that **each vehicle**, either passenger or freight, **produces higher GHG emissions** than the EU average, a situation that has accelerated throughout the study period. The graph below left shows that the **Estonian passenger vehicle fleet** had an **emission ratio close** to the **EU-28 average. Latvia** and **Lithuania** were actually **below** the **EU-28 average before** their old car **withdrawals,** after which the ratio increased drastically.

The graph on the right shows the **emissions ratio for freight transport vehicles**. Here, the behaviour is similar to the passenger car fleet, with **Estonia reducing** GHG emissions per vehicle by **38% between 2007 and 2017** and **Lithuania** and **Latvia** increasing their shares by **60%** and **30%**, respectively, during the same period..



Source: UNFCCC, 2018



Source: UNFCCC, 2018

Estonia was the only Baltic country to follow EU-28 emission ratio changes between 2007 and 2017 for both passenger and freight transport vehicles.

Transport Statistical Data and Projections in The Baltic States

Summary of findings

The transport sector is responsible for almost a third of final energy consumption and a quarter of total greenhouse gas emissions in the Baltic States. Based on the data collected and earlier analyses, the summary of the key findings are presented below:

KPI	Evolution of KPI			2017 value		
	Estonia	Latvia	Lithuania	Estonia	Latvia	Lithuania
Motorisation (Number of passenger cars per 1000 inhabitants)	↑	↓	↓	550	354	476
Passenger cars performance (bp-km)	↑	↓	↓	13.1	15.0	31.4
Freight transport performance (bt-km)	—	↑	↑	2.9	5.3	7.7
Passenger-km/vehicle	↓	↑	↑	18 020.7	21 707.3	23 110.5
Tonne-km/vehicle	↓	↑	↑	25 370.7	60 582.2	66 671.3
Freight transport vehicles stock evolution per million euros GDP	—	↓	↓	4.8	3.3	2.7
MJ/passenger-km	↓	↓	↑	1.6	1.6	1.5
MJ/tonne-km	↓	↓	↓	3.7	3.4	2.5
TJ per passenger car (TJ/vehicle)	↓	↑	↑	29.09	35.64	34.91
TJ per freight transport vehicle (TJ/vehicle)	↓	↑	↑	93.4	206.09	167.7
Total road transport emissions (ktCO2 eq)	↑	—	↑	2 345.2	3 134.4	5 569.8
GHG emissions per passenger vehicle (tCO2 eq/vehicle)	↓	↑	↑	2.1	2.6	2.4
GHG emissions per freight transport vehicle (tCO2 eq/vehicle)	↓	↑	↑	6.9	15.5	19.8

↑ Increase ↓ Decrease — No changes

ABB

Transport Statistical Data and Projections in The Baltic States

Chapter III: Current policy overview

Transport Statistical Data and Projections in The Baltic States

Current Policy Overview

As shown in the previous chapter, the **transport sector** is responsible for around a **third of the Baltic region's final energy consumption** and consequently **greenhouse gas emissions**. Appropriately addressing this issue will be the key to **decarbonising** the Baltic States.

Under the **second commitment period of the Kyoto Protocol (2013–2020)**, the **European Union** (together with Iceland) **pledged** to **reduce total GHG emissions by 20%** compared to 1990 levels. In order to facilitate this, the **EU** has established **targets** for all countries **to reduce their greenhouse gas emissions** and **to gradually raise the share of renewables in their energy consumption** in the period leading up to 2050. These targets are established in the following packages:

- **2020 climate and energy package**
- **2030 climate and energy package**

The **national emissions reduction targets** include **sectors** that are **not covered** by the **European Emission Trading System** (EU ETS) such as:

- **Housing**
- **Waste**
- **Agriculture**
- **Transport** (excluding aviation)

The **share of renewable in energy consumption targets** mainly refers to the following areas:

- **Electricity**
- **Transport**
- **Heating and cooling**

Transport Statistical Data and Projections in The Baltic States

2020 and 2030 targets

2020 targets

The Renewable Energy Directive (Directive 2009/28/EC) commits all EU member states to sourcing 20% of final energy consumption from renewable sources by 2020. The states are also required to have an at least **10%** share of renewable energy in the transport sector by 2020.

Country	RES share in FEC	RES share in transport
EU	20%	10%
Estonia	25%	10%
Latvia	40%	10%
Lithuania	23%	10%

For Greenhouse Gas emissions, the **Effort-Sharing Regulation** establishes binding targets for member states for the period 2013–2020, and sets national emissions targets for 2020, expressed as percentage changes from 2005 levels.

Country	GHG emissions limit in 2020 compared to 2005 levels
EU	10% higher
Estonia	11% higher
Latvia	17% higher
Lithuania	15% higher

2030 targets

All EU member states are obliged to adopt an integrated **National Energy and Climate Plans (NECP)** for the period 2021–2030, which has to be submitted to the European Commission by the end of 2019. In the draft NECPs, the Baltic States have proposed the following targets for 2030:

Country	RES share in FEC	RES share in transport
EU	32%	-
Estonia	42%	14%
Latvia	45%	14%
Lithuania	45%	15%

In addition, the **Effort-Sharing Regulation** for the period 2021–2030 sets the following GHG emission reduction targets:

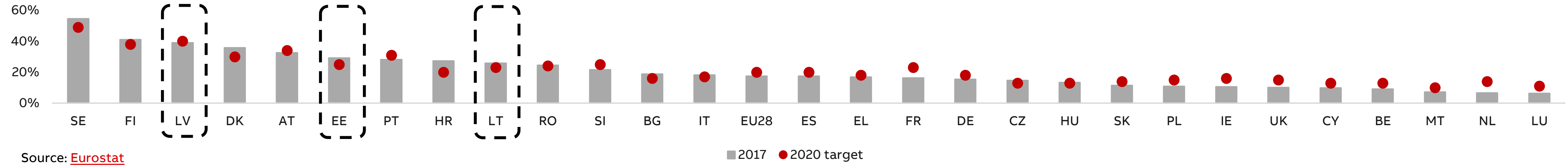
Country	GHG emissions limit in 2030 compared to 2005 levels
EU	30% lower
Estonia	13% lower
Latvia	6% lower
Lithuania	9% lower

Transport Statistical Data and Projections in The Baltic States

Actual target status

In general terms, the **Baltic States** are **performing well** when it comes to the share of renewable energy in final energy consumption. **By 2017,** the **three countries** had **surpassed the 2020 target** with an average **of 31.4%, compared to a joint target of 29.3%**.

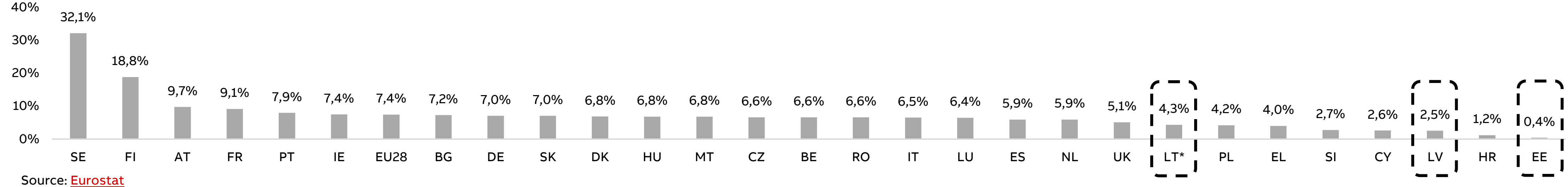
Share of energy from renewable sources in final energy consumption in 2017



Source: Eurostat

However, the picture in the **transport sector** changes dramatically. **In 2017**, the **EU-28 RES share** in the transport sector was **7.4%**, while the **Baltic States** lagged far behind with an **average** of **2.21%**. The share of energy from renewable sources in transport was **4.3% in Lithuania**, **2.5% in Latvia** and **0.41%** in the worst performing EU country **Estonia.**

Share of energy from renewable sources in transport in 2017



Source: Eurostat
* Corrected with data from Statistics Lithuania

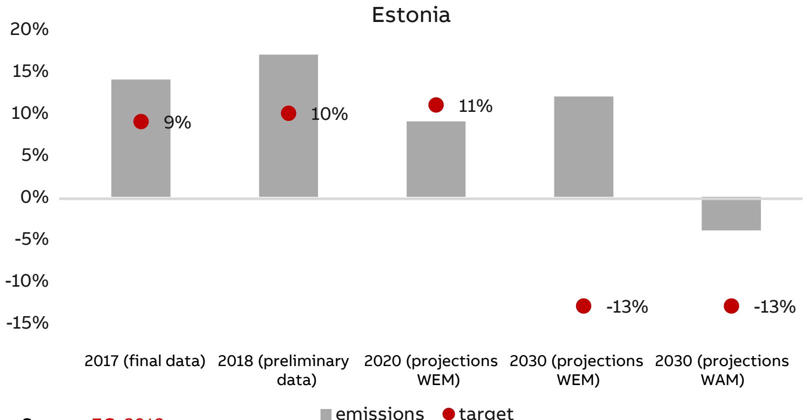
While the Baltic States have achieved their share of renewables in FEC since 2017, they are still a long way off the 10% target for transport.

Transport Statistical Data and Projections in The Baltic States

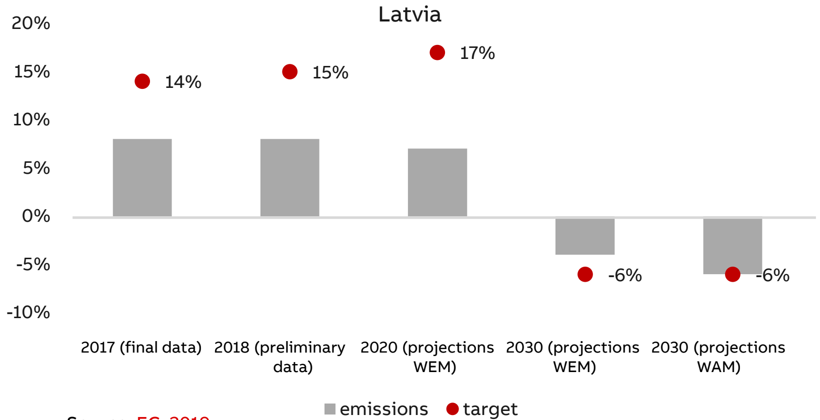
Actual target status

The pathway of the **Effort-Sharing Regulation,** the European Commission's latest compliance report [(1)], shows the following **preliminary results** for the **Baltic States**. Since 2018, **Latvia** and **Lithuania** have **surpassed their 2020 targets**, as the countries' GHG emissions have increased less than expected; however, in 2018, **Estonia** was **7% above** the **2020 target** (producing more GHG emissions than the permitted increase. Nonetheless, it will be able to achieve the target with the existing measures (WEM) according to the European Commission's projections.

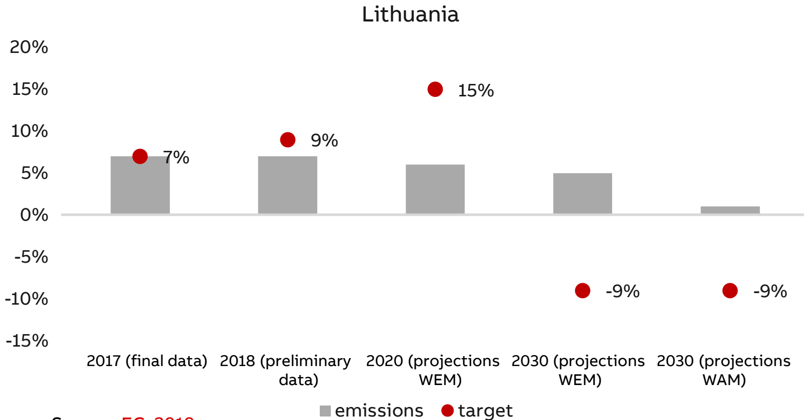
For **2030**, the **challenge for the three countries** is complicated, since they are **changing** from a **"limit-to-increase" target** (2020 target) to a **"minimum-to-decrease" target** (2030 target), which puts them **even further behind their targets.** Lithuania and Estonia's targets have changed by 24pp and Latvia's by 23pp, respectively. The **European Commission** has **forecast** the **2030 emissions** for all the EU member states with additional measures (WAM) and even under that scenario **Estonia** and **Lithuania miss** the **2030 target** and **Latvia only just gets there**.



Source: EC, 2019



Source: EC, 2019



Source: EC, 2019

The 2020 target for the Baltic States is expected to be achieved. However, the 2030 target, even with additional measures, will not be reached by Estonia and Lithuania

1. EC - Preparing the ground for raising long-term ambition EU Climate Action Progress Report 2019, 2019

Transport Statistical Data and Projections in The Baltic States

Initiatives and incentives on transport sector

To comply with the above-mentioned targets, the **Baltic States** need to **implement measures to promote the use of renewable energy** and **GHG emission reductions** in all sectors, including in **transport**. Since **2005**, each of the three countries has adopted **a long-term development strategy** for their **transport systems**, prioritising the following initiatives in the **short and medium term**:

- **Modernisation** and **development** of transport **infrastructure** to ensure quality
- **Adoption** and **enforcement** of **environmental standards** and safety regulations in the EU
- **Coordination** of the development of all transport modes, prioritising environmentally friendly options
- **Improving** the **consumption of alternative fuels** and **reducing** environmental **pollution**

The **long-term objectives** of these strategies for sustainable transport are:

- **Increasing** transportation **energy efficiency**
- **Increasing traffic safety**

Transport Statistical Data and Projections in The Baltic States

Initiatives and incentives on transport sector

Some of the **implemented** and **ongoing initiatives** in the **Baltic States** are summarised in the table below:

Implemented and ongoing initiatives	Estonia	Latvia	Lithuania
Free public transport for permanent residents	X		
Expansion and deployment of electric vehicle infrastructure	X	X	X
Renovation of existing and construction of new roads	X	X	X
Subsidies to promote vehicle upgrades (newer and cleaner – less than 130 g CO_2)			X
EVs exempt from vehicle tax		X	
Free initial registration for EVs		X	
Free public charging stations for EVs for the first 5 years of the vehicle's life *			X
Allow low-emission vehicles to use public transport lanes		X	X
Free parking for EVs in some municipalities		X	X
Subsidies to promote biofuel production	X		X
Quotas of biofuel for petrol and diesel		X	X
Exemption from the environmental pollution tax for biofuel-based vehicles (some exceptions may apply)			X
Excise tax reduction for vehicles using and/or companies processing, storing, receiving or delivering biofuel		X	X

* Applicable to the public charging stations owned by Lithuanian Road Administration under the Ministry of Transport and Communications

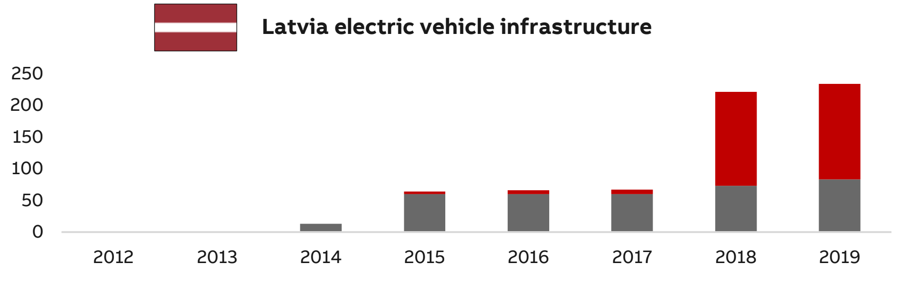
Transport Statistical Data and Projections in The Baltic States

Initiatives and incentives on transport sector

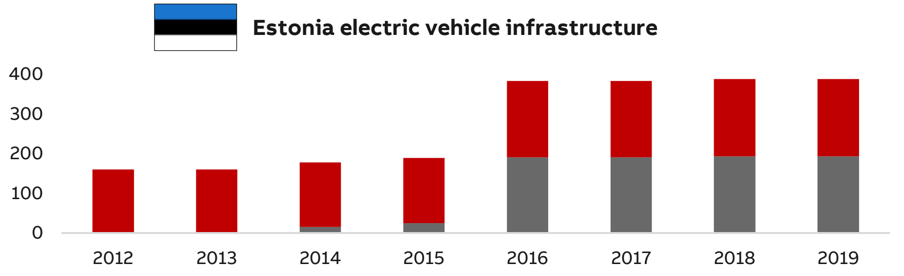
In terms of **EV infrastructure**, the **Baltic States** come in near the **bottom of the EU-28 in 2019**. Until 2012, there were no charging stations in the countries; however, **Lithuania** and **Latvia** have done **more** to introduce EV infrastructure in recent years. In contrast, installation of EV charging stations has virtually stagnated in Estonia **since 2016**.

EU countries with lower EV infrastructure deployment

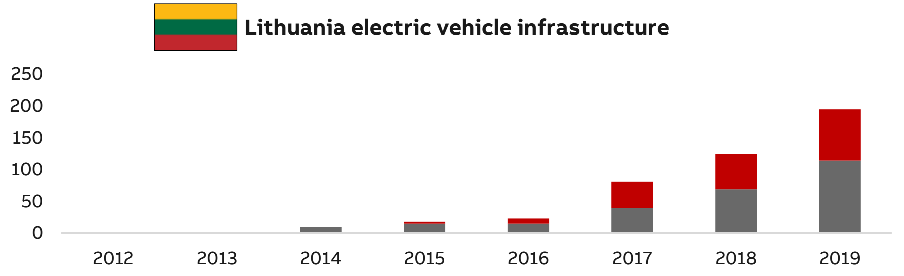
Country	EV charging points
Greece	50
Bulgaria	108
Romania	125
Lithuania	195
Latvia	234
Estonia	388



Source: EAFO, 2019



Source: EAFO, 2019



Source: EAFO, 2019

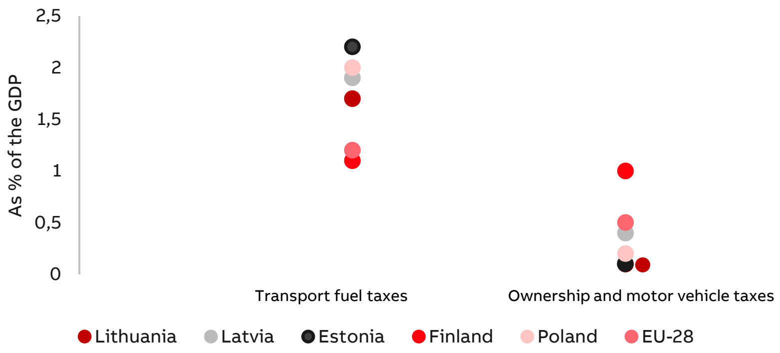
Transport Statistical Data and Projections in The Baltic States

Taxes on transport sector

The **Baltic States** do **not impose extra taxes** on transport modes that generate more pollution. However, the current level of taxes in the three countries is relatively high compared with neighbouring countries and the EU-28 average. As shown in the graph below, in **2017** the three countries had **higher passenger car transport fuel taxes** than the EU-28 average, but **taxes on ownership and use of motor vehicles** were lower, which could explain why exemption from these taxes does not incentivise the purchase of alternatively powered vehicles.

The **table** on the right summarises the **current levels of taxes** in each Baltic country and neighbouring countries[1]. In terms of **new acquisitions**, **Estonia and Latvia impose fixed registration taxes** while **Lithuania differentiates taxes depending on the vehicle type**. With regard to **ownership**, **Estonia** and **Lithuania** do **not** impose ownership **taxes** for **passenger cars** and **Latvia** considers certain **vehicle characteristics**. The parameters considered in the Baltic States for freight transport are aligned with the parameters in neighbouring countries. Finally, **excise duties on fuels** –in EUR/1,000 litres – clearly show **Estonia** to be the Baltic country with the **highest relative taxation on fuels**.

Passenger cars transport taxes in 2017



Source: EC, 2019

Transport sector taxes

Taxes on acquisition		
Country	**VAT**	**Registration Tax**
Estonia	20%	Registration label (62€) + registration card (130€)
Latvia	21%	Registration costs (43.93) + national resources tax (55€)
Lithuania	21%	Based on vehicle type
Finland	24%	Based on retail value and CO2 emissions (min 2.7% max 50%)
Poland	23%	Based on cylinder capacity (up to 18.6% of the vehicle's value)
Taxes on ownership		
Country	**Passenger cars**	**Freight transport vehicles**
Estonia	None	Weight, number of axles and suspension type
Latvia	GVW*, engine capacity (cc) and power (kW)	Weight, number of axles and suspension type
Lithuania	CO2 emissions (starting on July 2020)	Weight, number of axles and suspension type
Finland	CO2 emissions, weight and fuel type	Weight and number of axles
Poland	None	Weight and number of axles
Excise duties on fuels in €/1000 litres		
Country	**Unleaded petrol**	**Diesel**
Estonia	563	493
Latvia	476	372
Lithuania**	434	347
Finland	703	530
Poland	391	343

*Gross vehicle weight
** Excise duties are not applied to natural gas that is used in transport sector

1. ACEA – Tax Guide, 2019

Transport Statistical Data and Projections in The Baltic States

Other measures on transport sector

	Passenger transport	Trolleybuses	R&D Projects and Pilots
	The second phase of the **Joint Initiative for Hydrogen Vehicles across Europe** will deploy **10 fuel-cell buses** in **Riga**. The construction of hydrogen refuelling, production and storage facilities will be developed with European Investment Bank funds.	**Solaris** signed a cooperation agreement with Latvian capital city operator **Rigas Satiksme** in 2016 to deliver **10 Trollino** (18.75 metre) trolleybuses equipped with **hydrogen fuel cell** range extenders in 2018.	The country **implemented a project** *“Innovative technologies of hydrogen and biofuel production, storage, quality control, quality provision, and use in Latvia”* which has **laid** the **foundations** for the **initiative**.
	**ELMO** (Estonian Electromobility Programme) is a **cooperation programme** between **Mitsubishi Corporation** and the **Estonian Government** to **accelerate** the **introduction** of **EVs** in Estonia. This programme supported the purchase of 657 EVs and rechargeable plug hybrids	In 2019, **Eesti Energia** and **Tallinna Linnatranspordi AS signed** a cooperation agreement to develop new transport solutions. During the pilot project, Eesti Energia will develop a **smart charging solution** capable of adapting charging according to electricity prices and loads.	Since August 2019, **Sohjoa Baltic consortium** has started the first **automated driverless electric minibus pilot** in **Tallin**. This initiative promotes autonomous electric driving as part of the public transport network.
	**Energy operators** and **universities** in the Baltic States have developed a new generation of city bus, called the **“Dancer Bus”**. This is an **urban electric transport system**, consisting of electric buses, charging stations, service infrastructure and software.	At the end of 2017, **Solaris Bus & Coach** signed a contract to deliver **41 trolleybuses** to the Vilnius bus operator. These buses are expected to provide a low-noise and eco-friendly transport solution by March 2020 at the latest.	In September **2018**, **Scania** CV AB and partners launched a **field-test project** in Lithuania to examine alternative fuels for a **city bus. It was powered** by **hydrogen** enriched with **natural gas** (H_2NG), later in 2018 the project team planned to **test** a **truck** powered by similar fuels.

Transport Statistical Data and Projections in The Baltic States

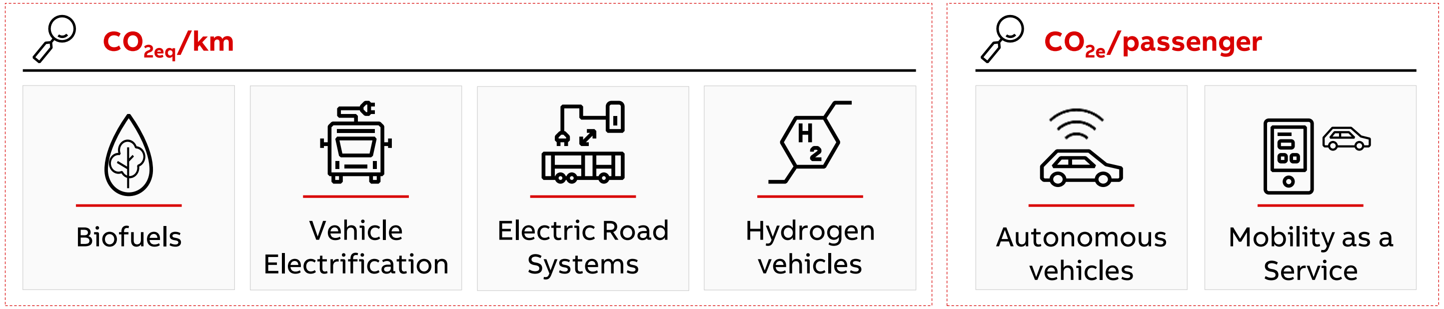
Chapter IV: Innovations for decarbonising the transport sector

Transport Statistical Data and Projections in The Baltic States

Innovations for decarbonising the transport sector

Various strategies have been introduced globally to decarbonise transport. This chapter focuses on **new vehicle and fuel technologies** as well as other solutions that could help reduce emissions such as Mobility as a Service (MaaS) and autonomous vehicles (AVs). In the first part of this chapter we consider the current status of these innovations in terms of global development. We then examine the application of these strategies in the Baltic States. Finally we present a qualitative comparison to consider the main differences in the various technologies and how they can be applied as complementary solutions to achieve the decarbonisation objectives.

The main innovations for decarbonising the transport sector evaluated are shown below:



These innovations have been categorised into two groups:

1. Solutions that aim to **reduce emissions per km** by displacing traditional fuels such as petrol or diesel from the vehicle fleet.
2. Solutions that aim to **reduce emissions by passenger** either by optimising journeys and/or reducing the total number of km travelled in a given population.

The analysis of both groups is detailed in the following.

Transport Statistical Data and Projections in The Baltic States

Vehicle electrification

Vehicle electrification

Electric Road Systems

Hydrogen vehicles

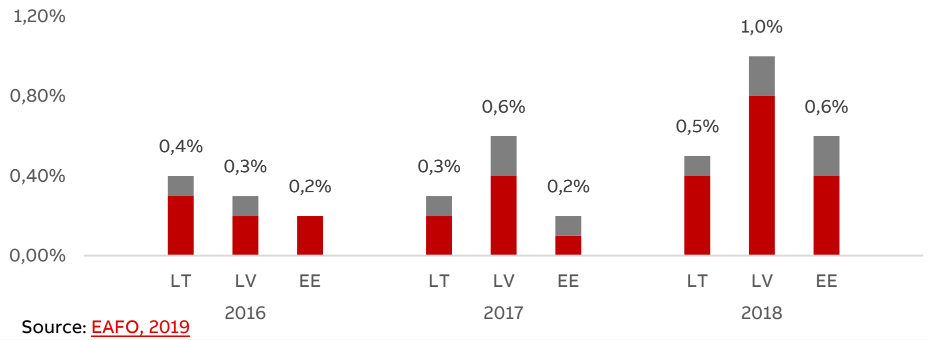
Biofuels

Reducing emissions from motor vehicle traffic requires crucial advances in new technologies and a transition to fossil-free energy sources. Electric vehicles (EVs) represent an important option for achieving the ambitious climate and environmental goals. Depending on the degree of electric propulsion, several types of EVs can be considered, such as:

- **Battery-electric vehicles (BEVs):** these types of vehicles are fully electric – they have one (or more) electric engines and no petrol engine. The electricity required to power the engine is stored in rechargeable batteries, which are currently in the range 30–90 kWh for Light Duty Vehicles (LDVs), providing autonomies up to 400 km.
- **Plug-in hybrid electric vehicles (PHEVs):** unlike BEVs, PHEVs are not fully-electric vehicles, they have a petrol engine, which in most cases is responsible for propelling the vehicle, while the electric engine acts as an auxiliary engine, providing extra power when needed or enabling the vehicle to run on zero emissions for a limited amount of km.
- **Fuel-cell electric vehicles (FCEVs):** these types of vehicles are powered by the electricity generated by a fuel cell powered by hydrogen (evaluation of FCEVs is included as a specific section due to its potential).

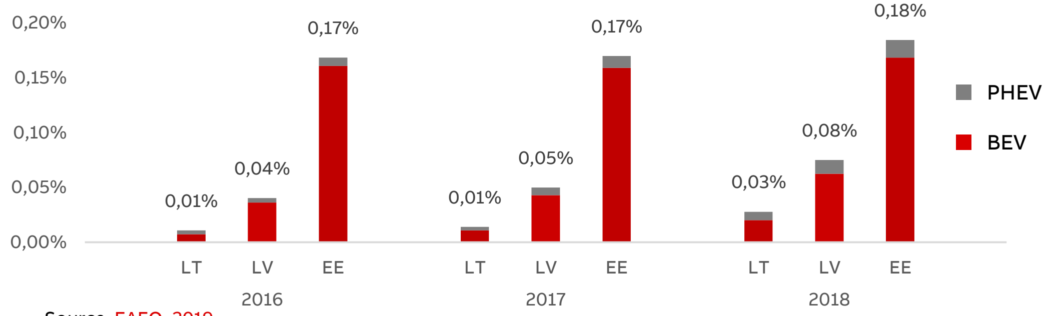
Although BEVs and PHEVs could make a significant contribution to decarbonising the transport sector, their share of the LDV fleet remains low because of their perceived disadvantages compared with traditional vehicles.

% of newly registered passenger cars



Source: EAFO, 2019

% of total passenger cars



Source: EAFO, 2019

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EV adoption is limited by different variables, such as a reduced autonomy or a higher price, but there are other aspects that will determine the speed and extent at which the EV vehicle fleet will grow:

Policies and regulation	Countries' efforts to promote EV penetration by adapting regulations and introducing financial incentives.
EV pricing	Although EV prices are rapidly falling, these vehicles are still more expensive than internal combustion engine vehicles (ICEVs). When considering buying a car, price is key and EVs will not penetrate significantly until they become competitive.
Charging patterns	People are used to spending a few minutes fueling their ICEVs, while charging an electric vehicle can take up to several hours. Although ultra-fast chargers are being developed, the current time required to charge an EV with a high range (up to 500 km) make these vehicles less attractive to consumers.
Driving patterns	"Range anxiety" is one of the major barriers to widespread sales of electric vehicles, meaning that the evolution of batteries will determine EV penetration.
Behavioral aspects	The decision to buy an EV is not only based on financial or technical considerations such as price or range, but also on a willingness to help reduce Greenhouse Gas (GHG) emissions. As people's environmental awareness increases, so too will EV sales.

As the previous factors show, to evaluate how EVs will support decarbonisation of the transport sector, it is necessary to consider regulatory, technical, financial and social parameters.

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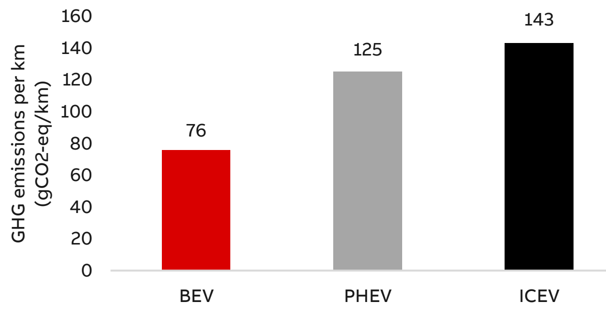
However, we not only have to take in to account existing barriers when considering how EVs can support sector decarbonisation – we also have to consider the CO_2 emissions of this type of vehicles as a result of the generation of electricity. This requires the introduction of solutions to reduce these emissions alongside measures to promote the adoption of EVs. To compare the emissions produced by different type of vehicles, we will use the concepts **well-to-tank (WTT), tank-to-wheel (TTW)** and **well-to-wheel (WTW)** as defined below:

Well-to-wheel

	Well-to-tank			Tank-to-wheel
ICEVs	Extraction	Refining	Transport	Combustion in engines
BEVs	Electricity generation	Transmission	Battery charging	Used to drive motor

Based on this categorisation, we can compare $CO_{2\text{-eq}}$ **WTW emissions**(1) for ICEVs, BEVs and PHEVs:



As shown in the graph, BEVs can cut WTW emissions by 45%. However, when considering the complete lifetime of the electric vehicles, **battery production**, as well as its **recycling process** need to be taken into account(2):

Manufacturing	61-146 kg CO_2.eq/kWh
Recycling	15 kg CO_2.eq/kWh

Such emissions could result in a increase of up to 45(3) in gCO_2.eq/km for medium BEVs

1. European Environment Agency: Electric vehicles from life cycle and circular economy perspectives, 2018
2. IVL Swedish Environmental Research Institute, Swedish Energy Agency: Lithium-Ion vehicle battery production, 2019
3. Figure calculated considering: lifetime = 180.000 km; battery capacity = 50 kWh

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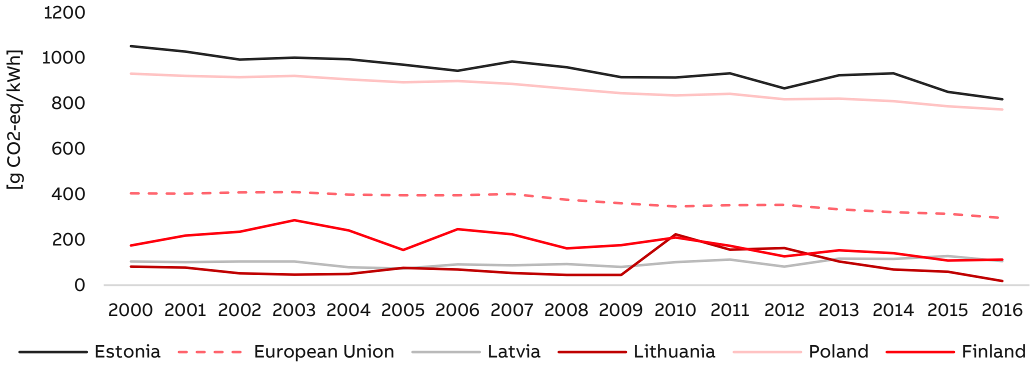
From the previous graph it can be concluded that BEVs and PHEVs can allow emissions savings of up to 50% and 10%, respectively, but never completely eliminate emissions. Such emissions mainly derive from the source of the electricity employed to charge the vehicles' batteries, which varies in line with the electricity generation mix in each country. This mix can vary considerably, as shown below:

Electricity generation - CO_2 emission intensity depending on electricity generation



Source: EEA, 2017

Electricity generation mix in the Baltic States in 2016

	Estonia	Latvia	Lithuania
Generation (GWh)	12 176	6 425	3 973
Traditional (%) (1)	94.8%	58.6%	47.3%
Renewable (%) (2)	5.2%	41.2%	52.7%

(1) Traditional includes electricity generation by biofuels and waste
(2) Zero emission renewables
Source: IEA, 2016

Consequently, the adoption of EVs must be accompanied by the introduction of renewable energy sources in order to achieve lower levels of CO_2 emissions per km.

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Electric road systems

Vehicle electrification

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Electric road systems (ERS) allow dynamic power transfer between a vehicle and the road infrastructure while the vehicle is in motion. ERS have emerged as a potential solution for electrifying heavy-duty trucks, which would require large batteries to provide sufficient autonomy, thereby reducing the load space and considerably increasing the trucks' weight and price.

ERS can be categorised into the following **three groups**:

- **Inductive (wireless)**
- **Conductive (catenary/overhead)**
- **Conductive (in-road rail)**

Regardless of the technology employed, the main benefits and challenges associated with the deployment of ERS infrastructure are:

Benefits	Challenges
• Facilitates the electrification of freight transport • Enables the reduction of EV battery size (and costs) • Supports decarbonisation of the transport sector • Suitable for all types of vehicle	• Large CAPEX and OPEX • Cooperation between the different stakeholders involved (vehicles manufacturers, public sector and road developers) • Relatively immature technology – high uncertainty regarding installation and operation procedures and costs • Impact on road infrastructure and driver safety • Required regulation

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In addition to the general benefits and challenges associated with ERS, each of the existing technologies has important differences to consider(1):

	Benefits	Challenges
Inductive (wireless)	• No visual impact • Suitable for all types of vehicle • No road infrastructure modification and no impact on traffic	• Lower power transmission rates (up to 300 kW) and lower efficiency (60–95%)
Conductive (catenary/overhead)	• Most mature solution • High level of power transmission (up to 500 kW, efficiency 80–97%) • Widely used in trams, trolleybuses,... • Can be installed at the roadside – no impact on road infrastructure	• High visual impact • Not appropriate for LDVs
Conductive (in-road rail)	• High level of power transmission (up to 450 kW, efficiency 80–97%) • Suitable for all types of 4-wheel vehicles • Extensive experience in this type of system (trams, trolleybuses etc.) that can be leveraged	• Medium visual impact • Impact on pavements • Road user safety (mainly cyclists/motorcyclists)

Furthermore, in terms of the CO_2 emissions that ERS could help to cut, the scenario is the same as for BEVs and PHEVs: their emissions would be directly related to the emissions intensity of the electricity generation mix in each country – and therefore also dependent on the penetration of RES to achieve a real zero-emissions transport sector.

1. PIARC – electric road systems: a solution for the future?, 2018

Transport Statistical Data and Projections in The Baltic States

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Finally, interest in ERS as a viable alternative **for electrifying freight transport**, as well as for providing **extra autonomy for light duty vehicles (LDVs)** and therefore unlocking the use of EVs for intercity routes, has resulted in the development of numerous pilot projects across the world[(1)], such as:

	Name	Organisations & Country	Cost [€/lkm]	Type of vehicle
Inductive (wireless)	OLEV	Dongwon Inc./KAIST (South Korea)	500.000	Buses/LDV/LCV
	PRIMOVE	Bombardier/Scania (Germany/Sweden)	3.25M – 6.15M	Buses/LDV/LCV
	WPT	Oak Ridge National Laboratories/OEM's (USA)	1.3M	LDV
Conductive (catenary/overhead)	e-Highway	Siemens/OEMs (Sweden/Germany)	1M-2M	HDV
Conductive (in-road rail)	Elways	eRoadArlanda/Elways AB (Sweden)	390k-1M	Buses/LDV/LCV/HDV
	Slide-In/APS	Alstom/Volvo (Sweden)	1M	Buses/LDV/LCV/HDV
	ElonRoad	Elon Road Inc./Lund university (Sweden)	600k-1.5M	Buses/LDV/LCV/HDV

1. PIARC – electric road systems: a solution for the future?, 2018

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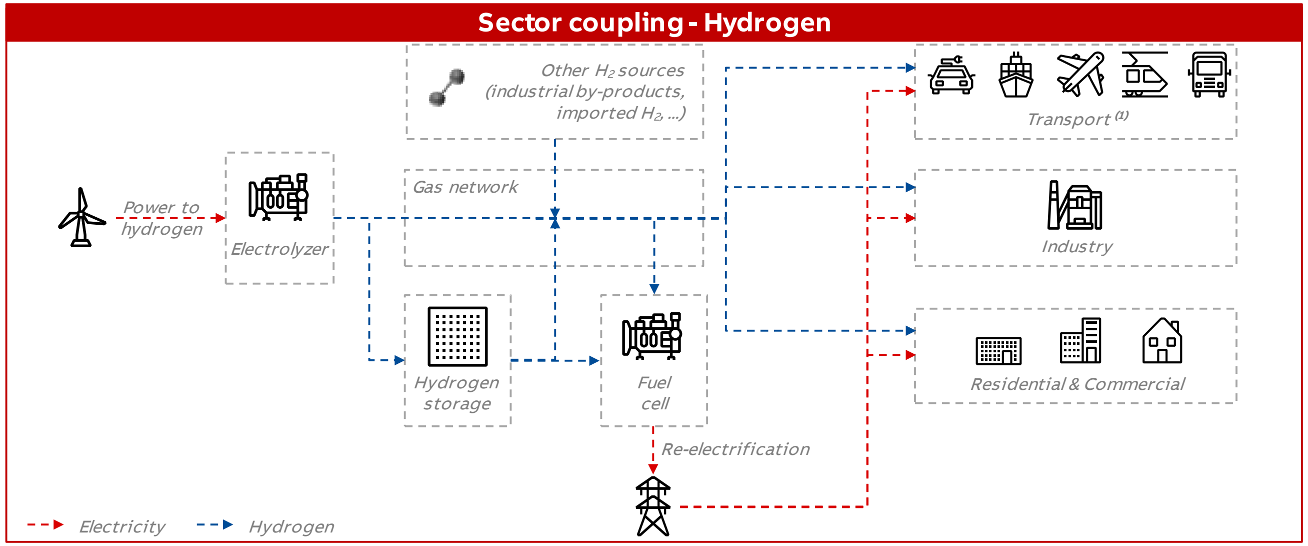
Hydrogen is becoming one of the main players in the transformation currently underway in the energy sector. Hydrogen can be produced from renewable energy sources such as wind or solar power. In addition, it can be easily stored on a large scale, and subsequently used in other sectors (*sector coupling*) that have traditionally mainly depended on fossil fuels, namely transport and heating. The figure below illustrates the future H_2 generation and utilisation scheme:



Currently, hydrogen is mainly produced by steam reforming of natural gas, although in the future this process is expected to be gradually displaced by electrolysis (using electricity from renewable sources, such as wind or solar). Hydrogen produced from zero-emission sources could then be used in electric vehicles by producing electricity through a fuel cell, a device that is fuelled by hydrogen and only generates water and oxygen as a by-product. Consequently, Fuel-cell Electric Vehicles' (FCEVs) WTW emissions could be considered as 0 gCO_2eq/km.

1. Hydrogen for transport sector is more appropriate for aviation, trains, shipping and heavy-duty vehicles than electricity. LDVs and LCVs can be fuelled either by hydrogen or electricity.

Transport Statistical Data and Projections in The Baltic States

Hydrogen vehicles

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The main differences amongst BEV and FCEV are:

	Battery Electric Vehicles (BEVs)	Fuel Cell Electric Vehicles (FCEVs)
Advantages	• Electricity can be easily produced and stored. • Higher efficiency – lower losses in charging-discharging cycles. • Charging infrastructure can be deployed in a wide variety of places (homes, pavements, car parks etc.) • Lower cost than FCEVs • Technologies such as smart-charging and Vehicle-to-Grid (V2G) could support power system operation, while generating economic benefits for owners.	• Refuelling time and autonomy are similar to for ICEVs. • Easier deployment of refueling infrastructure: traditional petrol stations could be adapted. • FCs can be used in any type of vehicle – can be scaled to provide higher power/ranges. • Less reliance on batteries: small batteries (e.g. the Toyota Mirai has a 1.6 kWh battery) can be included to increase efficiency but are not the main source of energy.
Challenges	• Autonomy constraint due to the capacity of the battery – typical values are still about 300-400 km. • Full charging requires more time than ICEVs, even with ultra-fast chargers. • Charging infrastructure may have a significant impact on the grid.	• Lower efficiency due to losses in hydrogen generation and re-electrification in the fuel cell: round trip efficiency ca. 30% vs 70-90% in BEVs[1]. • Higher costs. • Hydrogen has to be stored inside the vehicle at high pressure/low temperature. • Current H_2 production is mainly based on steam reforming of natural gas.

1. European Environment Agency: Electric vehicles from life cycle and circular economy perspectives, 2018; Energy storage association, 2019

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Although FCEVs have great potential to become an important player in the future, the current number of this type of vehicles in the European Union is negligible: **922 LDVs, 55 buses, 303 LCVs and 6 HDVs** in the **EU-28**, **none** of which are located in the **Baltic States**[(1)].

Three key factors are holding back mass adoption of FCEVs in the EU:

H_2 costs	Renewable H_2 (produced from renewable energy) is expensive to produce. Traditionally, H_2 has been produced mainly for industrial activities from sources such as natural gas or biomass, generating CO_2 as a by-product. However, producing H_2 without emissions requires electrolysers, which drive up production costs.
Charging infrastructure	In a similar way to the challenges for EV charging infrastructure, an extensive network of fuel stations capable of providing H_2 would need to be deployed in order to ensure high rates of FCEV penetration. Currently, there is only one H_2 fuel station in the Baltic States (in Latvia)[(2)].
Costs	Acquisition costs for FCEVs are still significantly higher than comparably sized ICEVs. This, combined with a lack of fuel stations adapted to provide H_2, makes buying an FCEV a less attractive option than a traditional vehicle or BEV.

Due to the possibilities H_2 offers to decarbonise not only the transport sector, but also the power system, governments are introducing new regulations to incentivise the private sector and individual users to consider FCEVs as a viable future option.

1. EAFO, 2019
2. H2 stations.org

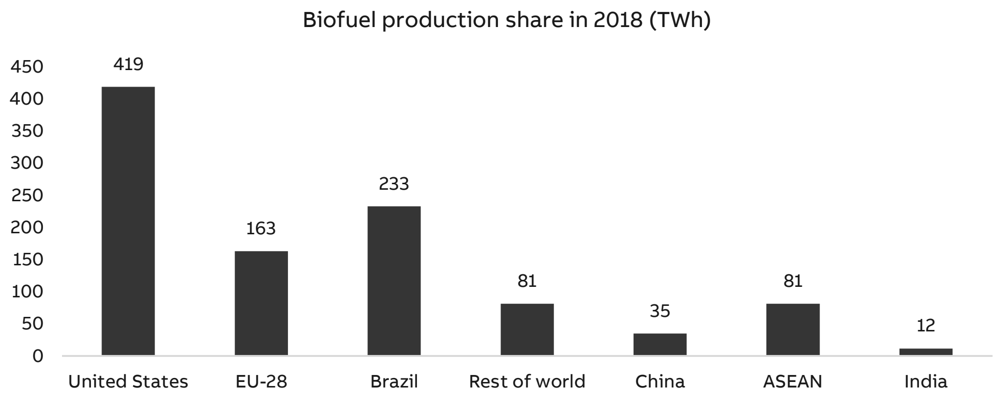
Transport Statistical Data and Projections in The Baltic States

Biofuels

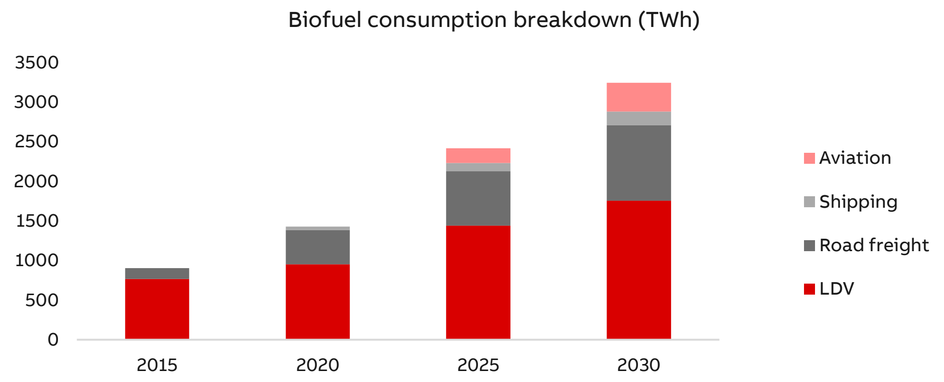
Biofuels are considered a potential replacement for traditional fossil fuels. There are four main types of biofuels, depending on the sources and process used to extract them:

- **Biodiesel** is extracted from vegetable/animal oils and fats through transesterification.
- **Biogas** is sourced from organic/animal waste and sewage via digestion.
- **Ethanol** is sourced from sugar-containing crops and transformed via fermentation
- **Synthetic fuels** are obtained from cellulosic materials and transformed via gasification processes.

Currently, biofuel production is concentrated in the US and Brazil and is mainly used for light duty vehicles. However, consumption by freight transport, aviation and shipping could potentially grow significantly:



Source: IEA, 2019



Source: IEA, 2019

Transport Statistical Data and Projections in The Baltic States

Biofuels

Vehicle electrification

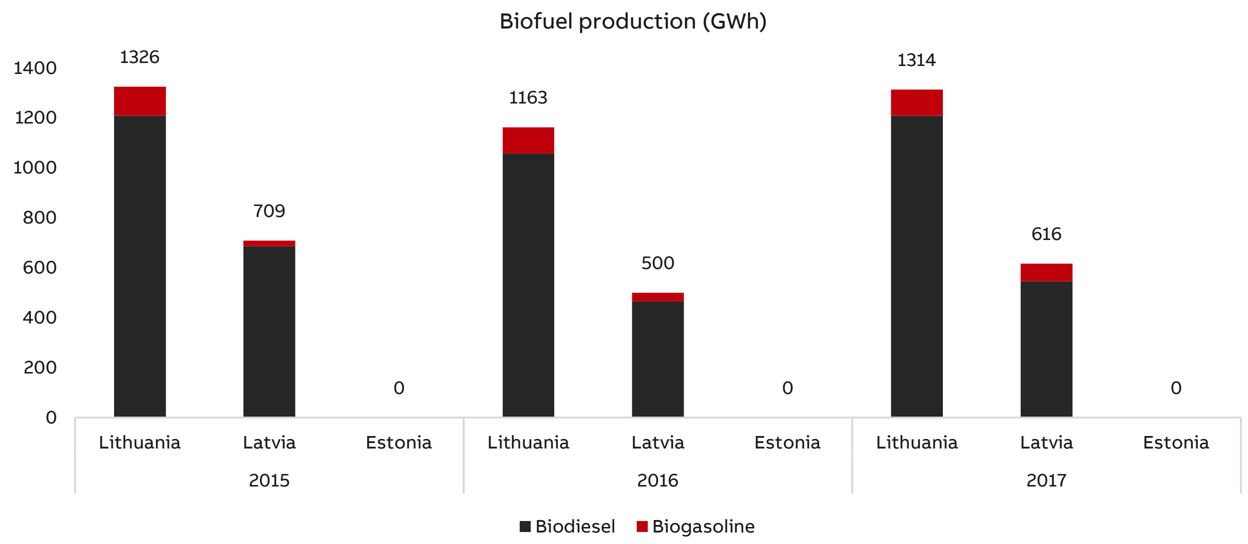
Electric Road Systems

Hydrogen vehicles

Biofuels

In addition to introducing alternative fuels, Lithuania and Latvia also produce biofuels. However, this production accounts for just 1% of total EU production.

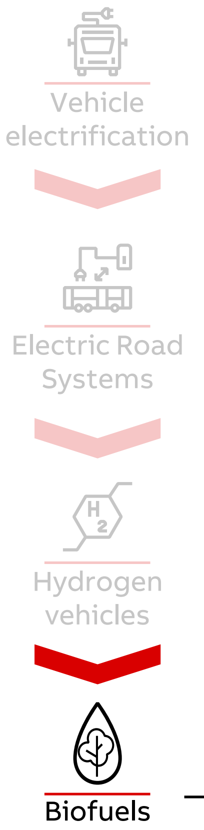
- **Biodiesel:** Renewable fuel with similar properties to those of petroleum diesel, for use in diesel vehicles
- **Biogasoline:** Renewable equivalent to petroleum. In the EU, nearly 100% of biogasoline is bioethanol, but other fuels like biomethanol can also be used.



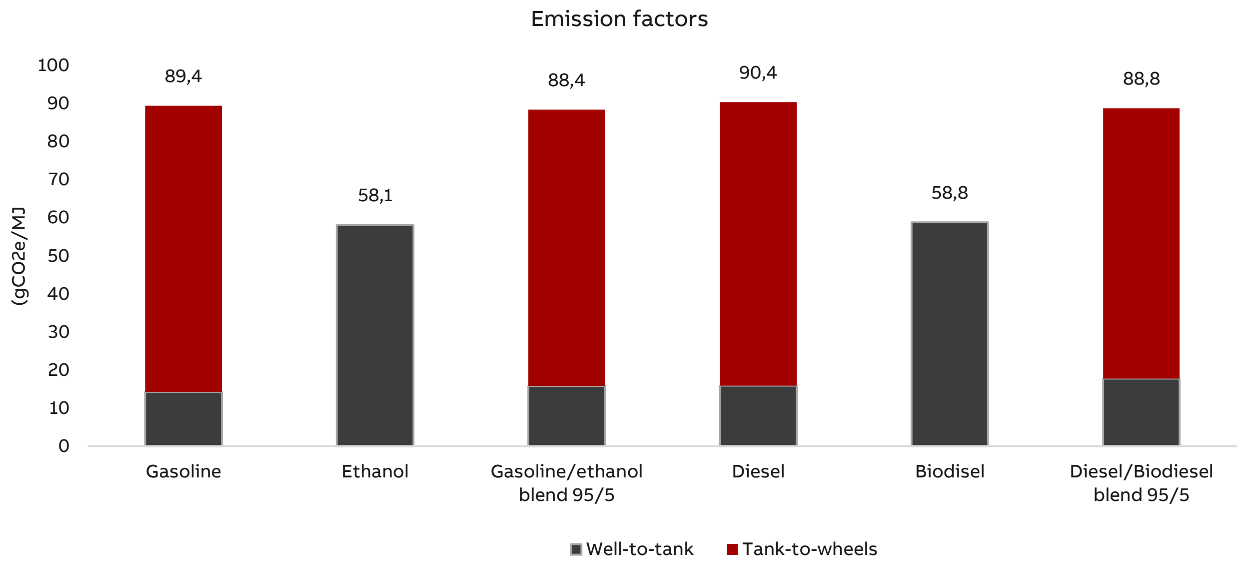
Source: EAFO, 2019

Transport Statistical Data and Projections in The Baltic States

Biofuels



Compared to diesel and petrol, biofuels can cut GHG emissions by around 35%:



Sources: STN EN 16258:2013 (2016); JRC Technical reports: JEC Well-to-wheels analysis (2014)

Despite the potential positive impacts of a higher share of biofuel-powered vehicles, the number of this type of vehicle in the Baltic States is negligible – only vehicles with diesel/petrol + biofuel blended solutions currently exist in these countries, accounting for less of the 5% of the total vehicle fleet.

Transport Statistical Data and Projections in The Baltic States

Biofuels

Vehicle electrification

Electric Road Systems

Hydrogen vehicles

Biofuels

As shown above, when evaluating alternatives for decarbonising the transport sector, both the positive and the negative impacts have to be analysed.

For biofuels, impacts can be categorised into the following groups:

	Benefits	Challenges
Environmental	• Lower emissions than ICEVs	• Extensive use of land • Threat to biodiversity • Water and air pollution during production process
Economic	• Stimulates economic development and creation of new jobs in rural areas and developing countries	• Increases food prices because of food-fuel competition
Social	• Increases social welfare in developing countries	• Deviates purpose of crops – threats to food security in developing countries.
Political	• Increases energy security and reduces dependency on fuel imports	• Requires subsidies to be distributed among the different renewables sources – political decisions may not result in optimal outcomes

Transport Statistical Data and Projections in The Baltic States

Biofuels

Vehicle electrification

Electric Road Systems

Hydrogen vehicles

Biofuels

Alongside the general challenges discussed above, biofuel production and utilisation entail other complications such as:

- Biofuels produced **from feedstocks** such as rape seed, wheat etc. have **limited blending possibilities**
- **Advanced biofuels** that can be produced from different categories of waste have **very limited feedstock availability in the EU**
- It can be **difficult** to effectively apply and prove the sustainability of the **biofuel feedstocks** produced in **third countries**
- Lack of **mature technologies** for the production of the **advanced biofuels**
- **Current internal combustion engines** may need **modifications** depending on the type of biofuel used.
- The higher oxygen content of biodiesel increases **NO_x emissions**
- Further research is required into the **corrosion and lubrication behaviour of materials** in biofuel environments

Transport Statistical Data and Projections in The Baltic States

Solutions to reduce emissions per km

We can now compare the various solutions intended to reduce the amount of CO_2 emitted per km:

	Environmental impact[1]	Benefits	Challenges	Presence in the Baltic States
Vehicle Electrification	-40%[2]	• Lower cost than FCEVs and less pollution than biofuel vehicles	• Deployment of charging infrastructure • Autonomy and charging time • Battery recycling process is rather complex	Low
Electric road systems		• Suitable for freight transport and long-distance routes	• Cost • Impact on road infrastructure	Low
Hydrogen Vehicles		• Higher autonomy and reduced charging time compared to EVs	• Cost • Lack of adapted fuelled stations • Fuel cells are relatively immature technology • H_2 is currently mainly produced from natural gas	Negligible
Biofuels	-35%	• Easy to implement: vehicles can be adapted to run on these types of fuel	• Water and air pollution during production process • Conflict with the food market	Low (blended solutions)

Given the characteristics of each solution, deciding which solution should be promoted in a particular country depends partly on the country's **specific characteristics and energy strategy** including the existing gas infrastructure to transport H_2, the renewable generation share in the generation mix and expected future changes, the volume of freight transport and the willingness to increase/decrease energy dependency from other countries.

However, the fact that these **technologies are rapidly evolving** also **means** governments have to **cooperate with the private sector** in order to facilitate innovation and the diffusion of those technologies that would result in a more advantageous outcome from an economic and environmental perspective.

1. Estimate reduction in emission with respect ICEV based upon the information included in this section
2. Dependent on the generation mix. A higher reduction will be achieved as share of renewable energies in the generation mix is increased.

Transport Statistical Data and Projections in The Baltic States

Autonomous vehicles

Autonomous vehicles

Mobility as a Service

While the objective of the previous group of technologies is to reduce GHG emitted per km, the technologies described in this **section** aim to **increase the efficiency of the transport sector** by **reducing the total number of km driven** either by optimising routes or by coordinating the different users to maximise the utilisation of vehicles.

The first of these technologies are **autonomous vehicles (AVs)**. In recent years, a wide range of driver-assistance systems have been developed that increase the capabilities of vehicles to respond to a wide variety of situations depending on the level of automation, which can be categorised according to the following levels:

Human driver monitors the driving environment	0	Vehicle manually controlled, but may include essential auxiliary systems to help the driver (e.g. emergency braking system)
	1	Lowest level of automation. Tasks such as accelerating/braking or steering can be performed automatically, but the driver must constantly monitor the environment.
	2	Vehicle can control both steering and acceleration/deceleration (e.g. simultaneous lane centering and adaptative cruise control)
Automate driving system monitors the driving environment	3	The main difference compared to the previous level is that vehicles can detect and evaluate the environment, thus allowing autonomous driving when certain conditions are met.
	4	This level includes previous features plus the capability to respond automatically to most situations, but still could require driver intervention.
	5	This level comprises vehicles that do not require any human intervention – eliminating the need for steering wheels and acceleration/brake pedals.

Source: SAE J3016, 2019

Transport Statistical Data and Projections in The Baltic States

Autonomous vehicles

Autonomous vehicles

Mobility as a Service

Existing commercially available highly-automated vehicles can reach **levels 3-4;** however, these have not yet been sufficiently tested and the development of level 5 capability vehicles presents not only a **technological challenge**, but also an **ethical** one.

Benefits	• Reduction in the number of km and the size of the fleet through facilitation of solutions such as journey-sharing and on-demand travel (discussed in more detail in the next section). • Vehicles are driven more efficiently. • Allows higher vehicle densities ("platooning") while improving traffic flows.
Challenges	• Level 5 automation is not yet sufficiently tested • To have a significant impact on decarbonisation, a critical mass of AVs must be achieved in order to leverage all the potential benefits. • AVs present ethical dilemmas in terms of the autonomous decisions that vehicles should make to avoid risks for the driver.

Once these barriers have been overcome, AVs will help increase driver safety and comfort, and also contribute to the decarbonisation of the transport sector by **optimising driver routes** and **improving traffic flows,** thereby **reducing energy use and produced emissions.**

Furthermore, autonomous, electrified vehicles could leverage the benefits offered by both technologies: highly efficient vehicles (reduction in km travelled) combined with low emissions (CO_2/km).

Along with AVs, Mobility as a Service (MaaS) solutions will also help boost the efficiency of transport as described below.

Transport Statistical Data and Projections in The Baltic States

Mobility as a Service

Autonomous vehicles

Mobility as a Service

The **Mobility as a Service (MaaS)** model is widely implemented to various degrees across Europe as an alternative to the traditional private car ownership model. Integration of different mobility services into a single offering available to users via a subscription-based application is the most common practice. Urbanisation, a sharing economy and digitalisation have influenced the transport system to create a model capable of appealing to demographic groups interested in sustainability and the service rather than ownership.

As for AVs, MaaS can be categorised as follows:

0	No integration between mobility services
1	Integrated informational services that can provide information on available mobility services (e.g. Google maps)
2	Aside from providing information, facilitates online bookings and payments (e.g. Uber)
3	Integration of functionalities regarding different mobility services (e.g. UbiGo)
4	Integrated MaaS ecosystems with societal goals such as transport policy and sustainability objectives and services relating to previous levels

Source: Sochor et al. (2017)

In a similar way to AVs, MaaS will contribute to decarbonisation by increasing the efficiency of the transport sector, mainly in cities by optimising traffic flow and using different transport means. MaaS offers many opportunities for consumers and governments, such as:

- **Improved traffic management:** real-time and detailed information about traffic, public transport and demand from users will be available which can be analysed to identify advanced solutions to reduce congestion and improve the transport network.
- **Supporting the user** in deciding which transport mean to use based on traffic conditions, origin and destination, price, …
- **Improving public transport services** and thus facilitating its adoption by users.

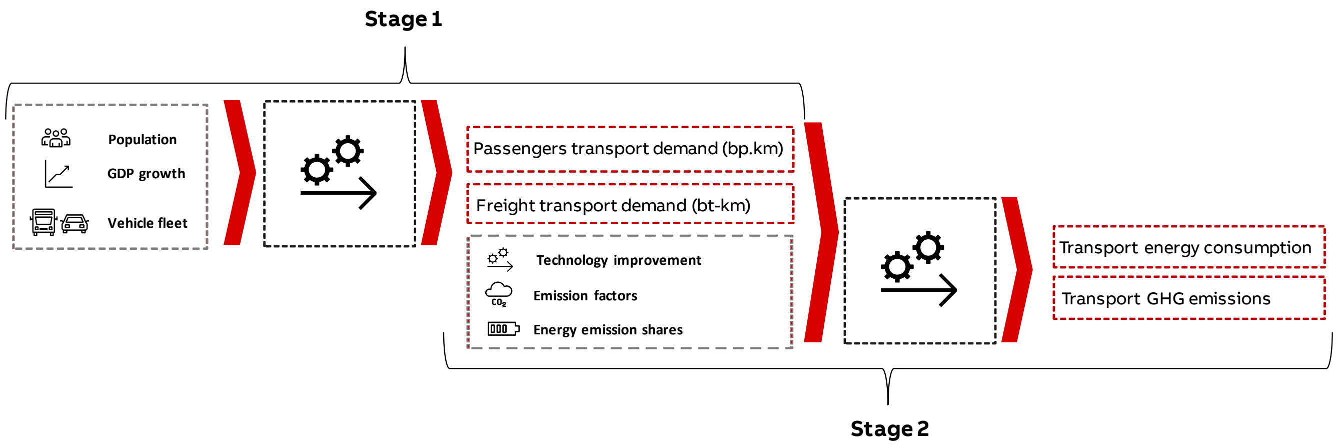
Transport Statistical Data and Projections in The Baltic States

Chapter V: 2030 Forecast and Scenarios

Transport Statistical Data and Projections in The Baltic States

Methodology

This chapter provides a **quantitative analysis** of forecast **future transport demand** and **transport-related GHG emissions** in the Baltic States. The analysis aims to provide a better understanding of the potential direction and magnitude of these impacts, as well as the role that new transport technologies can play in decarbonising the Baltic road transport sector moving forward. Our assessment of the transport sector outlook will be developed in two stages as shown in the image below:



The modelling is based on a multivariable regression model that uses **historical and forecast data** of relevant drivers in the transport sector. In the first stage of the modelling, **transport demand** is projected based on population and gross domestic product (GDP) growth, together with a modal shift in the transport sector. Population growth is a strong driver of transport demand as more passengers require more mobility. A higher population also results in more production and consumption of goods, and therefore increased demand for freight transport.

The last stage involves the **energy consumption and GHG emissions** produced to cover the previously calculated transport demand. In this stage, we consider fleet efficiency and innovation penetration. The innovative solutions discussed in the previous chapter are considered as one driver of sector improvement; however, improvements in the traditional fleet are considered as another potential option to decrease the sector's GHG emissions.

Transport Statistical Data and Projections in The Baltic States

Scenarios definition

To forecast transport demand and energy consumption, the model evaluates one trajectory based on expected population and GDP growth, while the GHG emission forecast considers three trajectories, as follow:

- **Low innovation penetration scenario (*ceteris paribus*):**
  Evaluates the current road transport situation in each of the Baltic States assuming no innovation in future years.
- **NECP trajectory (base scenario):**
  This scenario considers the transport trajectories established for the Baltic States in the NCEPs submitted to the European Commission in December 2018
- **High innovation penetration scenario:**
  Under this scenario, the Baltic States **double** their NECP targets by 2030.

Defined scenario	Scenario name
1 Low innovation penetration	Low
2 NECP trajectory	Base
3 High innovation penetration	High

Each of the previously stated scenarios have been established by defining the variables shown in the box below. Some of the variables have been defined using the same values for the three scenarios, whereas the values for technology improvement and energy consumption shares have been defined specifically for each scenario due to their significant impact on total GHG emission production.

Modelling assumptions

Population	GDP growth	Vehicle fleet	Technology improvement	Emission factors	Energy consumption shares

The assumptions of the model inputs are detailed in the following slides.

Transport Statistical Data and Projections in The Baltic States

Assumptions

Population

GDP growth

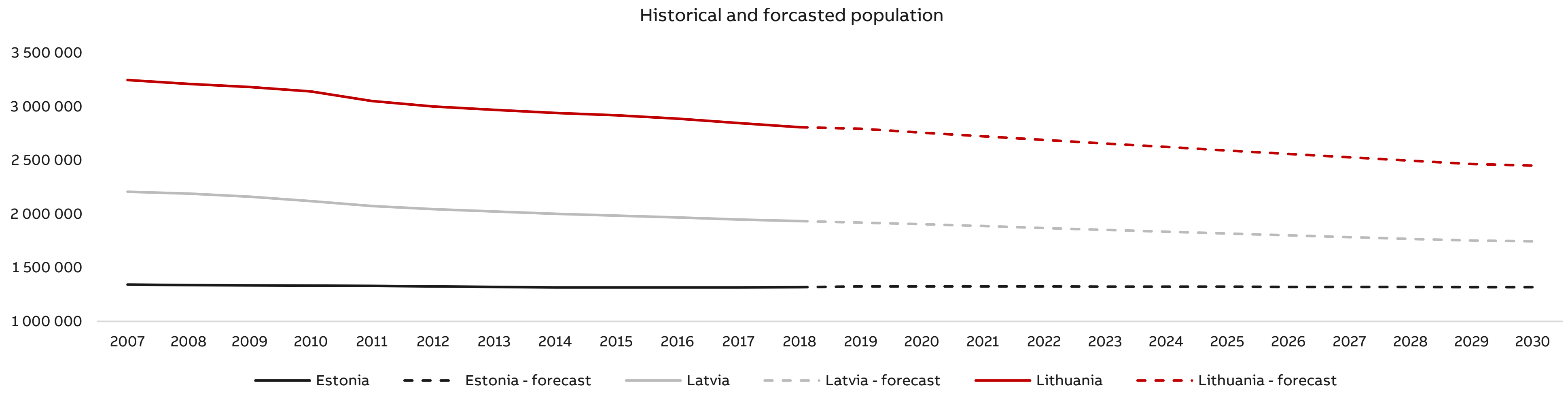
Vehicle fleet

Technology improvement

Emission factors

Energy consumption shares

Between 2007 and 2018, the population of the Baltic region decreased by 11%. This trend is expected to continue. According to the European Commission long-term forecast, the region's population will decrease by around 9% compared with 2018 levels by 2030. For the years in between, ABB has interpolated the data.



Source: Eurostat

Transport Statistical Data and Projections in The Baltic States

Assumptions

Population

GDP growth

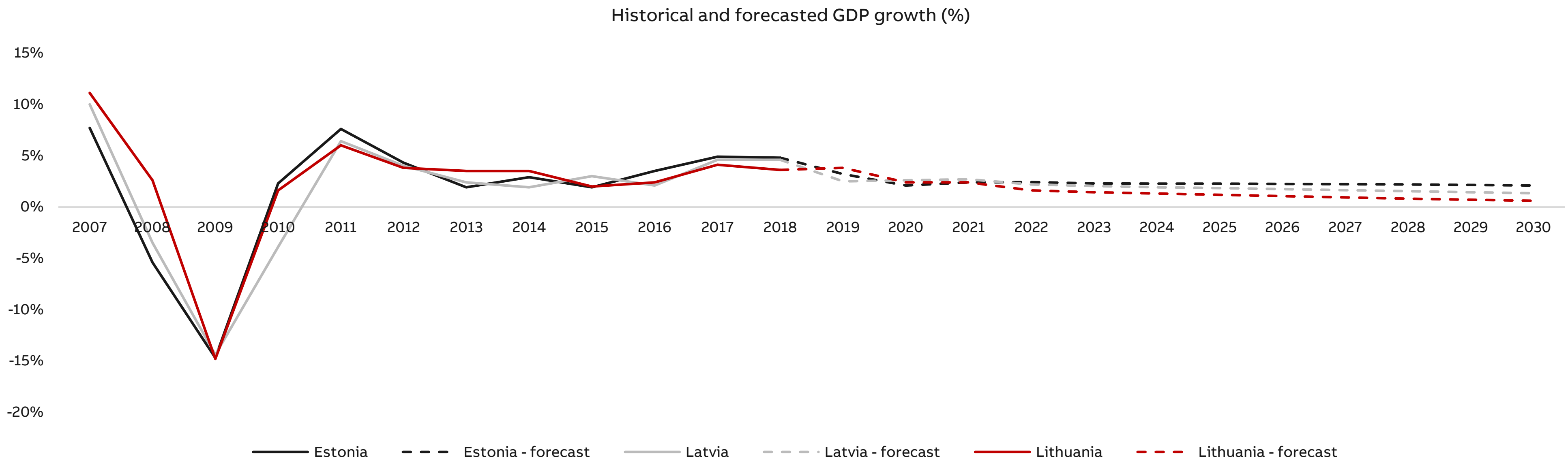
Vehicle fleet

Technology improvement

Emission factors

Energy consumption shares

GDP behaviour varies between the Baltic States. Estonia is expected to oscillate between 2.1% and 2.4% growth between 2020 and 2030. Latvia and Lithuania are likely to experience a **slowdown** in GDP growth during the forecast period, with an appreciable reduction in the late 2020s, where Lithuania is expected to experience y-o-y growth of less than 1%.



Source: EC (2018-2021) and OEDC (2022-2030)

Transport Statistical Data and Projections in The Baltic States

Assumptions

Population

GDP growth

Vehicle fleet

Technology improvement

Emission factors

Energy consumption shares

Historical fleet growth behaviour for both passengers and freight transport has been analysed from a European perspective. It is common to see a pattern of aggressive fleet expansion (Period 1 below) followed by more moderate increases (Period 2). In light of this, ABB has defined the following annual rates of increase for each of the Baltic States during each period.

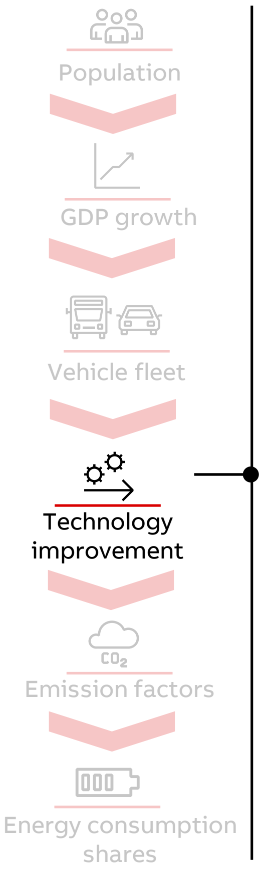
Based on our assumptions, Estonia will continue to experience the highest rates of increase in passenger transport during the first period, while Lithuania will generate higher growth in the second period. Freight transport will develop almost identically in all the Baltic States.

	Passengers transport		Freight transport	
	Period I	**Period II**	**Period I**	**Period II**
Estonia	**3.3%**	**1.1%**	**3.7%**	**1.8%**
Latvia	**2.0%**	**1.0%**	**3.1%**	**1.6%**
Lithuania	**3.1%**	**1.6%**	**3.6%**	**1.8%**

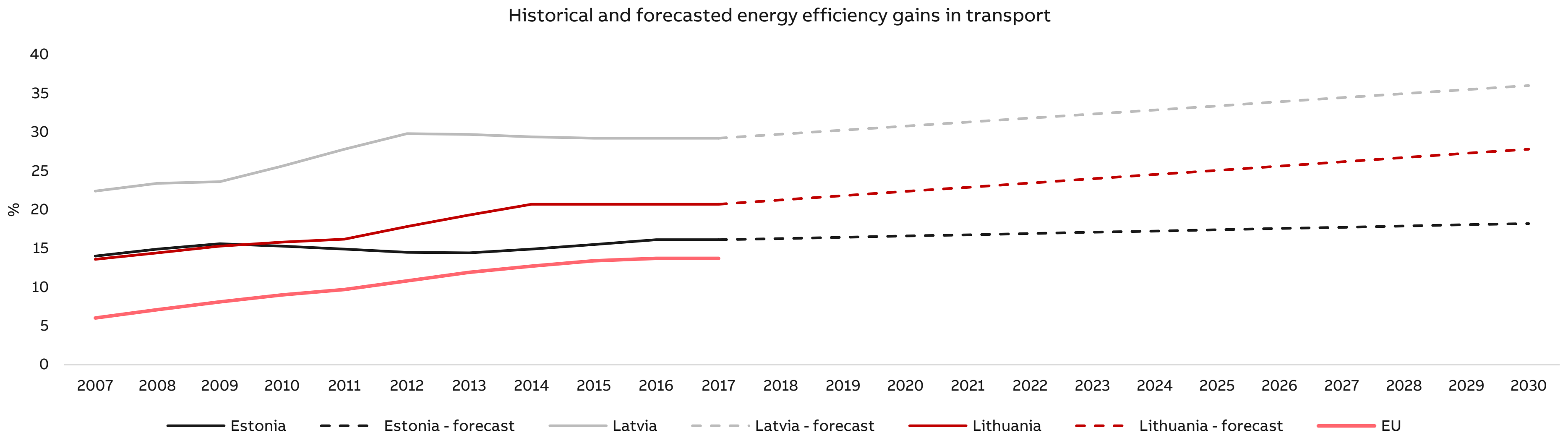
Source: ABB's assumptions based on historical data

Transport Statistical Data and Projections in The Baltic States

Assumptions



Technology improvements are the easiest way to improve energy efficiency in transport. According to ODYSSEE[1], the Baltic States have experienced growth in energy efficiency gains in the transport sector during recent years. Such technological improvements are expected to continue as the fleet size increases.

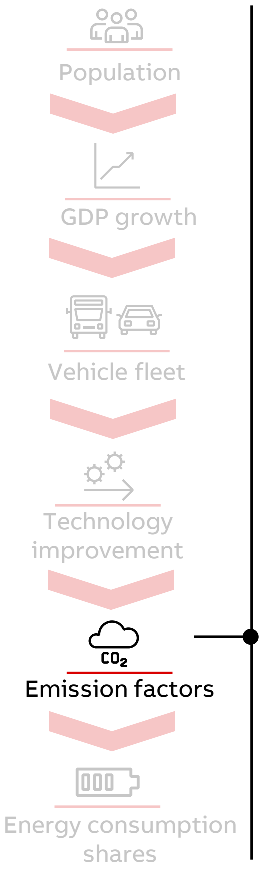


Source: Historical - ODYSSEE, EC. Forecast – ABB's assumptions

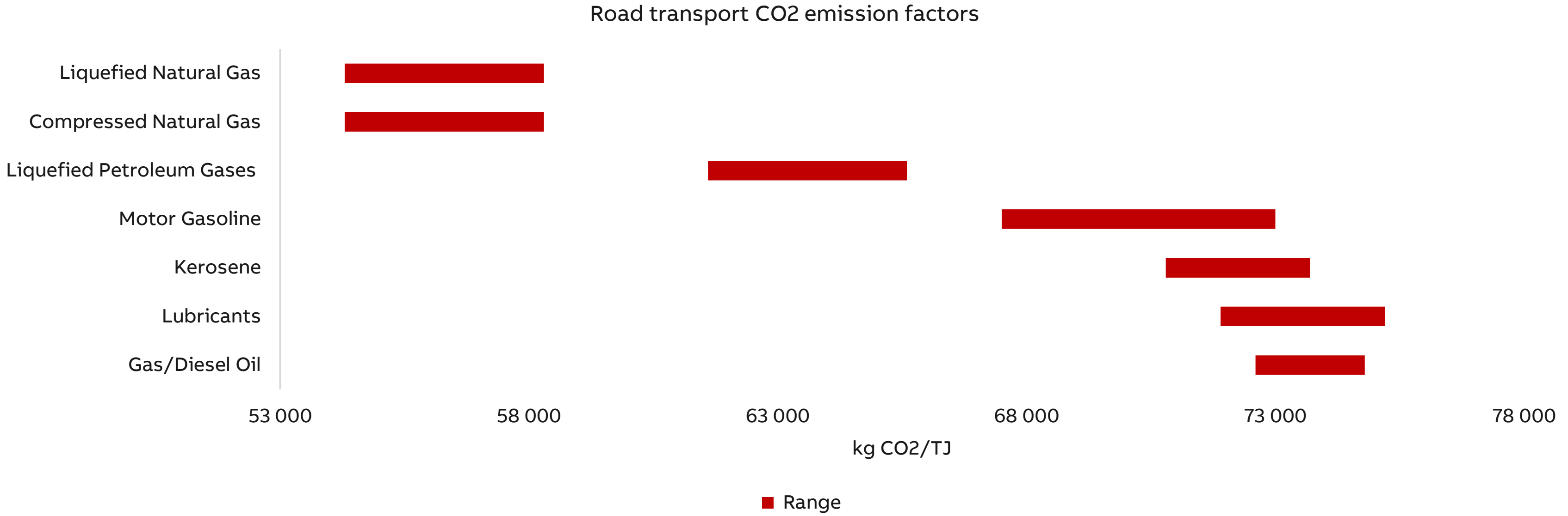
1. Project supported by H2020 programme of the European Commission

Transport Statistical Data and Projections in The Baltic States

Assumptions



The CO_2 emission factors of conventional fuels are based on the carbon content of each considered fuel, assuming 100 percent oxidation of the fuel carbon. The assumptions applied in the modelling are shown in the graph below.



Source: IPCC, 2006

Transport Statistical Data and Projections in The Baltic States

Assumptions

Population

GDP growth

Vehicle fleet

Technology improvement

Emission factors

Energy consumption shares

Blending biofuels is one of the methods that European countries can use to meet their long-term RES transport targets.
As shown in Chapter II, the Baltic States promote the use of biofuels through blending quotas, tax exemptions, subsidies among other measures. According to the Baltic States' NECPs, first and second generation biofuels are expected to follow the base trajectories shown in the table below.

First generation biofuels share in transport energy consumption in each scenario

		2020	2025	2030
Estonia	Low	0.1%	0.1%	0.1%
	Base	7.0%	7.0%	7.0%
	High	14.0%	14.0%	14.0%
Latvia	Low	0.8%	0.8%	0.8%
	Base	5.0%	5.0%	5.0%
	High	10.0%	10.0%	10.0%
Lithuania	Low	3.2%	3.2%	3.2%
	Base	5.9%	6.6%	6.9%
	High	11.8%	13.2%	13.8%

Source: Base - NECPs

Second generation biofuels share in transport energy consumption in each scenario

		2020	2025	2030
Estonia	Low	0.0%	0.0%	0.0%
	Base	3.0%	3.3%	3.5%
	High	6.0%	6.6%	7.0%
Latvia	Low	0.0%	0.0%	0.0%
	Base	0.2%	1.0%	3.5%
	High	0.4%	2.0%	7.0%
Lithuania	Low	0.0%	0.0%	0.0%
	Base	0.0%	1.9%	3.8%
	High	0.0%	3.8%	7.6%

Source: Base - NECPs

Transport Statistical Data and Projections in The Baltic States

Assumptions

Population

GDP growth

Vehicle fleet

Technology improvement

Emission factors

Energy consumption shares

Electric cars will play a key role in reducing CO_2 emissions and dependency on liquid fuels in individual passenger transport over the longer term. In parallel with the fuel targets, the Baltic States have proposed the introduction of electric and hybrid vehicles. In Estonia, for example, the government wishes to make development of electromobility the **main focus** as biofuels could be obsolete after 2030[1] However, until then, the Baltic States' previously demonstrated dependency on biofuels is expected to continue.

Electricity share in transport energy consumption in each scenario

		2020	2025	2030
Estonia	Low	0.2%	0.2%	0.2%
	Base	0.5%	2.0%	3.5%
	High	1.0%	4.0%	7.0%
Latvia	Low	0.5%	0.5%	0.5%
	Base	1.6%	3.6%	5.5%
	High	3.2%	7.2%	11.0%
Lithuania	Low	0.2%	0.2%	0.2%
	Base	0.2%	0.7%	3.5%
	High	0.4%	1.4%	7.0%

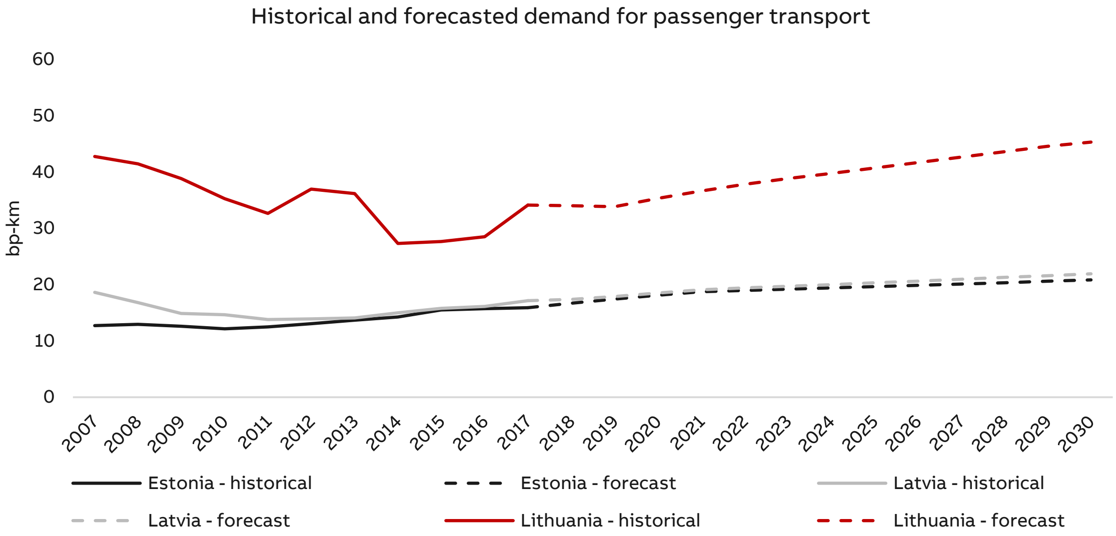
Source: Base - NECPs

1. Estonian National Energy and Climate Plan, 2018

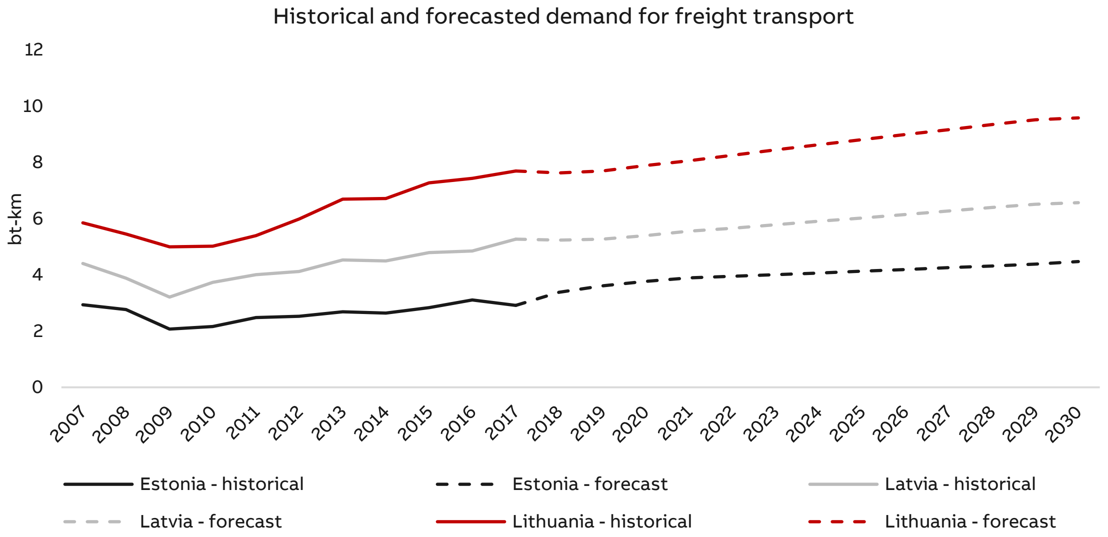
Transport Statistical Data and Projections in The Baltic States

Results

Baltic **transport demand** is expected to **increase** for both **passenger and freight** transport. No special measures to reduce transport demand have been considered under the modelling. The growth rate for passenger transport is assumed to oscillate between 1% and 3% per year in the study period, with Lithuania experiencing the highest and Latvia the lowest relative rate of change. For freight transport, the increase in demand is much higher for Lithuania and Latvia at 4% and 2% growth per year, respectively.



Source: ABB



Source: ABB

Transport Statistical Data and Projections in The Baltic States

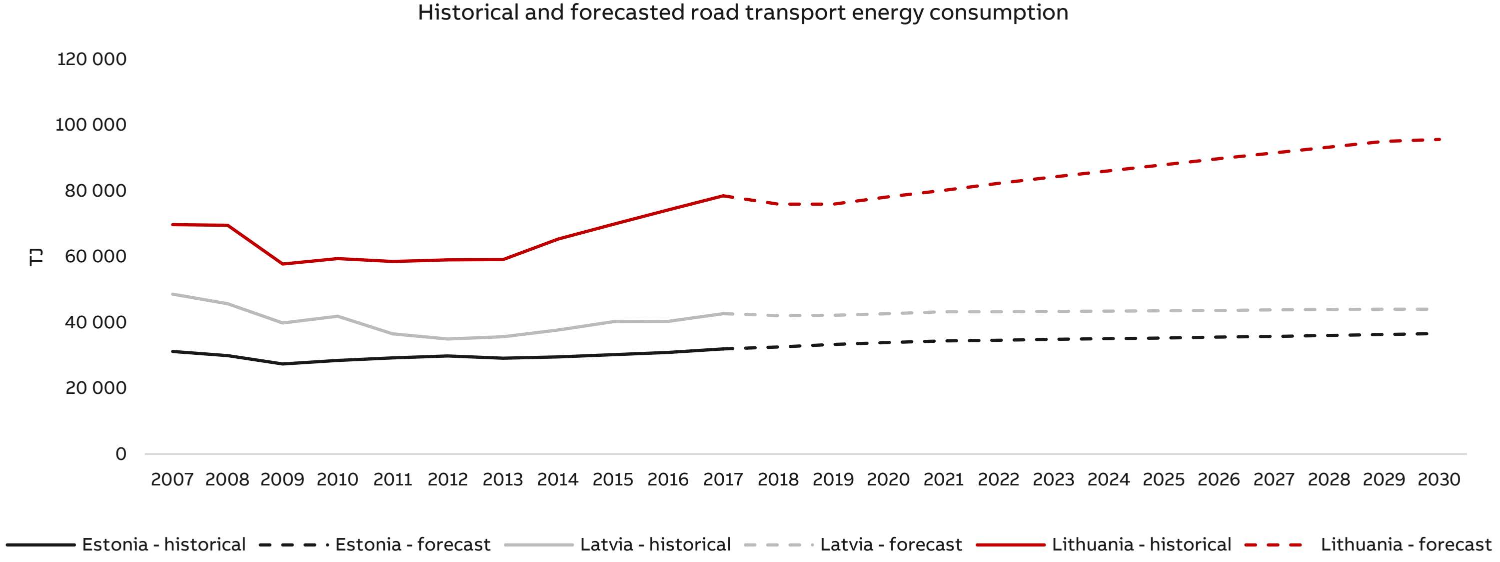
Results

While the total energy consumption for transport in the Baltic States increased just 2% between 2007 and 2017, the results in each country varied, from an increase of 12% in Lithuania to a decrease of 12% in Latvia.

As expected, with increasing transport demand forecast in future years, the modelling assumes that **energy consumption in the Baltic States will increase by 0.7% per year** between 2017 and 2030.

Individual growth rates are shown in the table below:

	Change from 2007 to 2030 (%)
Estonia	18%
Latvia	-10%
Lithuania	37%



Source: ABB

Transport Statistical Data and Projections in The Baltic States

Results

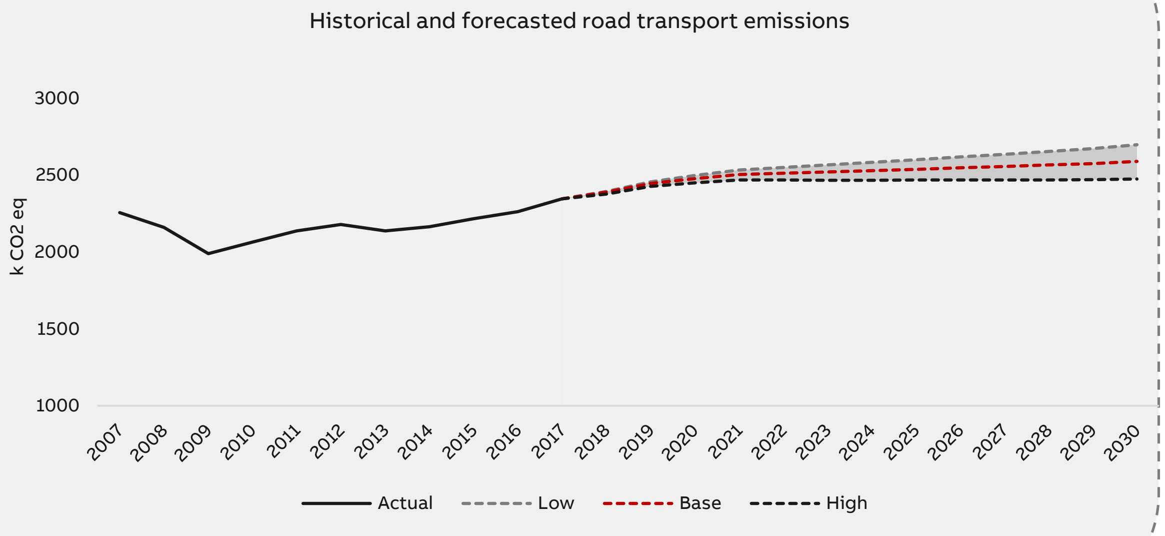
Overall, the **GHG emission forecast** in the transport sector is aligned with the **national projections** specified in the NECPs of the Baltic States.

In the **“low scenario”**, where the situation of the transport sector does not perceivably improve in the next few years, GHG emissions increase considerably (compared to 2007 levels) in Estonia and Lithuania, while Latvia experiences, even under the worst-case scenario, a decrease in GHG road transport emissions.

In the **“base scenario”,** the Baltic States fulfil their RES targets with the specified trajectories in the NECPs. However, these trajectories are not translated into notable GHG emission reductions; rather, they stabilise the emission production.

In order to significantly reduce current GHG emission levels, the **“high scenario”** stresses the road transport modelling by doubling the RES targets in each of the Baltic States. Under these conditions, there is a decrease in GHG emissions in Estonia and Latvia. Lithuania is likely to continue raising emissions, in a scenario similar to the “With Additional Measures” in the NECP proposed by the Lithuanian government.

Estonia



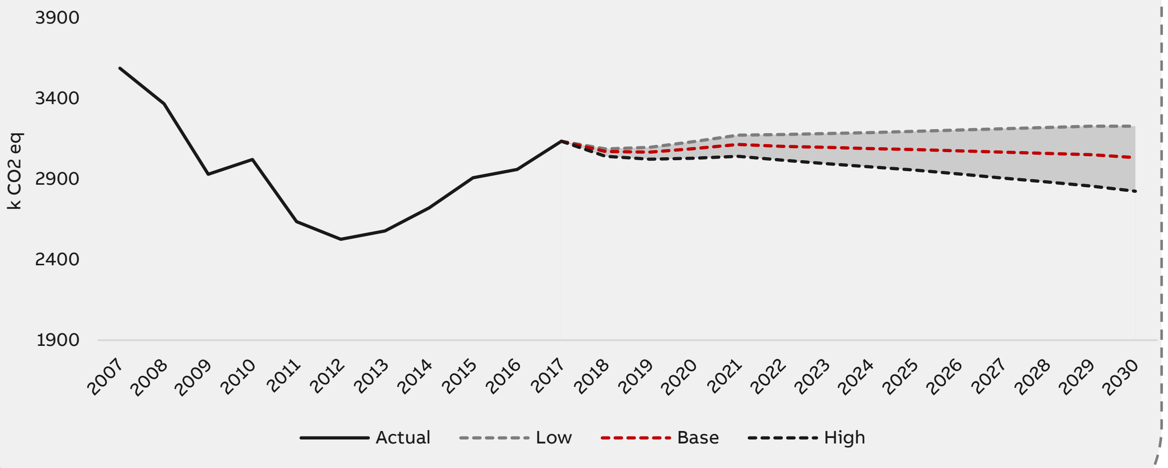
Source: ABB

Transport Statistical Data and Projections in The Baltic States

Results

Latvia

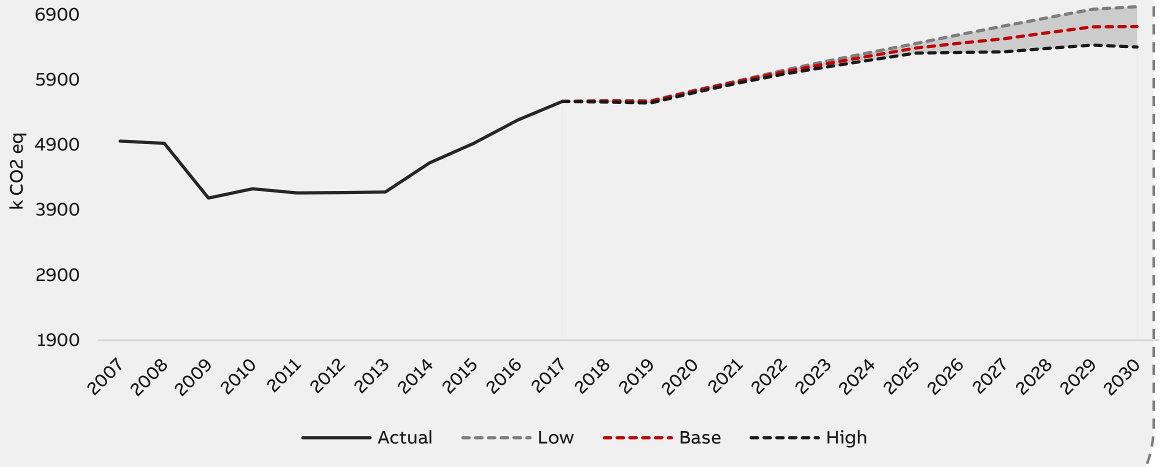
Historical and forecasted road transport emissions



Source: ABB

Lithuania

Historical and forecasted road transport emissions



Source: ABB

Transport Statistical Data and Projections in The Baltic States

Results

The **Baltic States** have a **difficult pathway towards** decarbonisation of the transport sector. The **Effort-Sharing Regulation** establishes binding GHG emissions targets for all the EU member states for two periods, 2013–2020 and 2021–2030. These targets consider the following sectors: transport (excluding aviation), buildings, agriculture and waste.

If the targets for the first period were only applied to road transport, Latvia would be the only Baltic country to be below the permitted GHG emissions increase with less than 11% growth compared with 2005 levels. Estonia and Lithuania would be – in the worst–case scenario – 15% and 30% above their targets respectively.

For the second compliance period, none of the Baltic States would meet the reduction target.

	Change from 2005 to 2020 (%)				Change from 2005 to 2030 (%)			
	Target	Low	Base	High	Target	Low	Base	High
Estonia	11%	26%	25%	24%	-13%	36%	31%	25%
Latvia	17%	11%	10%	8%	-6%	15%	7%	0%
Lithuania	15%	45%	45%	44%	-9%	78%	70%	62%

There is still **considerable potential to reduce road transport GHG emissions** in the Baltic States. The extent to which this potential can be achieved depends on several factors, some of which are **endogenous** and some of which are **exogenous**. Endogenous factors include internal policies and regulation to promote a modal shift in both passenger and freight transport, while exogenous factors include the cost of alternative technologies and fuels that are mainly driven by macroeconomic factors, economies of scale and technology learning effects. Some of these factors will be covered in the next chapter.

Transport Statistical Data and Projections in The Baltic States

Summary of results

In all the studied scenarios, the Baltic States increase their level of direct CO_2 emissions compared with the 2005 level. In order to be able to decarbonise the sector, additional measures have to be considered. Based on the modelling results, a summary of the key findings are presented below:

KPI	Evolution of KPI			2030 value		
	Estonia	Latvia	Lithuania	Estonia	Latvia	Lithuania
Passenger transport demand (bp-km)	Increase	Increase	Increase	20.8	21.9	45.3
Freight transport demand (bt-km)	Increase	Increase	Increase	4.5	6.6	9.6
Road transport energy consumption (PJ)	Increase	Increase	Increase	36.6	44.0	95.6
GHG emissions – Low scenario (tCO2 eq)	Increase	No changes	Increase	2.7	3.2	7.0
GHG emissions – Base scenario (tCO2 eq)	Increase	Decrease	Increase	2.6	3.0	6.7
GHG emissions – High scenario (tCO2 eq)	No changes	Decrease	Increase	2.5	2.8	6.4

Increase   Decrease   No changes

Transport Statistical Data and Projections in The Baltic States

Chapter VI: Policy Outlook

Transport Statistical Data and Projections in The Baltic States

Policy outlook

The **transport sector is in the midst of a fast-paced transformation** driven by technological, political, economic and social factors, including:

- Increasing awareness of climate change;
- Disruptive technologies that will change how mobility will be managed and the relationship between the different stakeholders;
- National and international policies to reduce Greenhouse Gas emissions (GHG emissions);
- Cost reductions of batteries and other alternative fuels;

In this context, there are two main transitions taking place to facilitate this transport sector transformation.

Transport transformation

Transition in the amount of energy consumed

Reduction of energy consumption without limiting mobility (efficiency)

Transition in the type of energy consumed

Transition to carbon-neutral energy consumption in the sector

All the policy recommendations detailed in this section will be defined to help during one or both of these transitions.

In addition, due to the importance of the modal shift and its relationship with previous transitions, those policies that will have an impact on the evolution of the modal shift are highlighted at the end of this section.

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United Nations Sustainable Development Summit goals

This transformation is directly reflected in various international targets and agreements. A good example are the 17 sustainable development goals (SDGs) defined during the **United Nations (UN) Sustainable Development Summit** (New York, 2015) intended to accomplish three ambitious goals in the next 15 years: (i) End extreme poverty, (ii) Fight inequality and injustice, and (iii) Fix climate change, highlighting:

- **Target 3.6:** Halve number of global deaths and road injuries from traffic accidents
- **Target 3.9:** Reduce deaths and illnesses from pollution.

- **Target 11.2:** Provide access to safe, affordable, accessible and sustainable transport systems for all
- **Target 11.6:** Reduce the adverse environmental impact of cities

- **Target 7.3:** Double the global rate of improvement in energy efficiency

- **Target 12.c:** Rationalise inefficient fossil-fuel subsidies

- **Target 9.1:** Develop sustainable and resilient infrastructure

- **Target 13.1:** Strengthen resilience
- **Target 13.2:** Integrate climate change measures into national plans

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European Green Deal

In parallel with this global goal, the **European Commission** has recently published the **“European Green Deal for the European Union and its citizens”**, which resets the Commission’s commitment to tackling climate- and environment-related challenges. Among other things, the deal commits member states to take the following measures with regard to the transport sector:

- Approve a strategy for **smart and sustainable mobility** by the end of 2020
- Propose initiatives to **optimise the capacity** of railways and waterways
- Support the **implementation of charging infrastructures and alternative energy service stations** through the launch of a specific programme
- Prepare legislative proposals that stimulate the **production and distribution of sustainable fuels and alternative energy** for different means of transport
- Withdraw and reformulate a proposal for the **Combined Transport Directive** by the end of 2021
- Review the **Alternative Energy Infrastructure Directive** and the regulation of the TEN-T network corridors by the end of 2021.
- Propose **more restrictive standards for vehicles powered by internal combustion** engines by the end of 2021.

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Transport sector transformation policy pillars

The targets set both in the SDGs and in the Green Deal provide a good example of the current direction of travel of international policies. All of these should be taken into consideration when defining future policies in the Baltic States to drive transport sector transformation in the right direction.

When formulating new policies, it is important to maintain a clear overview of three pillars: (i) the instruments available, (ii) the areas in which we want the policy to intervene and (iii) the output that we expect from these actions. The main pillars of this transport sector transformation are detailed below:

Transport sector transformation policy pillars

Policy instruments

- Government investment
- Regulatory obligations and restrictions
- Subsidies to support third party investment
- Incentives and price instruments
- Taxes and levies
- Strategic assessment

Areas of intervention

- Physical infrastructure
- Transport services/ digital solutions
- Technology
- Information

Output

- Transition in the amount of energy consumed
- Transition in the type of energy consumed

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Policies: Government investments and subsidies

Supported by these three pillars, the following policies could be implemented in Estonia, Lithuania and Latvia to move the countries closer to their 2020 targets and help them achieve their 2030 targets for decarbonisation of the transport sector. In the table below, a flag next to a policy indicates that this policy has already been (fully or partially) implemented by the country in question:

Government investment		• Create bicycle lanes and parking places in urban areas • Build parking areas outside major cities with free public transport to the city centre • Improve pedestrian conditions: safe walking areas, adequate routes, etc. • Improve existing railway/public transport infrastructure	Transition in the amount of energy consumed (CO_2)
Government investment	Estonia, Latvia, Lithuania (flags)	• Expand and deploy low-emission vehicles infrastructure and secure grid infrastructure for EVs • Public procurement of fleets using alternative fuels, increasing visibility and helping to create the market	Transition in the type of energy consumed
Subsidies to support third party investment		• Invest in new and more efficient technologies such as ultra-high speed rail • Launch R&D funding for new technologies and solutions • Support modernisation and efficiency improvements in the vehicle fleet	Transition in the amount of energy consumed (CO_2)
Subsidies to support third party investment	Lithuania (flag, next to "Promote biofuel production")	• Subsidise the expansion and deployment of low-emission vehicles infrastructure and secure grid infrastructure for EVs • Promote biofuel production • Subsidise training to increase awareness and secure appropriate technology expertise in the country and avoid future bottlenecks	Transition in the type of energy consumed

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Policies: Taxes and levies and regulatory obligations and restrictions

Taxes and levies

- Exempt low-emission vehicles from vehicle road tax
- Exempt low-emission vehicles from initial registration fees
- Exempt vehicles using biofuels from the environmental pollution tax (some exceptions may apply)
- Reduce excise tax for vehicles using and/or companies processing, storing, receiving or delivering low-emission vehicles (some exceptions may apply)
- Include all transports in the emission trading system (ETS)
- Deploy road charging policies designed to encourage users to optimise car usage and the transition to low-contaminant vehicles.

→ **Transition in the type of energy consumed**

Regulatory obligations and restrictions

- Restrict car use in certain areas of cities (city centres)

→ **Transition in the amount of energy consumed**

- Define quotas for biofuels in petrol and diesel
- Set clear targets
- Promote standards/compatible solutions
- Phase out the sale of diesel and petrol cars

→ **Transition in the type of energy consumed**

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Policies: Incentives and prices instruments and Strategic assessments

Incentives and price instruments

- Promote public transport: cheaper, more efficient, high quality
- Subsidise awareness and training initiatives to promote the use of public transport
- Incentivise logistics efficiency/smart solutions to minimise transportation time, distances or number of vehicles required
- Incentivise the development of autonomous vehicles
- Encourage teleworking where feasible

→ **Transition in the amount of energy consumed**

- Allow low-emission vehicles to use public transport lanes
- Allow low-emission vehicles to have free parking in some municipalities
- Define tariffs for EV charging and develop electricity flexibility markets to facilitate demand response services from EVs

→ **Transition in the type of energy consumed**

Strategic assessment

- Define a roadmap and embed in deep sectoral studies
- Develop feasibility studies, for example: capacity of the system to integrate EVs, hosting capacity of the network to allocate EV infrastructure, etc.
- Set a baseline and perform detailed target progress tracking

→ **Transition in the amount of energy consumed**

→ **Transition in the type of energy consumed**

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Policies: Execution examples

Some example of these policies and their benefits are described below:

Example: Cycling emission reduction

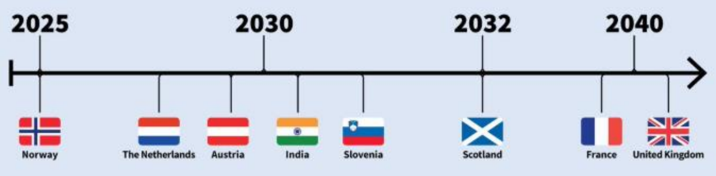
- Transport researchers from TU Dresden have analysed this potential. They concluded that if 25% of all short trips that have until now been made by car in Germany were in future made by bicycle, GHG emissions would be reduced by 3%, or 8,000 tones per day.
- **Source:** Potential of Cycling to reduce emissions in the road transport. Umweltbundesamt (German Environment Agency)

Example: Low-emission zones

- The Madrid Central programme made 472 hectares of the city centre off-limits to traffic, except for local residents and public transport. Some private vehicles can also enter the area if they are going to park in a public car park (see sidebar).
- According to a study intended to measure the environmental impact of Madrid Central, emissions of nitrogen oxide (NOx), fell by 38% in Madrid's centre the first month the programme was implemented, while carbon dioxide (CO_2) emissions fell by 14.2

Example: Phase out of diesel and petrol cars

- More and more countries have announced the phase out sale of diesel and petrol cars:



- **Source:** Low-Emission Zones are a success - but they must now move to zero-emission mobility, September 2019, Transport and Environment

From the evaluation of the policies already implemented in the study countries, it can be concluded that most of the policies already in place relate to the transition in the type of energy consumed, but not the transition in the amount of energy consumed.

It is recommended that measures to promote consumption reduction and efficiency are linked to measures to promote the transition in the type of energy consumed. The main reason is that these measures usually require lower investment, produce faster results and additionally increase social awareness, as well as directly benefit the transition in type of fuel consumed.

This makes it relevant to implement short- and medium-term policies that support the transition in the amount of energy consumed. The lack of these kinds of measures may also be one of the reasons why these countries are struggling to meet their 2020 targets.

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Policy roadmap

In light of the above, ABB proposes the following policy strategy to help the countries move closer to their 2020 targets and satisfy their 2030 targets. This policy roadmap does not reflect differences between the countries because they all have very similar starting points (items **with a red dot at the end** relate to **modal shifts**):

POLICY ROADMAP

SHORT TERM (within 1 year)	MID TERM (1 – 3 years)	LONG TERM (3 – 10 years)
• Improve pedestrian conditions: safe walking areas, adequate routes, etc. Restrict car use to certain areas of cities (city centres) ● • Allow low-emission vehicles to use public transport lanes • Allow low-emission vehicles to have free parking in some municipalities • Define quotas for biofuels in petrol and diesel • Subsidise the expansion and deployment of low-emission vehicles infrastructure and secure grid infrastructure for EVs • Promote biofuel production • Public procurement of fleets that use alternative fuels ● • Exempt low-emission vehicles from vehicle road tax and registration charges • Define a roadmap and embed in deep sectoral studies • Develop feasibility studies • Set clear targets and a baseline, and carry out detailed target progress tracking • Set road charges policies	• Create bicycle lanes and parking places in urban areas ● • Improve existing railway/public transport infrastructure ● • Build parking areas outside major cities with free public transport to the city centre ● • Support the modernisation of the vehicle fleet • Subsidise training to increase awareness and secure appropriate technology expertise in the country and avoid bottlenecks • Launch R&D funding for new technologies and solutions • Incentivise logistics efficiency/smart solutions to minimise transportation time, distances and number of vehicles required. ● • Define tariffs for EV charging and electricity flexibility markets to facilitate demand response • Promote standards/compatible solutions	• Include all transport modes in the emission trading system (ETS) • Incentivise the development of autonomous vehicles • Encourage teleworking where feasible ● • Invest in new and more efficient technologies such as ultra-high speed rail ● • Phase out the sale of diesel and petrol cars

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