

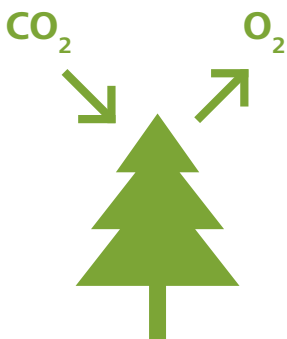
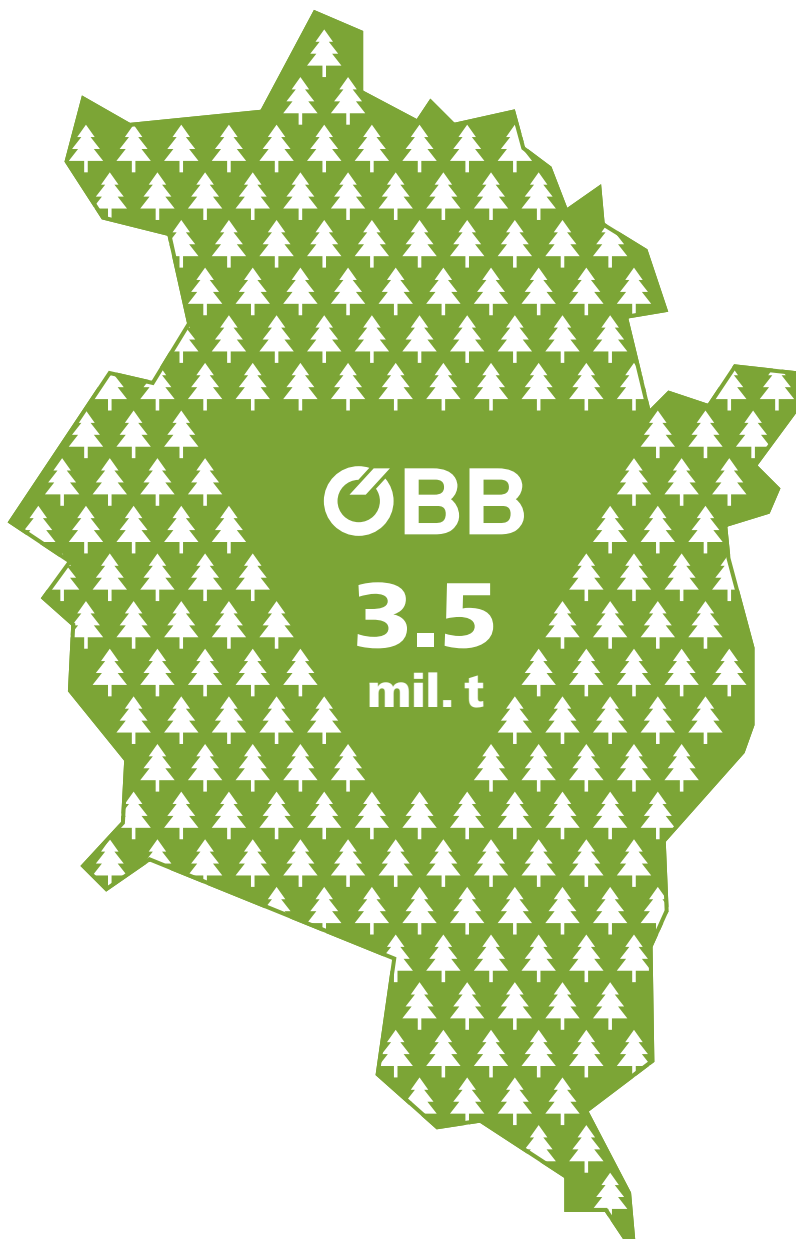


**We are climate
protection.**

ÖBB Climate Protection Strategy 2030

Climate protection.

Every year, ÖBB saves the climate 1.1 million tonnes of CO₂ through transporting goods by rail and 2.4 million tonnes of CO₂ through transporting passengers by rail. In total, that's 3.5 million tonnes of CO₂. A forest the size of Vorarlberg would need to be planted to capture this amount.



1.1



2.4



mil. t

of CO₂ emissions
saved through
ÖBB's rail transport

ÖBB CLIMATE PROTECTION STRATEGY 2030 – Foreword by the Board



BOARD OF ÖBB HOLDING. Ing. Mag. (FH) Andreas Matthä (CEO), Mag. Arnold Schiefer (CFO)

The railways are part of the solution. The fight against climate change is one of the greatest challenges of our time. One of the key questions is: How do we achieve the climate revolution in the area of transport? One thing is clear: The transport sector has to make a substantial contribution in order for Austria to reach its climate protection targets. In fact, this sector – excluding international air traffic – currently causes around 29 percent of Austria’s total greenhouse gas (GHG) emissions. About 99 percent of this comes from road traffic. The lever is therefore big: With the right measures, transport sector emissions can also be reduced quickly and significantly.

ÖBB alone currently saves around 3.5 million tonnes of GHG emissions from entering the environment each year with its rail transport services. A doubling of ÖBB’s performance and that of the other domestic railway companies would deliver almost 50 percent of the current shortfall of around 8 million tonnes in order to reach Austria’s commitment to cutting emissions in the transport sector. However, in order to actually create this – visionary but feasible – modal shift to rail, the railway companies need better overall conditions in which to operate. At the present time, competition between the individual modes of transport is often unfair. The problems start with unequal tax treatment, continue with massive support for fossil forms of mobility and end with the lack of true-cost pricing across all modes of transport. Legislators must provide clarity in these areas.

Climate-friendly mobility for the future

Of course, the railway companies also have to do their part to achieve the Austrian climate targets. ÖBB is doing so with an ambitious climate protection strategy. We want to and will significantly increase capacity with new technologies in the area of controlling and operational management as well as with more powerful vehicles. And the rapid electrification of further railway lines, the increased use of renewable energies, the increase in energy efficiency and the use of alternative propulsion technologies will additionally make transport by rail and bus more attractive. Two further important levers for the modal shift from road and air transport to rail are improvements in quality and the simplification of access to rail and bus services. Well trained and motivated employees are one of the main prerequisites for this. We are therefore investing massively in training and development measures and offering interested people the possibility to actively help shape the climate-friendly mobility of the future.

Austria has been a leading railway nation for decades

Back in the days of the monarchy, the expansion of the railways brought people together and facilitated a successful economy. Groundbreaking lines such as the Semmeringbahn, the first railway line to cross the Alps, made Austria a leading railway nation many decades ago. We retain this position to this day. Our claim for the years that lie ahead of us should be similar. Climate protection – and the same naturally also applies to the transport sector – represents an enormous opportunity for growth. The Austrian rail industry is already a world leader in many areas today. Through innovations and the further development of technologies in the rail sector, Austrian companies could further expand their strong position in the future-orientated area of the railways. Austrian railway companies – above all ÖBB – continue to stand ready as strong partners and provide the domestic market in which future patents for the world market can be jointly developed and tested.

In any event, ÖBB will do everything it can as one of the biggest companies in the Republic of Austria to ensure that Austria delivers on its climate protection commitments. In this sense, we are partners of legislators and partners of the economy. Above all, we are partners of the people in our country, and are committed to them as Austria's biggest climate protection company.

At the present time, competition between the individual modes of transport is frequently unfair. Legislators must provide clarity in this area.

Ing. Mag. (FH) Andreas Matthä

Chairman of the Board of Management,
ÖBB-Holding AG

Mag. Arnold Schiefer

Member of the Board of Management,
ÖBB-Holding AG

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THE COVER. Twelve apprentices from the ÖBB training workshops in Vienna took part in the "Fridays for Future" demonstration in Vienna on 29 November 2019. We were there with them. The cover photo was taken at the event.



About this report

Climate protection is a central topic of current socio-political discussions – globally, in Europe and in Austria. There is much discussion about a new way of thinking and acting, about challenges and opportunities for growth, about **strategic objectives for a decarbonised society**, about the topic of achieving defined or new CO₂ targets, and about possible potentials for doing so.

As Austria's biggest climate protection company, ÖBB is going one step further. For the first time, this report on the ÖBB Climate Protection Strategy describes the ambitious objectives for reducing the greenhouse gas (GHG) emissions of ÖBB by 2030 and for the period from 2040 to 2050, and above all the commitment to climate-neutral mobility by means of six key levers. **ÖBB wants to draw attention to the additional potential GHG savings of rail and bus – to make an offer, so to speak.** For each lever of the ÖBB Climate Protection Strategy 2030, a maximum potential for saving GHG emissions is indicated; corresponding measures of ÖBB and subsidies are also described. Suitable overall conditions are needed to leverage all these potentials.

Information on further developments of the ÖBB Climate Protection Strategy will be provided on a regular basis in ÖBB Climate Protection Reports.

DIGITAL. You can find the report on the Climate Protection Strategy 2030 online as a PDF at: konzern.oebb.at/ksb2019en

The Climate is Changin

FUTURE. There is no longer any doubt that we humans are causing today's climate change. It is now our great challenge and responsibility to reverse it.

Our planet's climate has, in fact, always changed. Yet the extent and speed at which the climate has changed since the Industrial Revolution gives pause for thought.

Fossil fuels such as coal, gas and oil have been used as sources of energy around the world for a good 200 years. The consequences: levels of greenhouse gases in the atmosphere have risen dramatically, as has the temperature of the earth's surface – currently by an average of 0.8 degrees Celsius. That is more than enough to push the earth's sensitive equilibrium out of balance. Rapid and committed action is needed to prevent the warming from getting any worse. Nobody can predict with any certainty what lies ahead of us. Climate researchers make forecasts on the basis of past data. The following scenarios are possible and probable: the seasons will change. Winter is beginning later and ending earlier. In some places, summer

heatwaves will become more frequent. The ice at the poles will melt, glaciers will disappear – sea levels will rise. The oceans will warm, more water will evaporate. This will further increase the greenhouse effect. What's more, warmer air can hold more moisture. It will rain more and extreme weather events such as heavy rainfall, periods of drought, storms, etc. will increase.

New thinking, new action

Can climate change caused by humans be slowed down, stopped or even reversed? The basic prerequisite for this is a new way of thinking and acting across many different areas of our lives. It is about the planet we share, which requires global, concerted action – another big challenge in itself. The United Nations have been concerned about our climate for many decades. At climate conferences, policy-makers have therefore

discussed setting clear limits on the global warming caused by humans. The so-called "2-degree target" was adopted at the climate conference in Paris in 2015. Since then,

Rapid and committed action is needed to prevent the warming from getting any worse.

g



however, it has become clear that an average warming of 1.5 degree Celsius should not be exceeded. Every country should make its contribution to this and, for example, to using more renewable energies such as solar energy, wind power and hydropower. Whether these measures will suffice remains to be seen. Some researchers even fear that the average temperature will rise by 5 degrees Celsius or more by the year 2100.

Austria's commitments

For the second Kyoto commitment period covering 2013 to 2020, Austria also supports the goal of the EU Climate and Energy Package (CARE) to reduce greenhouse gas emissions by a total of 20 percent compared to the level of 1990. Austria is required to reduce the greenhouse gas emissions caused by the sectors not covered by emissions trading (e. g. transport, buildings, agriculture) by 16 percent by 2020 compared to 2005 levels. The action plans aimed at this target are created in accordance with the Climate Protection Act (KSG). This act also defines the target paths for the maximum quantities of greenhouse gas emissions per sector in the period from 2013 to 2020.

The European Union has now also defined the next target stage up to the year 2030. The emissions caused by greenhouse gases should be reduced by at least 40 percent compared to 1990 levels, the proportion of renewable energies increased to 32 percent of end consumption, and energy efficiency improved by 32.5 percent.

The climate target of minus 40 percent is in turn divided between the areas of emissions trading and non-emissions trading. In emissions trading, the



GREEN. In order to achieve the ambitious EU and national targets, the federal

greenhouse gas emissions must be reduced by 43 percent over 2005 levels by 2030, in other sectors by 30 percent. In terms of "effort sharing" (the sharing of the burden within the EU), Austria is considered to be a country with a high level of income and must thus meet a target of minus 36 percent.

In order to achieve the ambitious EU and national targets, the federal government has created an Austrian climate and energy strategy (#mission2030), which was adopted at the end of May 2018. This strategy contains the defined targets for Austria as well as the corresponding measures for achieving these targets. In the coming years, 12 flagship projects in the areas of mobility, buildings and heat, energy economy, research and innovation, bio-economy and green finance as well as in the area of communication and education will be implemented together with the federal provinces.

A comprehensive discussion process for creating the Austrian National Energy and Climate Plan (NEKP) was initiated in summer 2018 in collaboration with the federal provinces. This plan was initially presented in draft form to the European Commission at the end of 2018. The political coordination of the final plan will take place by the end of 2019 within the scope of the Governance Regulation on the Energy Union.

It is about the planet we share, which requires global, concerted action – another big challenge in itself.



government has created a climate and energy strategy (#mission2030)

Austrian Climate and Energy Strategy (#mission2030) and the targets for the transport sector

Austria has set itself ambitious targets in matters of climate and environmental protection with the aim of becoming an international pioneer on the way to a climate-friendly future. #mission2030, the Austrian climate and energy strategy, is the starting shot for the end of the fossil age. The central goal for 2030 is to reduce greenhouse gas emissions by 36 percent over 2005 levels and to generate 100 percent of Austrian electricity from renewable sources of energy. The recipe for success: a sustainable combination of awareness-raising measures, the efficient use of renewable energies and the targeted support of innovative environmental technologies.

The objective in detail: by 2030, Austria wants to reduce its greenhouse gas emissions by 36 percent over 2005 levels. In 2016, Austrian greenhouse gas emissions in the areas not covered by the EU's emissions trading scheme amounted to around 50.6 million tonnes of CO₂ equivalent. The target for 2030 is about 36.4 million tonnes of CO₂ equivalent, which means a reduction of around 28 percent. All sectors outside the EU's emission trading scheme should make a contribution to reaching the target. The focus is on the sectors of transport and buildings, which have the biggest

An overview of the main global climate protection agreements

AGREEMENT. The climate is changing. Work to find a global consensus has been ongoing for decades. The most important agreements

Climate Framework Convention

The United Nations Framework Convention on Climate Change, UNFCCC, was signed by almost every country in the world in 1992 as an international climate protection agreement.

Kyoto Protocol

The Kyoto Protocol, which for the first time set out binding GHG reduction targets for industrialised countries under international law, came into force in 2005. The corresponding target of the EU: to reduce greenhouse gas emissions by 8 percent. The first Kyoto commitment period ended on 31 December 2012; an agreement on a second Kyoto period was achieved at COP18/CMP8 in Doha in 2012 (period 2013-2020). The agreed reduction for the EU and its member states amounts of 20 percent compared to 1990. This commitment is in line with the already existing 2020 climate and energy package.

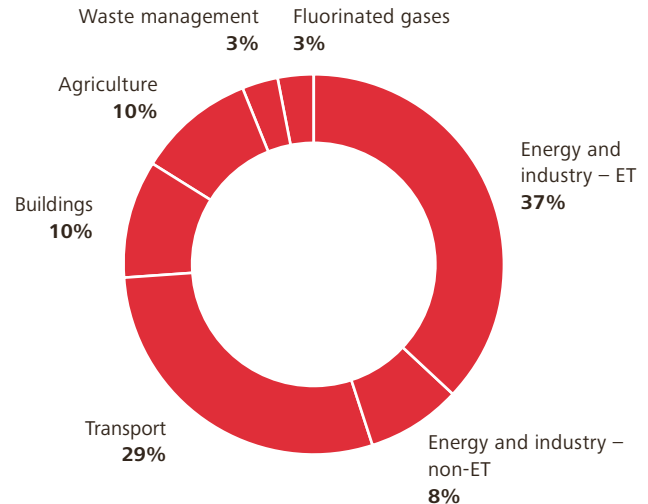
Paris Agreement 2015

The Paris Agreement, which was adopted in December 2015 at COP21 in Paris, defines the long-term, 2-degree target for the first time in an international treaty. It came into force on 4 November 2016, as more than 55 contracting parties which cause at least 55 percent of the global of greenhouse gas emissions, ratified the agreement. In contrast to the Kyoto Protocol, this new treaty encompasses not only industrialised but also emerging and developing countries, in order to take account of the change in the global distribution of greenhouse gas emissions. Global efforts to decarbonise should lead to "net zero emissions" by the second half of this century.

Katowice Rulebook 2018

To further shape the Paris Agreement, the so-called implementation rulebook (a rulebook supported by all member states) was adopted at COP24 in the Polish city of Katowice (2-15 December 2018).

Proportions of greenhouse gas emissions 2017



TRANSPORT is currently one of the sectors with the highest emissions, accounting for 29 percent of total emissions (source: Federal Environment Agency 2019)

land in Austria) as well as mobile military equipment. Important note: the emissions of international air transport are not included in these calculations.

potential for reductions. The target reduction should be achieved through measures in Austria and thus represent an important step towards decarbonisation. With a share of 29 percent of total emissions (incl. emissions trading), transport is currently one of the sectors with the most emissions. Achieving the overall target by 2030 will require a reduction in emissions to around 15.7 million tonnes of CO₂ equivalent (a current shortfall of around 8 million tonnes of CO₂). Austria could therefore position itself as a pioneer in electric mobility and in alternative means of propulsion, and lobby strongly at federal and provincial level for a further expansion of public transport. A path will also be taken that is compatible with the goal of fossil-free mobility as established in the government's programme.

Greenhouse gas emissions in the transport sector

The transport sector causes around 24 million tonnes of greenhouse gas emissions. The main emitter is road traffic, which accounts for about 99 percent of the greenhouse gas emissions of the entire transport sector. The national greenhouse gas emissions in transport amount to approx. 29 percent and are composed as follows: around 18 percentage points are caused by passenger transport on the road (cars, buses, mopeds, motorcycles), around 10 percent points of which by road freight transport. The remaining percentage points of the greenhouse gas emissions of the transport sector are distributed between rail, ship and national air transport (caution: only flights that depart from and

The transport sector causes around 24 million tonnes of greenhouse gas emissions. The main emitter is road traffic with about 99 percent.



GRETA THUNBERG after the "Fridays for Future" demo, before departing on board the Railjet

Climate protection is defining a new zeitgeist

THE CHANGE is coming – whether you want it or not. Clear words from Greta Thunberg at the UN Climate Conference in New York

The "Fridays for Future" demonstrations started by Greta Thunberg have developed into global movements. Many scientists as well as artists and actors – above all Arnold Schwarzenegger – are supporting the fight against climate change. Even if some people refuse to believe it, climate protection has become an important topic and is also developing a new zeitgeist. Loosely based on Arnold Schwarzenegger's statement "Action", it is about doing something yourself, to get involved now. Whether at work or in private – climate protection is an issue. This applies above all in the transport

sector too – not only with regard to daily mobility but also when taking that well-deserved holiday. How we get from A to B has suddenly become interesting.

Questioning one's own actions

Sometimes, behaviour that harms the environment even becomes an issue amongst friends or within the family. "Flygskam", or "flight-shaming" is a behaviour that has become visibly established, above all in the Scandinavian countries. The trend is moving clearly in the direction of sustainable travel – where the railways have the edge. The CO₂

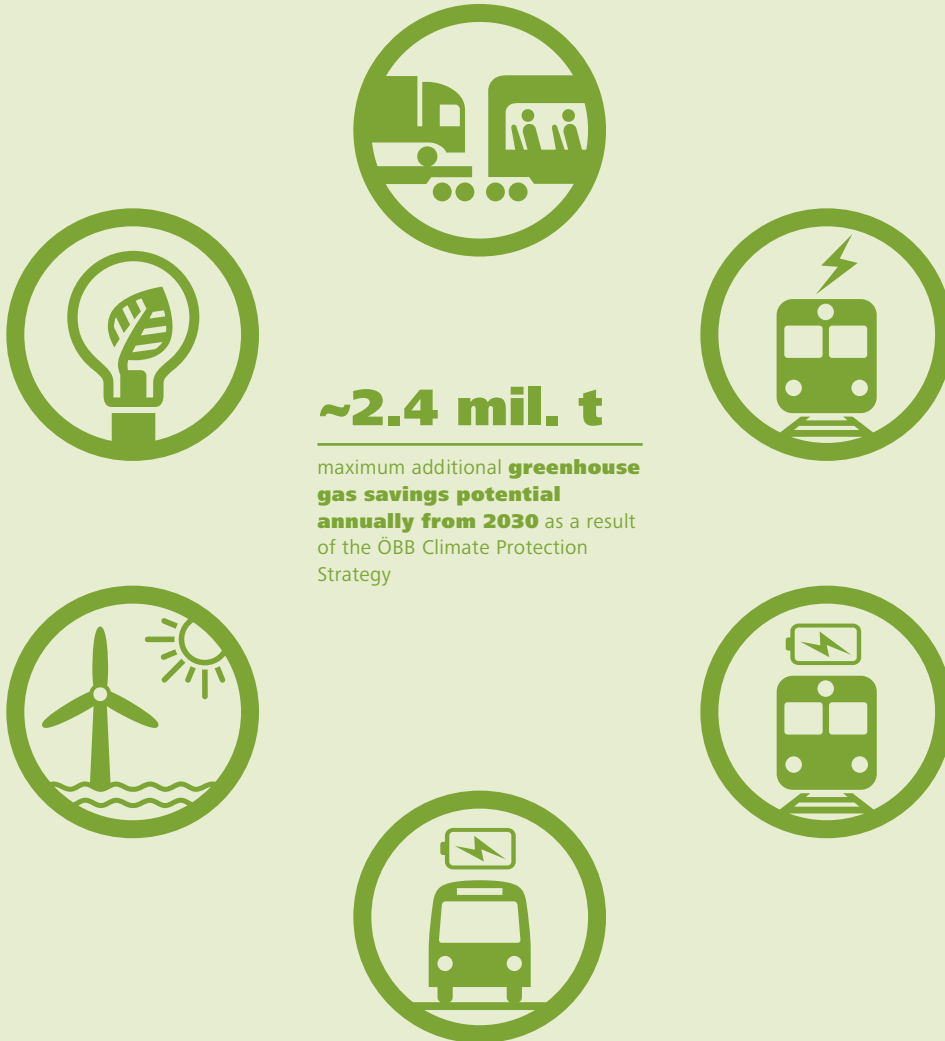
footprint is also being visibly questioned in other sectors of daily life – regardless of whether in food, packaging, production process or services.

Climate protection is an issue

Awareness-raising and the exchange of opinions on the issue of climate change have also reached remarkable proportions. Apart from global climate conferences, there is a boom in discussion and award ceremonies, conferences and events. Austria's biggest international climate protection conference is the "R20 Austrian World Summit". Leading politicians, companies, representatives of civil society, start-ups, players from regions and cities as well as experts come together to strengthen partnerships, swap experiences and ideas and in doing so get sustainable climate protection projects on the rails more quickly. Talking of "rails": ÖBB has, of course, already been a partner of the "Austrian World Summit" for many years and advocates climate-friendly railways. Even Greta Thunberg and her team travelled by climate-friendly train in 2019 and were driven from Vienna main station to the hotel in electric cars from ÖBB's Rail&Drive fleet.

CO₂-NEUTRAL ÖBB MOBILITY SECTOR AS THE FIRST STEP

The ÖBB Climate Protec



tion Strategy 2030

Our ambitions

CLIMATE NEUTRALITY. ÖBB has set itself big targets with its Climate Protection Strategy:

- **CO₂-neutral ÖBB mobility sector** by 2030
(Scope 1 & 2 – excl. buildings)
- **Complete CO₂ neutrality** 2040 to 2050
(Scope 1, 2 & 3 in full)
- **Modal shift** by making the system more attractive and adding more capacity (innovation / technology)

Mobility with responsibility

GREEN ÖBB. ÖBB is already making an important contribution to protecting the climate. This is a contribution it wants to massively increase. The ÖBB Climate Protection Strategy 2030 defines six central levers for making this possible.



GREEN. Recapturing the CO₂ saved by the mobility services of ÖBB would

ÖBB is Austria's biggest climate protection company. Through its transport services with rail and bus, it prevented around 4.1 million tonnes of greenhouse gas emissions from being released into Austria's environment in 2017. If all the people and goods carried by ÖBB in 2017 had covered the same distance in cars and lorries, that would have meant an additional 4.1 million tonnes of CO₂ being released into Austria's environment. This clearly shows that ÖBB is making a not inconsiderable contribution to protecting the climate in Austria with its mobility services. But it's still nowhere near enough. In order for Austria to reach its promised climate protection targets, a further 8 million or tonnes of CO₂ will have to be saved by 2030 in the transport sector alone.

So if ÖBB were to double its transport services by 2030, half of the difference needed to achieve the target would be covered by the Austrian mobility sector. What looks so simple at first glance requires a plethora of measures and, of course, investments – for example, in infrastructure, rolling stock, technology and much more besides.

Better to invest than compensate

In other words, there will be costs incurred. However, not investing will probably cost considerably more. If Austria fails to reach its CO₂ targets, many experts believe it will be faced with compensation payments running to several billion euros. If we do absolutely nothing, CO₂ emissions will certainly not get any less

by 2030. "So it's better to invest in expanding the railways and public transport than to make high compensation payments," says Herbert Minarik, Climate Protection Officer at ÖBB.

Investing in rail and bus creates the

"It's better to invest in expanding the railways and public transport than to make high compensation payments."

HERBERT MINARIK, ÖBB-HOLDING AG





require a forest bigger than Vorarlberg

realistic chance of being able to save a large quantity of CO₂ emissions in the mobility sector. And, an investment in the railways also has the positive additional effect of being an investment in Austria's economy. Professionally recognised studies have since impressively demonstrated this. Of the 8 billion euros of value creation in the area of public transport (rail and transport companies), around 5 billion euros are already generated by the services and investments of ÖBB.

Investments in the railways benefit climate protection.

But apart from the additional value added, the central issue is this: each investment in the expansion of the railways and public transport benefits our climate. As the backbone of climate-friendly mobility, ÖBB is conscious of its special responsibility for future generations. Creating sustainable values and "thinking together" about the environment and economic efficiency is the central approach.

To this end, ÖBB has set itself highly ambitious targets with its climate protection strategy: **the mobility sector of ÖBB should be CO₂ neutral by 2030 and**

The background to the ÖBB Climate Protection Strategy

SUPPORTIVE. Accompanying aspects support ÖBB's contribution to climate protection.

For the ÖBB Climate Protection Strategy to have optimal effect, accompanying aspects are just as important as the general objectives and the six central levers. The following involved topics, when optimally coordinated, will have a supportive effect on the further implementation of the Climate Protection Strategy:

Legal developments/basic conditions

Financing/funding

Research and development (innovation)

Procurement/purchasing

Lobbying

Cooperation (e. g. with NGOs)

Communication (internal and external)/**Marketing**

Adjustments to climate change (esp. infrastructure, vehicles)

that of the entire company by 2040/50. The climate protection strategy defines the key issues as the first phase on the journey to 2040/50 and focuses on six central levers.

Electrification. 73 percent of the railway lines are currently electrified. The degree of electrification should be raised to 85 percent by 2030 and to 89 percent by 2035 by means of a multi-stage electrification strategy.

Alternative drives for rail. Over 90 percent of ÖBB's transport services are already operated by rail with electric traction. In the case of branch lines where electrification does not make sense for economic reasons, the diesel fleet should be replaced. The development of alternative drive technologies will be accelerated for this.

Alternative drives for road. Alternative drive technologies will also be advanced in ÖBB's road transport >

sector, at ÖBB Postbus GmbH and for internal transport. It is therefore intended to convert the ÖBB Postbus fleet in stages to electric and hydrogen buses.

Renewable energies. Since July 2018, the electricity for ÖBB's trains has come entirely from sources of renewable energy – since 2019, so has the three-phase electricity for operational facilities such as buildings, workshops and points heating systems. The electricity obtained from renewable energies is the central pillar for the climate advantages of ÖBB. However, it must be remembered that the costs of renewable energies will rise. To continue being able to act independently in the market in the future, ÖBB should further increase its own production of electricity from renewable sources of energy.

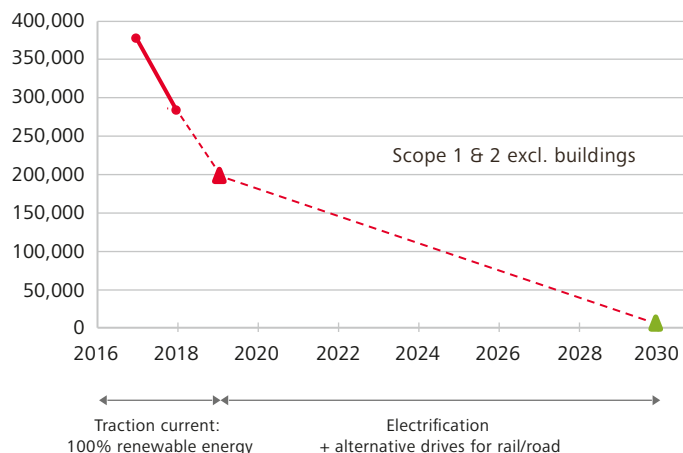
Energy efficiency. Energy that is not used saves money and CO₂. Apart from optimising the operational management of trains, another key aspect of saving energy involves the Austrian locations of ÖBB. The keywords here are: building refurbishment, LED lighting, etc.

Modal shift. Modal shift is the central driver and lever of the ÖBB Climate Protection Strategy. The task is this: how can we shift traffic from air and road to rail? What has to be done to make the conversion attractive, and what are the prerequisites for being able to cope with future capacities?

ÖBB cannot achieve its goal alone. Suitable basic conditions are essential for the success of the ÖBB Climate Protection Strategy 2030.

ÖBB greenhouse gas emissions are falling

Planned development of the entire greenhouse gas emissions of ÖBB's transport sector in Austria (values in tonnes of CO₂eq)*



Additional potentials for saving CO₂ through the ÖBB Climate Protection Strategy

As described above, ÖBB saves Austria about 4.1 million tonnes of greenhouse gas emissions every year with its current transport services. The six levers of the ÖBB Climate Protection Strategy give rise to new, additionally calculated potentials for saving CO₂ which are supported by the Federal Environment Agency. But how high are these?

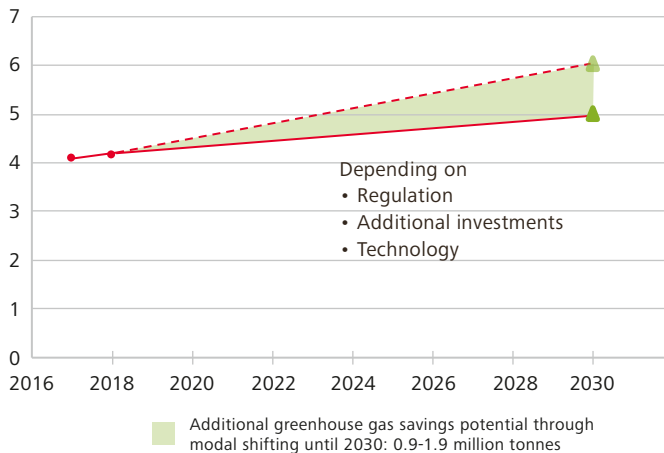
Should the measures of the six levers be fully effective and deliver the intended effects, the ÖBB Climate Protection Strategy could additionally prevent the emission of up to 2.4 million tonnes of greenhouse gases.

The central levers of the ÖBB Climate Protection Strategy are described in detail on the following pages with an indication of the respective potential for saving greenhouse gas emissions and with important supporting initiatives and measures.

Of course, ÖBB cannot do this alone. Therefore, for each lever, requirements are also listed for the important prerequisites/necessities which will be critical for actually being able to achieve the ambitious savings of greenhouse gas emissions –

The savings potential is rising

Greenhouse gas savings potential through modal shift
(rail & bus, values in millions of tonnes of CO₂eq)*



and perhaps even more.

This publication on the ÖBB Climate Protection Strategy is the starting shot for further regular reports on the topic of climate. In the future, ÖBB will publish a climate protection report every two years in order to inform readers about progress and developments regarding the ÖBB Climate Protection Strategy.

* CO₂ equivalents are a unit of measurement for standardising the effect of different greenhouse gases on the climate. In addition to the familiar greenhouse gas of carbon dioxide (CO₂), there are further greenhouse gases such as, for example, methane or nitrous oxide.

Our requirements

FAR-REACHING. What should be done to be able to further increase CO₂ savings in the transport sector

Greening subsidies in the mobility sector – the commuter allowance, for example

Make external costs of road and air traffic transparent – as a first step towards an internalisation of the external costs

Closer linkage of tenders/awards for transport service contracts for buses with funding measures for climate protection in the bus sector (e.g. conversion to alternative drives, innovative feeder concepts)

Harmonise the technical and legal norms and standards in the mobility sector in Europe – in order to harmonise licensing procedures, roll-outs of environmentally friendly mobility technologies and to focus on research and development

Prioritise life-cycle costs over manufacturing costs when awarding funding

Involve environmental, climate and mobility topics in spatial planning and concentrate spatial planning skills at provincial and federal levels

Encourage individuals and companies to change their behaviour: mandatory product or service information about CO₂ impact, also in the transport sector

Use EU funds more efficiently and release them for the retention of existing railway infrastructure – e.g. opening up of the EU fund (CEF)

Create a holistic, Europe-wide expansion strategy for a first-class rail network

Push ahead with high-speed rail connections in Europe

Promote interoperability/harmonisation: removal of operational and technical barriers between national rail networks in Europe

ÖBB CLIMATE PROTECTION STRATEGY 2030 LEVERS

Electrification

44,200 t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of electrification

89%

electrified lines for the ÖBB rail network is the target for 2035; currently, 73% is electrified.

100%

electrified: **the gap in Tyrol was closed in 2019.** All ÖBB railway lines in the province, covering a total distance of 459 kilometres, are now electrified.



>90%

of ÖBB's rail transport services are already **provided on electrified lines today.**

3 phases

to the target in 2035: in order to achieve successful implementation, the electrification of our lines will be done in three phases.

~50 km

of railway line are **electrified annually.**



Green traction current

ELECTRIFICATION. ÖBB wants to electrify the vast majority of its route network by 2035.

Whether electrically powered trains have their fuel tank in a power station or simply run while being constantly refuelled is a matter of perspective. In any case, trains can travel long distances under electricity without having to make refuelling stops or the like. The prerequisite is that the line they are running on is electrified. Therefore, in order to further advance climate protection, ÖBB will continue to expand the electrification of its route network – from 73 percent today to 89 percent by 2035.

Under electricity

ELECTRIFICATION. If ÖBB wants to further improve its CO₂ balance, diesel locomotives will soon have to be a thing of the past. The fundamental prerequisite for this is to continue driving the electrification of the route network forwards.



BRANCH LINES. Branch lines in the ÖBB network will be electrified step by

On the railways, the electricity comes from above. As can currently be seen in the automotive industry, for example, the biggest problem is how sufficient electricity can be stored for longer journeys and quickly put in the “tank”. It’s a problem the railways simply don’t have. The electricity runs above the train in the so-called catenary. That’s an important prerequisite for the railway being able to operate on electricity – which some routes in Austria have been doing for over 100 years.

Today, ÖBB operates more than 90 percent of its train journeys with electric traction – and since 2018 with electricity generated from 100 percent renewable energies. The results are in: ÖBB saves 3.5 million tonnes of CO₂ emissions from entering Austria’s environment with

Even today, 73 percent of the Austrian railway network, which has a total length of around 5,000 kilometres, is already electrified. This puts Austria right at the top of the European tables.

its rail-based mobility services. If ÖBB wants to further increase its positive CO₂ balance, the routes operated on diesel must be reduced and the electrification of the railway lines advanced.

Even today, 73 percent of the Austrian railway network, which has a total length of around 5,000 kilometres, is already electrified. This puts Austria right at the top of the European tables. But ÖBB wants even more. This proportion should be raised in stages – to 85 percent by 2030 and finally to 89 percent by 2035.

Around 50 kilometres of railway line should now be electrified each year in order to reach the desired levels of expansion. That leaves about 11 percent of the route network, or around 500 kilometres, whose electrification is not worthwhile for economic reasons.

In future, environmental drive technologies such as battery-powered trains instead of diesel vehicles should be used here (see page 24 onwards).



step in coming years – around 50 kilometres per year

From coal and steam to electricity from regenerative sources

Electrically powered trains have a long tradition in Austria. The first trains with electric drives were already in use in Austria before 1900 – i.e. at a time when coal and steam were the main propulsion technologies. In 1883, the first electric railway intended for permanent operation was inaugurated between Mödling and Hinterbrühl. The electrification of the main lines then began in grand style in the interwar years. The Tauernbahn was fully electrified in 1935, the first sections of the Western Line were spanned with catenaries in 1940, and the Semmeringbahn followed in 1959. In the mid-1980s, around half of the Austrian railway network was electrified.

Expressed in kilometres, just 215 kilometres of the Austrian route network accepted electric trains in 1918, over 1,000 kilometres were supplied with electricity by 1945, and today the figure is 3,560 kilometres or 73 percent of the entire route network.

Initial measures: electrification

EXPANSION. Measures for the lever of electrification (in accordance with current circumstances)

Electrification programme, phase 0 – in the framework plan for 2018-2023

- Koralmbahn (regional sections in Carinthia), 28 km, by 2023
- Marchegger Ast (Vienna – border with Slovakia), 38 km, by 2022
- Gänserndorf – Marchegg, 18 km, by 2020
- Herzogenburg – Krems, 20 km, by 2025
- Arnoldstein – Hermagor, 31 km, by 2019
- Steindorf bei Straßwalchen – Friedburg, 4 km, by 2022
- Klagenfurt – Weizelsdorf, 12 km, by 2024
- Styrian Eastern Line (Graz to Szentgotthárd), 75 km, by 2027
- Wiener Neustadt – Loipersbach, 25 km, by 2026
- Reutte – border to Schönbichl, 16 km, by 2019
- Linz Stadthafen (City Harbour), 10 km, by 2021

Scheduled: electrification programme, phase 1

An additional 200 to 250 kilometres should be electrified by about 2028. Discussions are currently being held on this with the federal government, the provinces and other stakeholders. Particular consideration is being given to well frequented routes for passenger and freight traffic and to connecting sections of line (“gap closures”).

Electrification programme, phase 2
Additionally, around 285 kilometres are planned for between 2027 and 2035. An exact evaluation of the routes should take place from 2020.

Remaining stock and alternative solutions (e.g. alternative drive concepts), by 2035



TOP OF THE LINE. Catenaries are obviously standard in the new tunnels on high-speed lines

What are the benefits of electrification?

In the future, diesel vehicles will be gradually replaced by electric locomotives. This will reduce the emissions of greenhouse gases (CO₂ and nitrous oxide) and air pollution caused by particulates will decline. But that's not all. This will make the railways not only more sustainable but also more efficient: the procurement and maintenance costs of the vehicles are lower, the vehicles are more available and can be used on more routes in the ÖBB network. Consequently, longer stops to change vehicles will also disappear. And higher traction powers are feasible, especially in freight traffic. Twice the power is possible for the same weight of the vehicles – simply because there is no need to carry diesel fuel along. And there's more. Higher speeds can be achieved, the vehicles accelerate more quickly, journey times are generally reduced. At the same time, electric vehicles are

“In addition to having a positive effect on the climate, electrification also offers value added for the entire railway system and the movement of vehicles.”

VIKTOR PLANK, ASSET MANAGEMENT AND STRATEGIC PLANNING, ÖBB-INFRASTRUKTUR AG

Electrification

44,200 t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of electrification

Our requirements: electrification

EXTENSIVE NATIONWIDE electrification of the railway lines is an important prerequisite for further CO₂ savings in rail traffic.

Accelerated electrification: continuation of the programme for the accelerated electrification of existing routes; this applies in particular to individual routes that are especially important for freight traffic due to higher transport volumes.

EU-wide route electrification: drive this forwards and use renewable energies in the European rail sector

more energy efficient: they feed energy back into the grid when braking and there are synergy effects when supplying power to the air-conditioning system and the heating. “In addition to having a positive effect on the climate, electrification also offers value added for the entire railway system and the movement of vehicles,” summarises Viktor Plank, Asset Management and Strategic Planning, ÖBB-Infrastruktur AG.

The further plan

Before the next routes are electrified, ÖBB-Infrastruktur AG, which is responsible for this, will explore the best sequence on the basis of exacting criteria. For example, TEN and high-speed routes will be electrified as a priority. Another deciding factor is whether the times of the timetable can be optimised or the stability of the timetable can be increased in this way.

The current and future market requirements that passenger and freight traffic have on the individual lines will be checked. And pending reinvestments and other route measures will also be considered on the way to expanding the electrification of the Austrian route network.





THE LAND OF THE RAILWAY. The route network of ÖBB has found its way between the mountain chains of Tyrol – now fully electrified

Tyrol runs 100% on electrical energy

CLOSING THE GAP. Almost 15 kilometres were missing before the entire ÖBB network in Tyrol was electrified. This “gap” in the line was closed during 2019.

The entire route network of ÖBB in the Tyrol region is now electrified. The final gaps were closed in 2019 and all 421 kilometres between Pass Thurn and Arlberg are now operated with 100 percent climate-friendly traction current. For the final gap,

14,390 metres were missing on the Außerfernbahn between Reutte station in Tyrol and the border at Schönbichl.

During the early summer of 2019, around 300 catenary mast foundations were poured along the entire

section of line between Reutte station and the border, and the masts then erected. Next, the approximately 15,900 metre-long “catenary chain” and around 1,000 insulators were installed. The section of line from the border at Schönbichl to Pfronten-Steinach railway station is now being electrified by Deutsche Bahn. And there’s more. For example, the Gailtalbahn from Arnoldstein to Hermagor in Carinthia is being electrified and modernised – after which Carinthia will also be almost entirely electric.



WEISSENSEE. One third of the traction current comes from ÖBB power plants

From power plant to network

NETWORKED. For transport connections to function flawlessly, electrified lines need one thing in particular: namely, their own “powerbank” to suit the specific frequency of the traction current.

Electricity can’t be seen, so we aren’t really aware that it comes in quite different “forms”. At home, 50 Hertz comes out of the power socket. However, this frequency couldn’t move a single locomotive on the Austrian network. Traction current has a frequency of 16.7 Hertz. What looks like two simple numbers makes a big difference. From the power station via the distribution network to the

transformer stations, the entire traction current system has to be set up for this 16.7 Hertz.

Around one-third of the traction current that ÖBB needs to drive its trains is produced by the company itself – in eight of its own power plants. The other two-thirds are supplied from partner power plants and from the public grid. To ensure the frequency is correct before the so-called three-phase current flows

into ÖBB’s own grid, it is transformed into traction current in the seven frequency converter plants. To make things a little more complicated: ÖBB also needs three-phase current – e.g. for its buildings and operational facilities. And a small proportion of this is also generated in two of the company’s own power plants.

Networked throughout the whole of Austria

But back to the traction current.

At the start of electrification, each section was isolated and a dedicated grid constructed with its own hydropower plant. As electrification proceeded, the main lines were also converted to electricity. In this way, the various routes coalesced. The next logical step was to connect the transmission lines and further expand the power plants. Thus, ÖBB’s own power network gradually came about and now covers all of Austria. 110,000 Volt (110 kV) voltage and 2,000 kilometres in length. The network runs mostly above ground. Yet even here, Austria’s topography presents obstacles. For example, below the Alps or wherever else it has to cross mountains, the traction current network dives underground for 85 kilometres. However, the 110 kV supply was a little too strong for propelling trains. At 15 kV, the traction current has an overhead line voltage and

Around one-third of the traction current that ÖBB needs to drive its trains is produced by the company itself – in eight of its own power plants.



can thus be fed into the catenary. The voltage is stepped down in railway substations beforehand. From there, the energy flows via the pickup to the train and, if necessary, return current flows via the rails and the soil to the railway substation. A power network is a sensitive structure that has to be kept constantly in balance. The central control point in Innsbruck is responsible for fault-free, efficient operation of the network and provides control, regulation and monitoring of the traction current supply. From here, the use of the machinery in the power and transformer plants is centrally managed and the load situation in the railway network permanently adjusted and optimised. Two further energy control centres guarantee operational management of the energy supply networks for 15 kV traction current and the 50 Hz power supply.



POWERBANK. Inside the turbine room of the ÖBB power plant at Enzingerboden



CATENARY MASTS are rammed into the ground by machine

The plan is in place

EXPANSION. By 2035, 89 percent of all ÖBB railway lines should be electrified. The next step is to equip another 277 kilometres of railway line with a traction current supply by 2027.

ÖBB takes its role as Austria's biggest climate protection company seriously. That is why it wants to further improve its CO₂ balance. A key measure for achieving this involves expanding the electrification programme. In the coming years, further important railway lines are in ÖBB's upgrade plan. A total of 277 kilometres will be converted to run on electricity. The proportion of electrified routes will thus rise to 79 percent by 2027. By 2020, for example, the 18 kilometre-long Gänserndorf – Marchegg line in Lower Austria should be electrified; conversion of the section of line between Arnoldstein and Hermagor in

Carinthia should be completed over a distance of 31 kilometres by the end of 2019. Diesel vehicles will also be removed from the following sections of the domestic railway network by 2027:

- Koralmbahn regional sections in Carinthia
- Marchegger branch line from Vienna to the Slovakian border
- Herzogenburg – Krems
- Steindorf bei Straßwalchen – Friedburg
- Klagenfurt – Weizelsdorf
- Styrian Eastern Line (Graz to Szentgotthárd)
- Wiener Neustadt – Loipersbach
- Linz Stadthafen (City Harbour)
- Zeltweg – Pöls

ÖBB CLIMATE PROTECTION STRATEGY 2030 LEVERS

Alternative drives for rail

81,600 t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of alternative drives for rail

Innovative

Alternatives in the competition: battery equipment or fuel cells?

2030

It is our goal to **replace the ÖBB diesel fleet with rail vehicles with alternative drives** by this date.



~400

diesel vehicles should be **replaced** to achieve the CO₂ savings potential.

~32 mil.

litres of diesel should be saved from 2030 onwards.

2019

The prototype train **Cityjet eco with electric hybrid battery drive** has been undergoing trials in passenger operations since September 2019. The first tests will run until March 2020.



il

Practical tests

ALL CHANGE. In railway transport, new technologies are being tested for the alternative drives for rail.

From the Cityjet eco, which is currently undergoing real-time trials, to the use of hydrogen-powered trains and the conversion of shunting locomotives to the hydrogen drive: ÖBB is focusing on converting to alternative drives for rail in a variety of projects. The transport sector should finally be completely CO₂ neutral by 2030. And on those lines for which electrification is not possible or not practical, battery or hydrogen-powered trains could be the options for the future.

Full steam ahead for green energy

OUT WITH DIESEL. To achieve the target of being CO₂ neutral in the transport sector by 2030, the conversion to alternative drives for rail is imperative. Test projects are currently investigating which technologies are best suited to this.

The targets have been set very high. By 2030, ÖBB wants to be completely CO₂ neutral in the transport sector; by then, amongst other measures, the use of diesel should have ceased completely as a drive type. Around 90 percent of passenger transport services are already operated with electric traction; around three-quarters of the entire ÖBB network are already electrified – the figure should be 85 percent by 2030.

However, there are routes on which electrification is not possible or practical for technical and economic reasons – for these, efforts will now be made to convert to clean energy.

“The railways have been unbeatably climate-friendly in their energy efficiency for over 180 years. The successful model of the railways has more of a future today than ever before – however else can we bring about the mobility and climate revolution.”

MICHAELA HUBER, CEO ÖBB-PERSONENVERKEHR AG



PILOT PROJECT. When the Cityjet eco enters a non-electrified section of

This means there will be a conversion to alternative types of rail drives in the coming years. A variety of practical projects are currently testing which option is viable for future use. This involves not only looking at the energy source used but also assessing the entire value chain for the use of alternative drives.

Specific applications in rail transport

In this regard, ÖBB is going down several tracks, so to speak, and wants to spend the next few years testing out the technologies which have the greatest potential for specific applications in rail transport. Above all, two technologies are in the race: on the one hand, battery trains (electric vehicles with an electric hybrid battery drive); on the other, hydrogen trains, which draw their energy from fuel cells. The latter represent a foray into new technological territory. The comparison with the first use of diesel locomotives around 150 years ago springs to mind – then, too,





track, it uses its electric hybrid battery drive

a technology was trialled that changed rail transport entirely in the years that followed. Hydrogen could, for example, be recommended for longer routes for which battery-powered trains are unsuitable.

Up to 80 kilometres

Both of these technologies must generally prove themselves suitable for use on those branch lines that are unsuitable for electrification. It is therefore important, especially in passenger transport, that highly regular operation is possible, in other words that there is, for example, no loss of speed. The minimum distance requirement for trains with an alternative drive is 80 kilometres. Only one branch line in Austria is longer: the Aspangbahn from Vienna via Wiener Neustadt to Fehring, for which a separate solution will be needed. Freight transport has different requirements from passenger transport. Alternative drives are of interest here, especially for shunting and the so-called “last mile” – including on those sections of line for which there can be no catenary because the vehicles have to be loaded from above.



Initial measures: alternative drives for rail

STEP BY STEP. Measures for the lever of alternative drives for rail (in accordance with current circumstances)

Greentrain (study). Evaluation of the use of alternative drives in passenger transport for replacement of the entire passenger transport diesel fleet, completed in 2018

HyTrail (study). Hydrogen – possible applications in the railway infrastructure, completed in 2019

Cityjet eco. Trialling of the Desiro ML with electric hybrid battery drive (pilot project), by 2020

Replacement of the 1063/64 series. Purchase of a new battery-pantograph hybrid shunting locomotive as a replacement for the BR 1063/64, under evaluation

Hydrogen drives for rail. Testing of potential applications, by 2020

Budapest Bilk. Leasing of two hybrid shunting locomotives for Budapest Bilk, by 2021

Conversion of 2068 HyRail series. Conversion to hybrid shunting locomotives, under evaluation

Research & development. ÖBB is engaged in a wide range of research projects on the topic of alternative drives



BRIDGING. When the Cityjet eco enters an electrified section of track, the “battery” is charged up again

Receptive to all results

Important: as far as alternative drives for rail vehicles are concerned, ÖBB wants to be totally receptive to the results. Thus, there are no preconceptions about which drive will be suitable in practice. A decision will then have to be taken at system level with regard to alternative drives for rail. Individual workshops will also have to be prepared and equipped accordingly, based on the respective technologies.

There are three projects in particular which are exemplary for the journey towards clean energy. The first is the Cityjet eco, which will put its suitability as a battery-powered train (with electric hybrid battery drive) for passenger transport to the test in a one-year trial run. ÖBB is additionally evaluating the trial use of hydrogen trains for passenger transport. And finally, the planned pilot conversion of existing diesel shunting

There are two technologies in the race: battery trains – i.e. electric vehicles with an additional battery system – and hydrogen trains that draw energy from fuel cells.

81,600 t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of alternative drives for rail

Our requirements: alternative drives for rail

MODERNISATION. For rail transport to become CO₂-free, the diesel drive must give way to modern technologies in the near future.

Use of alternative drive technologies (e. g. battery or hydrogen drives) on the basis of available technological possibilities – wherever the electrification of routes would not be efficient for reasons of economy

Significant incentives for the further development and wide-scale use of low-CO₂ technologies (battery or hydrogen drives, ...) should be put in place.

Investment grants for hydrogen technologies: the production of green hydrogen and the use of hydrogen technologies in the mobility sector are currently still associated with disproportionately high costs compared to conventional technologies. Nevertheless, investment grants are needed as a financial incentive to drive the conversion to this technology forwards.

locomotives to hybrid drive with hydrogen will rely on the green wave in freight transport, too.

All in all, the use of alternative drives is an important measure for reducing CO₂ emissions in the transport sector.



HYDROGEN SHUNTING LOCOMOTIVES should in practice indicate the kind of future this technology could have in the railway sector

Clean shunting

RESEARCH PROJECT. The conversion of shunting locomotives to the hydrogen drive will also set the points towards clean energy in freight transport.

The shunting diesel locomotives of series 2068 have been tirelessly in use since the beginning of the 1990s. Under the nickname “whisper locomotives”, which they were given due to the relatively low-noise engine, they are a familiar sight at large railway stations in Austria. And now they are to form the basis

for one of the research projects involving ÖBB. This one concerns the conversion to a fuel cell hybrid vehicle. The electricity needed to propel the vehicle on non-electrified routes should come partly from batteries and partly from fuel cells. For the latter, hydrogen and oxygen are converted into electrical energy.

These hydrogen shunting locomotives should in practice indicate the kind of future this technology could have in the railway sector. Here, too, the collaboration with research and industry is important, as this is the only way to obtain valid data and findings. Emission-free hybrid locomotives could therefore replace the old 2068 series units in the very near future, should the project prove practicable. Shunting can therefore proceed on a more environmentally friendly basis.



CLEAN. A "battery" makes it possible for the Cityjet eco to also operate with electricity on non-electrified routes

Train with battery

LOCAL TRANSPORT. The Cityjet eco is currently being trialled in a test project – the results will show whether the train can prove successful with an electric hybrid battery drive.

Electric instead of diesel: this motto applies for passenger transport – and one project is very important in this respect. The aim is to gather important experiences of how the train functions under practical conditions.

We're talking about the Cityjet eco – a battery-powered train that is being trialled in partnership with Siemens and is currently being tested in passenger operations.

Specifically, this special train has an electric hybrid battery drive. This means that if it is not running on an electrified line, the energy comes from the installed lithium-titanium batteries, which are able to supply the necessary charging current at a moment's notice.

These batteries are charged on lines with a catenary. They should last for a total of around 15 years, which would be of interest for practical

use – in theory, a replacement would only be necessary once.

Reliability in extreme weather conditions

The background: while locomotives with additional battery equipment have been in use on the last mile in freight transport for a number of years now, quite different challenges have to be overcome in passenger transport. The goal is to cover longer distances and guarantee a high degree of reliability in extreme weather conditions. Particular attention will therefore be paid to how the Cityjet eco behaves in summer and in winter.

After all, the train has to operate at plus 35 degrees as well as at minus 20 degrees – comfort must remain the same for passengers at all times. The Cityjet eco has therefore been operating in Austria for a year now. It is the only way to assess

The Cityjet eco will in future be an sustainable alternative to the use of diesel vehicles on routes that are not scheduled for electrification.



whether it is suitable for use on the non-electrified routes.

Test project for a year

A range of 80 kilometres is required. This distance would – with the exception a single branch line – be sufficient for being able to dispense with diesel as a fuel on such routes and to converting to alternative drives such as batteries. This will become evident after the test project comes to an end in a year's time.



HYDROGEN. Initial pilot projects form the basis for further steps

Hydrogen as an alternative

EXPLORATORY PROJECT. Hydrogen drives have many advantages.

It is now being examined in practice how their use could pan out in passenger transport.

Hydrogen is considered to be another highly promising technology for rail transport – hence an exploratory project on the possible use of a hydrogen-powered train for passenger transport. In such trains, a fuel cell uses hydrogen to generate the necessary electricity, which is then stored. The train is subsequently propelled by electric motors, which means it can operate entirely emission-free on routes without a catenary. It doesn't get any greener than this.

structure, such as for refuelling along the way. This supply network must be considered accordingly when assessing the practicability of hydrogen technology. Since 2018, rail vehicles with such technology have been undergoing practical trials in a number of countries and are on the threshold of production readiness. For this reason, ÖBB is also following developments in the industry very closely. Industrial partners should therefore be suitably motivated to participate in hydrogen projects for the railways. ÖBB wants to focus more on this topic because of its high level of relevance for climate protection in Austria.

Checking practicability

It should be borne in mind that such trains, unlike battery-powered trains, need a corresponding infra-



A RANGE OF UP TO 80 KILOMETRES
to be able to operate on (almost) all routes

ÖBB CLIMATE PROTECTION STRATEGY 2030 LEVERS

Alternative drives for ro

162,500 t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of alternative drives for road

2030

The alternative drives should be extensively advanced for the **in-house ÖBB fleet** by this date.

Vision

ÖBB-Postbus: **conversion of the bus fleet** to electric or hydrogen buses (if basic conditions are in place)



2018

The first test drive of an **ÖBB hydrogen bus** was completed with success.

EU

The **Clean Vehicles Directive** of the EU points the way.

~46 mil.

litres of diesel per year – the big **savings potential** at ÖBB-Postbus



ad

Alternatives on the move

POTENTIAL. Alternative drive technologies on the road: The ÖBB Postbuses and Rail&Drive offer great resources.

The first electric buses for ÖBB-Postbus GmbH will be in regular use by the end of 2019. However, that is just the start. In the long term, ÖBB-Postbus wants to convert the entire bus fleet to alternative drives – i.e. to battery-operated electric and hydrogen buses. Around 140,000 tonnes of CO₂ could be saved each year in this way. A continuously growing range of electric cars in the Rail&Drive fleet and in the internal fleet of ÖBB as well as the expansion of the electric charging point infrastructure are ensuring that the low-emission mobility chain comes full circle.

The green alternative on the road

GREEN DRIVES. On the way to a green future, the aim is to get alternative drive technologies rolling on the road, too. ÖBB-Postbus and the in-house fleet along with the Rail&Drive fleet offer lots of possibilities here.



FILLING UP WITH ELECTRICITY. With cooperation partner SMATRICS, 50

In order to achieve the national and EU stipulations on air quality and limiting emissions, there is no getting around alternative forms of drive – they are an important element for implementing the Paris Agreement on the world’s climate. The EU’s Clean Vehicles Directive also stipulates that 45 percent of all purchased buses must be “clean” vehicles by 2025; the target is 60 percent by 2030.

Two different drive technologies are under consideration: battery-powered and hydrogen-powered buses. But this is not a decision that favours one technology over the other. Which of the two is better suited depends on the area of use. Thus electric buses in urban transport or on shorter routes are a practical alternative, while hydrogen buses can do well on

cross-country routes due to their operating range of up to 450 kilometres.

What both drives have in common: they are essentially emission-free to operate and are also good for our climate when using electricity from renewable energies. Another advantage is the low level of noise they emit. Today, the Postbus fleet has around 2,300 buses, which cover some 122.5 million kilometres per year. From an operational perspective alone, the complete conversion of the bus fleet could save up to 140,000 tonnes of CO₂ emissions per year. When it comes to green drive technologies, ÖBB-Postbus GmbH is a pioneer on the Austrian bus market. For example, the first hydrogen bus took to Austria’s roads in October 2018 on a route operated by Vienna Airport Lines. The three-week test was met with a very positive response.

A second pilot run in August 2019 in Graz and Klagenfurt also passed off successfully, both for the media attention it generated and for the operational results. While hydrogen buses in Austria are still in the test phase, ÖBB-Postbus GmbH was able

In the long term, ÖBB-Postbus wants to convert its entire bus fleet to alternative drives. The complete conversion of the bus fleet could save up to 140,000 tonnes of CO₂ per year.



e-charging points have so far been put into operation at Park&Ride facilities

to put the first battery-operated electric bus into regular operation this year. The E-Citybus in Judenburg, with room for 27 people, has been in use since this summer and another E-Citybus has already been ordered for the municipality of Wolfsberg. The first four 12 metre-long electric buses in Vorarlberg should enter into scheduled service in 2020.

Green down to the last mile

However, ÖBB-Postbus cannot improve the world of drives on the roads on its own. The transport associations, as purchasers of transport services, must therefore go down the same path, as must the industry. There are hardly any manufacturers of electric buses in Europe at present. The market for hydrogen buses is even smaller. Nevertheless, large bus manufacturers have announced their entry into the market for 2020 and 2022, respectively.

Great potential also exists beyond just the Postbus. ÖBB also offers sustainable solutions for private transport on the first and last mile. Both in-house transport and the Rail&Drive car sharing fleet should produce the lowest possible emissions while on the road.



Initial measures: alternative drives for road

NEW TECHNOLOGIES. Measures for the lever of alternative drives for road (in accordance with current circumstances)

Use of electric buses (ÖBB-Postbus GmbH)

Carinthia – Wolfsberg Transport: use of an e-solar city bus based on the Nissan e-NV 200 (K-Bus), vehicle delivery probably in January 2020, contract signed, by 2026

Styria – Judenburg Transport: use of an e-solar city bus based on the Nissan e-NV 200 (K-Bus), commissioned on 29 August 2019, by 2022

Vorarlberg – Upper Rhine Valley: use of four battery-operated 12 metre-long electric buses from 2020, option to expand to up to 20 buses, by 2026

Use of hydrogen buses (ÖBB-Postbus GmbH)

Trial run of a hydrogen fuel cell-operated bus on the routes of **Vienna Airport Lines (VAL)**, by 2018

Styria / Carinthia: Trial run of a hydrogen bus in Styria (Graz) and in Carinthia (Klagenfurt), by 2019

Vienna: Planned conversion of VAL's fleet of diesel buses to hydrogen buses, 15 buses, earliest-possible implementation from 2021/22, financing still outstanding

Burgenland – North Burgenland: planned conversion of 15 diesel buses to hydrogen buses for Neusiedl district, earliest-possible implementation from 2021/22, financing still outstanding

In-house fleet (ÖBB-Infrastruktur AG)

CO₂-neutral mobility offering through the **mobility linking of rail and e-carsharing**, by 2020

Procurement of electric vehicles: increase in the proportion of electric vehicles to 10% of the car fleet, by 2021

Renewal of the fleet of existing vehicles: goal is the increased use of vehicles with state-of-the-art engine technology and of electric vehicles, by 2030.



ON QUIET TYRES. In 2020, a total of six electric buses should be plying Austria roads for ÖBB-Postbus GmbH

50 e-charging points at Park&Ride facilities

The total number of electric vehicles will be increased to 50 by the end of 2019. The majority of these, all electric cars of the newest generation, will then be available for Rail&Drive customers at 12 locations across the whole of Austria. This will offer an environmentally friendly solution for the journey to or from the railway station. And because these electric cars also need the necessary charging points, ÖBB expanded its e-mobility services last year and is working on growing the infrastructure. Together with cooperation partner SMAT-RICS, 43 e-charging points have so far been opened at Park&Ride facilities and at railway stations, with the number set to grow to 50 by the end of 2019. An important step for closing the mobility chain a little more.

Fifty electric cars of the newest generation will be available at the end of 2019 for Rail&Drive customers at 12 locations across the whole of Austria.

162,500 t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of alternative drives for road

Our requirements: alternative drives for road

RIGHT ACROSS THE COUNTRY. Without the bus, there would be no public transport in many regions. Yet here, too, the diesel engine will soon have outlived its purpose.

Nationwide commitment to the use and funding of the conversion to electric and hydrogen buses in implementation of the Clean Vehicles Directive. A focus on technology should be established for urban and regional bus services on the basis of objective and economic criteria.

Infrastructure roll-out plan: in order to ensure a coordinated approach to implementing the Clean Vehicles Directive across Austria and the mobility revolution in public bus transport, an Austria-wide roll-out plan is needed at federal and provincial level.

Funding package for alternative drives: in order to speed up the conversion to climate-friendly buses, the additional costs for purchasing and operating these buses should be considered or funded in tender exercises.



READY FOR USE. The battery-operated buses have room for 80 passengers and a range of up to 240 kilometres

Electric buses hit the road

OVER LAND. Each bus with an electric drive enables annual CO₂ savings of 110 tonnes.

The first electric bus, an E-Citybus from Austrian manufacturer Kutschenits, has been on the road with ÖBB-Postbus GmbH in Austria, in the Styrian town of Judenburg. The next bus has already been ordered for Wolfsberg in the Lavanttal valley.

About four 12 metre-long electric buses should enter into regular

use in the Upper Rhine Valley in Vorarlberg in 2020. According to the framework agreement, they could be joined by a further 16 in the coming years.

Each of these 12 metre-long battery-operated buses has room for 80 passengers and saves around 110 tonnes of CO₂ per year. Each bus has a range of about 240 kilo-

metres before it needs charging. Charging is done overnight or along the route, if necessary. The actual range depends on many factors. Apart from the power source, the range is affected by the load (full/empty), the topography, the speed and the temperature (heating/air-conditioning).

The erection of individual charging points for battery-operated buses no longer poses any problem. A total of four charging points have been installed at the transport hub in Feldkirch.



E-FILLING STATION. The ÖBB charging network is being expanded as required. New locations are being constantly evaluated

Travel and charge

ELECTRIC CHARGING POINTS. ÖBB currently operates 50 e-filling stations with over 100 charging points – and the number is growing rapidly.

Environmentally friendly rail meets environmentally friendly private transport. Since the opening of the first pilot locations for e-filling stations, the charging network of ÖBB has been constantly expanded with its partner SMATRICS. By the end of 2019, a total of 50 e-filling stations will be in operation in a network with over 100 charging points. On the one hand, this goes a good way to closing the mobility chain. On the other, it makes Austria's transport sector more environmentally friendly overall, because the

e-filling stations are supplied with electricity generated 100 percent from renewable sources of energy.

ÖBB charging card

The customers of ÖBB are benefiting enormously from the expansion of the e-charging infrastructure at railway stations: they travel in comfort on the train while their e-car charges up. And to ensure this really is always possible, holders of an ÖBB charging card can also fill up with electricity in other networks via roaming. Around 85 percent, and

thus the majority of the Austrian e-charging infrastructure, can be used with the ÖBB cards.

New locations

Attention was paid to this even before the expansion got under way and the operators undertook to collaborate with other providers at the tender stage. This allows charging points of the Austrian Federal Association for Electric Mobility – Bundesverband Elektromobilität in Österreich (BEÖ) –, which has a market share of around 70 percent, to also be used like those of SMATRICS, which cover about 15 percent of the market. Together, that's over 3,500 charging points across the whole of Austria. The ÖBB charging network will then be expanded further as required. New locations are being constantly evaluated and extended in the course of conversion and expansion measures.

Around 85 percent, and thus the majority of the Austrian e-charging infrastructure, can be used with the ÖBB charging card.

E-fleet for operations

FLEET. The CO₂ emissions of the internal fleet should be reduced through a package of measures.

The internal fleet of ÖBB consists of 1,237 utility vehicles and 2,795 cars, of which 520 are car sharing vehicles. In addition to this are all road vehicles used for the construction and maintenance of railway tracks, railway stations, stops and other facilities. "The fleet is being constantly converted to electric vehicles," says Alexander Klug, head of Fleet Management. By the end of 2019, the number of electric vehicles should rise to 50, and to 100 by the end of 2020. "We want to continuously reduce the average consumption of our fleet. Compared to 2011, we now consume about 0.75 litres less per 100 kilometres. When you consider that our vehicles do about 85 million kilometres a year, that's a significant success," says Klug.



CONVERSION. ÖBB wants to have 100 electric vehicles in its fleet in 2020



VIENNA AIRPORT LINES Fleet being trialled with hydrogen drive

First test runs

HYDROGEN BUSES. The test run has gone well and work is now being done on production readiness and the necessary infrastructure.

While battery-powered buses are ideally suited for use over shorter distances, hydrogen buses can also be used for longer ranges. A bus powered by hydrogen fuel cells was successfully trialled at Vienna Airport Lines for the first time in October 2018. Another trial run took place in city traffic in Graz in August and September 2019, and there was a one-day presentation trip in Klagenfurt. But there are hurdles to overcome in this area, too. On the one hand, the situation on the vehicle market for hydrogen-powered buses is currently tight – there are not enough vehicles with market production readiness to operate a fleet of buses at the moment.

Sufficient availability is expected from 2020 at the earliest. Experts from the Postbus engineering division have also voiced their doubts about the installation of hydrogen filling stations. As they see it, at least two years should be set aside for the process – from planning, submission and approval to commissioning. And finally, there's the question of supplying the hydrogen. Making hydrogen will need investments in electrolysis plants. Unlike electricity, hydrogen can also be stored and thus, for example, any excess energy from wind turbines can be used.

ÖBB CLIMATE PROTECTION STRATEGY 2030 LEVERS

Renewable energy

164,100 t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of renewable energy

2.8

football pitches (2 ha); that's the size of our first photovoltaic system in Wilfleinsdorf, Lower Austria.

100%

traction current (16.7 Hz) from renewable energies

since July 2018: a big step towards CO₂ neutrality in ÖBB rail transport.



100%

three-phase electricity (50 Hz range) from renewable energy: all railway stations, offices, workshops and container cranes have been supplied with this since May 2019.

8

hydropower plants are operated by ÖBB: the company therefore produces around one-third of the required traction current itself.

40%

own generation of renewable energies is the long-term goal: ÖBB wants to be less dependent on the market. **Advancing photovoltaics and wind power**



Climate-friendly electricity

ENERGY SOURCES. The use of renewable energy to generate electricity is being expanded further at ÖBB.

Renewable energy is an important part of the climate protection strategy for ÖBB. With the expansion of existing and the construction of new plants in Austria, the in-house generation of green electricity is now being consistently advanced. Which technologies and locations are especially well suited is being closely examined in a range of projects: in terms of photovoltaics, this is being done on the roof of the Auhof frequency converter and at selected bike shelters, amongst other places. The potential of wind power is also being tested in practice.

Even greener railways

WITHOUT FOSSIL FUELS. 100 percent traction current from renewable energy sources has been a reality since 2018. The proportion of in-house generation is now being expanded further – unusual methods are also being examined in pilot projects.

Since 2018, all of ÖBB's trains have been powered exclusively with clean energy – that was a milestone for climate protection in Austria. Before that, 92 percent already came from renewable sources. The fact that traction current is generated only from the energy sources of hydropower, solar and wind nowadays is another important sign for the country. Ultimately, greenhouse gas emissions in Austria have fallen only slightly in recent years and the big targets of a significant reduction are still a long way off. ÖBB on the other hand prevents around 3.5 million tonnes of harmful carbon dioxide from being emitted by rail transport thanks to its climate protection strategy – and every single customer can therefore proud-

“About one-third of the traction current comes from our eight hydropower plants at present. In the future, we want to further expand the in-house generation of traction current and increase it to 40 percent.” **JOHANN PLUY, MEMBER OF THE BOARD OF ÖBB-INFRASTRUKTUR AG**



THE RAILWAYS are an important piece of the puzzle for clean mobility – all the

ly assert that they are doing their bit to protect the climate. The railways are generally an important piece of the puzzle for clean mobility – all the more so, of course, when the electricity for operating the vehicles comes from renewable sources.

Expanding in-house generation

Of course, the train bound for renewable energy is still a long way from reaching its destination as far as ÖBB is concerned. Efforts continue to be made in various areas to become even more climate friendly. “We are continuing to drive the in-house generation of clean electricity forwards with the expansion of existing and the construction of new plants,” says Georg Pöpl, Rail System Division and Head of Energy Systems Management of ÖBB-Infrastruktur AG.

But not only trains run on 100 percent electricity from renewable energy; since 2019, operational facilities such as buildings, workshops and point heaters have been supplied solely with electricity from





more so when the electricity needed comes from renewable sources

regenerative energy sources. ÖBB's need for traction current in Austria is currently about 1,600 GWh a year, one-third of which is generated by the company's eight hydropower plants (Braz, Spullersee, Flupmes, Obervellach as well as the Stubachtal group with Enzingerboden, Schneiderau, Uttendorf I and Uttendorf II); a ninth – the first pumped storage power plant – is at the planning stage. One-quarter comes from the hydropower plants of partners, the rest is supplied from the public grid – corresponding certificates are available, proving that the electricity comes from renewable energies.

Evaluation of the technologies

The further expansion of in-house generation is based on three specific pillars: firstly, the optimisation of existing power plant such as, for example, Obervellach and Spullersee; secondly, the increased use of photovoltaics – not only, for example, the plant in Wilfleinsdorf, Lower Austria, but also examination of the potential for further expansion; and thirdly, wind power plants should also be tested in practice for the extent to which they can make a contribution. "We're looking very closely at the advantages offered by the individual technologies,"



Initial measures: renewable energy

REGENERATIVE. Measures for the lever of renewable energy (in accordance with current circumstances)

Conversion of 16.7 Hz traction current

Conversion of traction current to 100% renewable energies, since 2018

Conversion of 50 Hz current

Conversion of three-phase current (50 Hz range) to 100% renewable energies, since 2019

Long-term goal – Increase in in-house production from renewable energy sources

Increase in in-house generation to over 40% – e. g. by means of photovoltaic and wind power plants

Specific projects

Pilot plants on noise protection walls and in open spaces (e. g. railway embankments, decking) – the possibility of fitting buildings with PV plants is also being examined in the area of operational facilities

Auhof frequency converter: photovoltaics (FV) on roof, 16.7 Hz, by 2019

Tullnerfeld: PV on noise protection wall, 16.7 Hz (pilot), completed in 2019

Gatterndorf: PV in open area, 16.7 Hz, by 2020

Kottingneusiedl: PV in open area, 16.7 Hz, by 2020

Ladendorf: PV in open area, 16.7 Hz, by 2020

Bruck an der Leitha/Höflein: wind power, 16.7 Hz, by 2021

Spullersee: optimisation of hydropower plant, 16.7 Hz, by 2022

Obervellach II: optimisation of hydropower plant, 16.7 Hz, by 2023

Mittlern on the Koralmbahn: PV on construction site, by 2024

Tauernmoos: pumped storage power plant, 50 Hz, by 2025

says Georg Pöppl, Railway System, head of Energy Systems Management of ÖBB-Infrastruktur AG. In addition to evaluating the individual projects, a feasibility study is also being carried out, with which the entire development can be observed and assessed. Photovoltaics in particular offer many advantages as well as challenges, says Kuralovics, Railway Systems, Energy Systems Management of ÖBB-Infrastruktur AG. Through the flexible use of new modules, which can be produced in every conceivable form nowadays, there will be more possibilities in the future.

“For example, not only can the solar panels be mounted on roofs but can even serve as the roof, as is the case, for example, in the pilot project involving bike shelters,” says Thomas Huef of ÖBB-Immobilienmanagement GmbH.

They can also be integrated into façades – the new technological alternatives are being monitored closely here in order to be able to adopt them if necessary. Geothermics could also play more of a role to a certain degree, even if only as a supplement to other sources of energy at new and larger railway stations.

European pioneer

“In general, the increase in in-house generation from renewable energy sources continues to play an important role for ÖBB within the scope of the climate protection strategy,” says Georg Pöppl. The further expansion also proves that ÖBB takes its role of pioneer in this area very seriously, not only in Austria but across Europe. And finally, all of this benefits the customers, who can be sure of travelling with clean energy.

“We are continuing to drive the in-house generation of clean electricity with the expansion of existing and the construction of new plants.”

GEORG PÖPPL, ÖBB-INFRASTRUKTUR AG



164,100 t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of renewable energy

Our requirements: renewable energy

FREE OF GREENHOUSE GAS. In the future, ÖBB wants to further expand the use of hydropower, photovoltaics and wind power for the use of energy.

Freeing traction current from the energy levy

Cancelling the domestic electricity tax on self-produced and self-consumed 50 Hz power from all renewable sources of energy (wind power, photovoltaics, hydropower).

Investment subsidies for companies and industrial operations within the scope of the planned amendment of the Renewables Expansion Act in order to provide the best-possible support for using the potential of alternative energy products.

Funding of sector coupling, in order to create synergies between the infrastructures of transport and energy systems and to actively involve public transport in reshaping the energy system. The electricity infrastructure of the Austrian railways is, for example, ideally suited for the integration of renewable energy generation plants.

Funding for the development of further renewable sources, acceleration of electricity storage technologies and of e-fuels (hydrogen, Power-to-X): research and development must play an important role in this. For example, using hydrogen as a connecting link in the energy-related provision, storage and transport chain, etc.



THE PUMPED STORAGE POWER PLANT at Tauernmoos will generate around 460 Gigawatt hours (GWh) of electricity annually

Electricity from the Stubachtal valley

HYDROPOWER. With the new pumped storage power plant at Tauernmoos, the resources of hydropower will be used even better. The facility will deliver clean electricity for the railways from 2026.

Electricity from hydropower plays a big role for Austria and is also an important component of ÖBB's energy strategy. The environmentally friendly in-house production of traction current is now being expanded further. The already approved pumped

storage power plant at Tauernmoos will allow peak loads on the railway power network to be covered even better. The new pumped storage power plant at Tauernmoos – the first of its kind for ÖBB – will generate around 460 Gigawatt hours

(GWh) of electricity annually. This will not only fulfil stringent environmental stipulations. By pumping water uphill to the Weisssee, energy can be stored for those periods in which it is urgently needed – i.e. at times of heavy traffic.

Planning of the tenders for the new power plant in the Stubachtal is currently ongoing; work on converting the infrastructure will then proceed in April 2020. The new power plant should be in full operation in 2026. It will then be the most powerful power plant of ÖBB.



SOLAR POWER. The world's first photovoltaic system for traction in Wilfleinsdorf.

Solar panels for the railways

THE PHOTOVOLTAIC SYSTEM at Wilfleinsdorf has proven itself to be an important element of the ÖBB Climate Protection Strategy and is an international model for rail transport.

Where does the energy for mobility actually come from? Given the victory march of electric drives, that is an important question for many transport operators. After all, what good is a clean drive if the energy does not come from environmentally friendly sources? In the meantime, ÖBB can answer this question with a clear conscience: 100 percent of green traction current from renew-

able energy has been a fact for a year. And an important proportion of this is supplied by the photovoltaic plant at Wilfleinsdorf in Lower Austria. The plant was commissioned in 2015 and has proven itself in practice ever since. Solar panels with a total area of 7,000 square metres have been installed on a site of around 2 hectares on an open-air site to the south of the Wilfleins-

dorf stop. The generate around 1,100 MWh per year – enough to carry 80,000 passengers from Vienna to Salzburg. The south-facing alignment guarantees the best-possible yield.

Straight to the catenary

Operation of the Wilfleinsdorf photovoltaic system is causing a worldwide sensation; after all, it was the first installation of its kind for 16.7 Hertz traction current. With a total of 95 inverters, the DC voltage is converted to the required AC voltage, which is then fed directly into the catenary along the railway line. This means an extremely low loss of energy because the electricity does not have to be transported first, but can be used right at the point of generation. The data collected during operations at Wilfleinsdorf are also important for the planning of future activities in the area of photovoltaics.

With the photovoltaic system in Wilfleinsdorf, ÖBB has not only consistently advanced the expansion of its in-house generation and thus found international recognition but has even won various prizes. One was first place in the "UIC Research & Innovation Award" in 2016 – this competition awards innovations in the European railway industry.

"Not only can solar panels be mounted on roofs but can even serve as the roof, as is the case, for example, in the pilot project involving bike shelters."

THOMAS HUEF, ÖBB-IMMOBILIENMANAGEMENT GMBH





Electricity from above

EFFICIENT. A photovoltaic system is being installed on the frequency inverter in Auhof, Vienna, by the Railway Systems division of ÖBB-Infrastruktur AG.

A photovoltaic system has recently started adorning the Auhof transformer plant in Vienna. The solar modules are mounted on the south-facing side of the machine hall's roof. The modules will have an area of 630 square metres and generate around 99 MWh of electricity annually. Whatever exceeds the location's own needs will be fed into the 15 kV network via existing cable routes.

So how does a traction current photovoltaic system work exactly? The solar plant generates DC voltage, which is converted into AC voltage by an inverter. A transformer then raises the low voltage to the catenary voltage. The electricity can then be fed either into the network for the requirements of the Auhof frequency inverter or into the 15 kV network.



ELECTRICITY-GENERATING frequency inverter in Auhof, Vienna



PHOTOVOLTAIC ELEMENTS serve as the roof of a bike shelter

Harnessing the power of the sun

SOLAR ROOF. As part of the photovoltaic measures, photovoltaic elements are also being tested for bike shelters.

There are many ways that photovoltaic modules can use the power of the sun to generate environmentally friendly energy. One particularly exciting application is currently being trialled as part of the project "Using photovoltaics in the ÖBB Group". The photovoltaic elements serve as the roof of a bike shelter, which means they aren't simply attached to an existing roof but actually form the roof itself and provide protection against rain and other kinds of weather. This project is being managed by ÖBB-Immobilienmanagement GmbH together with the company SOLtechnik. It is concerned not only with electricity generation at the Bike&Ride facilities

but also with the visibility of climate protection and the corresponding measures.

Charging station for e-bikes

The modules themselves also enable use of the sun's energy through reflection on the underside. The necessary inverters are mounted to the construction in a box; performance data are monitored as a source of important data. In the future, this plant could also be used as a charging point for e-bikes and e-scooters.

ÖBB CLIMATE PROTECTION STRATEGY 2030 LEVERS

Energy efficiency

14,500 t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of energy efficiency

9 mil.

kilowatt hours of energy can be saved by replacing 300,000 lorry trips with **conveyor belts during the construction of the Semmering Base Tunnel.**

3

terrawatt hours of energy are needed by ÖBB each year. **Saving energy means reducing costs and CO₂.**



61%

of the total energy needed is used by **ÖBB rail transport.**

~180

gigawatt hours of energy – that's the amount we want to save by 2024.

16

ÖBB has defined flagship projects for saving energy in the coming years.



How we save energy

ENERGY EFFICIENCY. Nothing protects the environment better than energy that isn't needed.

Energy efficiency in all areas has preoccupied ÖBB for years. In a first major energy efficiency programme, 185 Gigawatt hours (GWh) of energy were already saved in 2016 compared to 2011. Since 2017, a group-wide working group has been regularly taking care of further energy efficiency measures. The goal: a further 180 GWh of energy should be saved by 2024, for example through the use of the newest power cars, through recuperation, adaptive train control, intelligent preheating operation and many others.

More power with less energy

ENERGY-SAVING SCHEME. The best energy for the climate is the energy that isn't consumed in the first place. In order to keep the energy requirement as low as possible, a comprehensive energy efficiency programme has been in place at ÖBB for many years.



SAVING ENERGY. In order to keep the energy requirement as low as possible, a

More than 40,000 employees work in the office buildings, workshops and railway stations of the ÖBB Group, over 6,000 trains operate passenger and freight services every day, more than 2,000 Postbuses also provide mobility where the trains don't reach. ÖBB makes people mobile, and that naturally requires bit of energy.

The biggest need internally is traction current and diesel (61%) for rail transport. After this follow the so-called fixed operational facilities (22%) – i.e. all office buildings, railway stations, workshops, as well as technical facilities such as signals and points heaters that operate on electricity. And finally, mobility on the roads also needs energy: 17 percent in total, of which 88 percent flows into the Postbus.

100 percent renewable energy for train operation and operational facilities

Since summer 2018, ÖBB has operated with 100 percent green traction current from renewable energy, and the fixed operational facilities have also been supplied with electricity from renewable energy sources since 2019. Tender documents stipulate that the mix of electricity procured by suppliers must come entirely from regenerative sources.

However, the best electricity for the climate is the electricity that isn't consumed in the first place. In order to keep the energy requirement as low as possible, ÖBB has operated a comprehensive energy efficiency programme for many years. It has thus been possible to keep consumption stable since 2001 – despite increasing transport services.



Ideas with big potential

Numerous measures have been implemented in the course of the energy-saving programme – as a

“We were able to achieve many savings without big financial expense, mainly by implementing smart ideas and organisational changes.”

RUDOLF KURALOVICS, ÖBB-INFRASTRUKTUR AG



comprehensive energy efficiency programme has been in place at ÖBB for years

result, 185 Gigawatt hours of energy were saved in 2016 compared to 2011. One of the most successful measures was the feeding of braking energy back into the catenary.

The optimisation of operational management and locations, e.g. through (thermal) building refurbishments, led to a clear improvement in energy efficiency. "We were able to achieve many savings without big financial expense, mainly by implementing smart ideas and organisational changes," says Energy Manager Rudolf Kuralovics from ÖBB-Infrastruktur AG, Railway Systems, the internal energy service provider of ÖBB.

Saving energy – a perennial issue

However, because energy efficiency is a never-ending story and is negatively impacted by factors such as heatwaves or longer periods of cold weather, a group-wide working group of 10 people was formed as a consequence of the last energy efficiency programme. Since 2017, the colleagues have been at work on identifying and initiating energy-saving measures, which are then also dealt with by the working group. They flow in their entirety into a monitoring system and give

Initial measures: expanding energy

EFFICIENCY. Measures for the lever of energy efficiency (in accordance with current circumstances)

Implementation of ÖBB energy efficiency programme
Flagship projects, by 2024

Pilot of driver advisory system (DAS), by 2020

Double-deck shuttle train (Dosto) - heating mode, by 2022

Talent ECO Drives, by 2020

Railjet occupancy-dependent air-conditioning control system RG01-51, by 2022

Procurement of new electric locomotives for passenger transport, by 2024

Calculation of energy-optimised speed/DAS, by 2020

Taurus software release, by 2020

Traction vehicles capable of energy recovery, by 2024

Adaptive train guidance, by 2023

Driving recommendation with text/SMS, by 2020

Energy-optimised network timetable, by 2022

Vehicle data system, by 2024

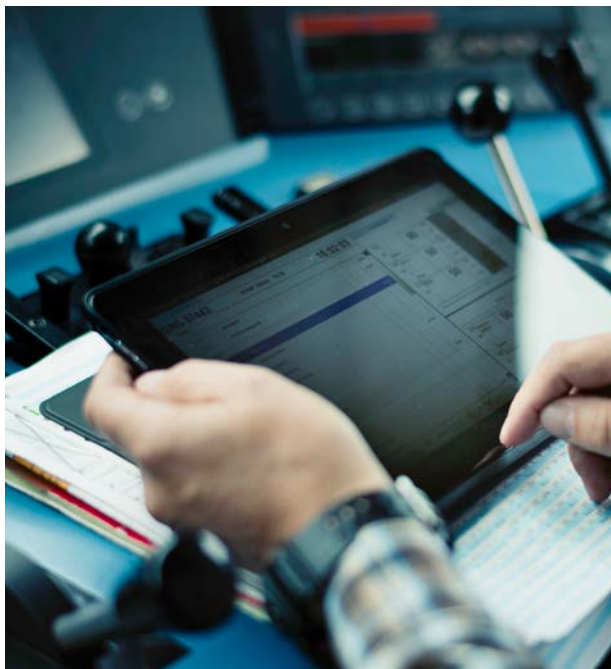
Kledering frequency inverter, by 2021

Energy efficiency at Simmering, St. Pölten, by 2021

an overview of how much energy is saved. In addition, a higher-level committee made up of members of management deals with the topic of energy efficiency and sets corporate targets that are then cascaded to individual areas for distribution and in-depth processing. The current target was also defined in this way: a further 180 Gigawatt hours of energy should be saved across the group by 2024.

Investing in even more thrift

One thing is clear: "Almost everything that was saved at little expense has already been implemented in



Energy efficiency

14,500 t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of energy efficiency

Our requirements: energy efficiency

SAVING ENERGY. The careful use of energy delivers both economical and ecological advantages.

Energy efficiency funding options also made accessible for all public transport providers – above all for new low-CO₂ and energy-efficient technologies

Creating incentive systems for increasing energy efficiency – especially in the area of building refurbishment (e. g. investment grants)

EFFICIENT. Colleagues are working on identifying further energy-saving measures

recent years,” says Cornelia Walch, who is responsible for CSR and sustainable mobility in the area of System Technology and Group Production at ÖBB-Holding. A further increase in energy efficiency is virtually impossible without spending more on resources and making bigger investments. Apart from the procurement of more modern and more powerful fleets, there is also a focus on the investments of ÖBB-Infrastruktur AG in adaptive train guidance as the basis for automated train operation. Further significant savings potentials would also be achieved through shifting traffic from road to rail – although this can only be implemented with political support and national guidelines. The following projects give an overview of the range of measures that are currently delivering a more energy-efficient ÖBB and will continue to do so in the future.

Projects/measures:

1. Adaptive train guidance
2. Procurement of new locomotives
3. Energy recovery
4. Double-deck carriages – warming mode
5. Tunnel-building projects

“When 40,000 employees switch off their computers overnight and make sure that lights aren't left on unnecessarily in our buildings, then we're all doing our bit to increase energy efficiency.”

CORNELIA WALCH, ÖBB-HOLDING AG





BRAKING ENERGY. About 200 million kilowatt hours can be saved every year – the annual requirement of around 50,000 households

Using braking energy in a smart way

RECUPERATION. The energy consumption of a locomotive can be reduced by 25 percent through energy recovery and optimal operation.

Small numbers of locomotives capable of energy recovery were already in use at ÖBB in the 1990s. However, this technology has been used in grand style since the delivery of the Taurus fleet in 2000, since then a total of 429 locomotives have ensured a much reduced need for

energy. In other words, optimal operation can lower consumption by up to 25 percent per train journey. During braking, the drive motors work like generators – and the electricity generated is fed back into the catenary. In total, about 200 million kilowatt hours can be saved this

way every year – the annual requirement of around 50,000 households.

Also without a catenary

All locomotives and traction cars of ÖBB are now fitted with regenerative brakes as standard. And as the Cityjet eco and the planned conversion of the electric shunting locomotives of series 1063 show, battery, hydrogen and hybrid vehicles will in future be able to recover braking energy even on lines without a catenary.



ROCK ON A MOVING BELT saves around 2 million litres of diesel

Conveyor belts instead of lorries

SEMMERING BASE TUNNEL. Another aim during the construction of this major project is to use energy as sensibly as possible and avoid emissions – transport routes are a key factor in this.

The Semmering Base Tunnel is a sustainable investment in the future of rail transport: each tonne of freight that goes by train means around 15 times fewer CO₂ emissions than transporting it by lorry. Emissions should also be avoided during the tunnel's construction. Most of the excavated material from the Semmering Base Tunnel is

removed from the mountain at the so-called "Fröschnitzgraben intermediate access". Between 2016 and 2021, a total of 5.9 million tonnes of rock have to be transported from here to the landfill at Longsgraben. This amount corresponds to almost 300,000 lorry trips, which would consume around 2 million litres of diesel. We say "would" because the

Between 2016 and 2021, a total of 5.9 million tonnes of rock will have to be transported to the landfill at Longsgraben. This amount corresponds to almost 300,000 lorry trips.

use of conveyor belts on this section can save more than 9,000,000 kilowatt hours (kWh) or energy – and thus almost 5,200 tonnes of CO₂. In the portal area at Gloggnitz, too, about 1.92 million tonnes of rock will be removed from the tunnel by conveyor belt between 2017 and 2022. Using conveyor belts here does away with about 64,000 trips by dump truck, saving about 830,000 litres of diesel.

What started out as a 1,000 metre-long conveyor belt is extended by 500 metres each year – in 2022, it will be a full 4,000 metres in length. Apart from saving about 5,000,000 kWh of energy in the indicated period, the environmental effect is also considerable: the conveyor belts in the portal area at Gloggnitz will save 2,200 tonnes of CO₂.

Positive effect

And finally, about 1.32 million tonnes of rock will be removed from the tunnel at the "Göstritz intermediate access" from 2018 to 2021 – also by conveyor belt, of course. This replaces around 41,000 trips by dump truck. The positive effect on the environment amounts to 545 tonnes of saved CO₂. In total, something relatively simple like a conveyor belt can therefore save almost 8,000 tonnes of CO₂ in the construction of the Semmering Base Tunnel.



At a pleasant temperature

THERMOSTAT. Intelligent preheating instead of wasted energy

Since 2018, all double-deck carriages (Dosto) have undergone special treatment during maintenance: new software releases have been loaded into the control car and the hardware wiring has been modified slightly. As a result, the locomotive driver can now activate the so-called "preheating mode" at the press of a button when parking the train. Although the train is still under high voltage, the heating, air-conditioning and ventilation systems are deactivated. Energy is saved and the intense noise of fans emanating from double-deck carriages parked up over night is a thing of the past.

Like with a conventional thermostat, the preheating mode ensures that the temperature inside the train does not drop below a minimum value on frosty winter days. Nothing changes for the passengers with this measure. The heating or cooling system starts up again automatically 120 minutes before departure.



DOSTO. Maintaining the temperature in stand-by mode with low use of energy



OPTIMISING OPERATING PROCEDURES and network capacities, saving costs and energy

Fewer conflicts – less need for energy

ADAPTIVE TRAIN GUIDANCE. Optimisation measures in operations simultaneously improve punctuality and energy efficiency.

The planned adaptive train guidance is a measure for optimising operational management and leads to a reduction in the energy needed to operate a train. It will support stable, punctual and energy-efficient operation by detecting and avoiding conflicts on the line or in railway stations early on.

Optimising capacities

In the first phase, operational recommendations are sent by the dispatcher to the train radio in the locomotive by text message. In this way, the locomotive driver is promptly informed that the train

should proceed at a slower speed through an indicated section of track to avoid braking and energy-intensive acceleration. The second phase will then be about optimising operating procedures. Also necessary is a complex interaction of the different infrastructure systems and operating processes, each of which have to exchange information at different interfaces in real time. In return, operations will become more punctual, the available network capacity will be optimised, costs – and, of course, energy – will be saved.

ÖBB CLIMATE PROTECTION STRATEGY 2030 LEVERS

Modal shift

1.9 mil. t

maximum additional greenhouse gas savings potential annually from 2030 through the lever of modal shifting

4.1 mil.

tonnes of CO₂ are currently being saved by Austria through all of **ÖBB's transport services (rail and bus)**. That's the volume of greenhouse gas emissions that would be produced if the ÖBB transport services were to be replaced by cars and lorries.



50%

of the current difference for hitting targets in the Austrian transport sector could be achieved by **doubling the ÖBB transport services**.

190,000

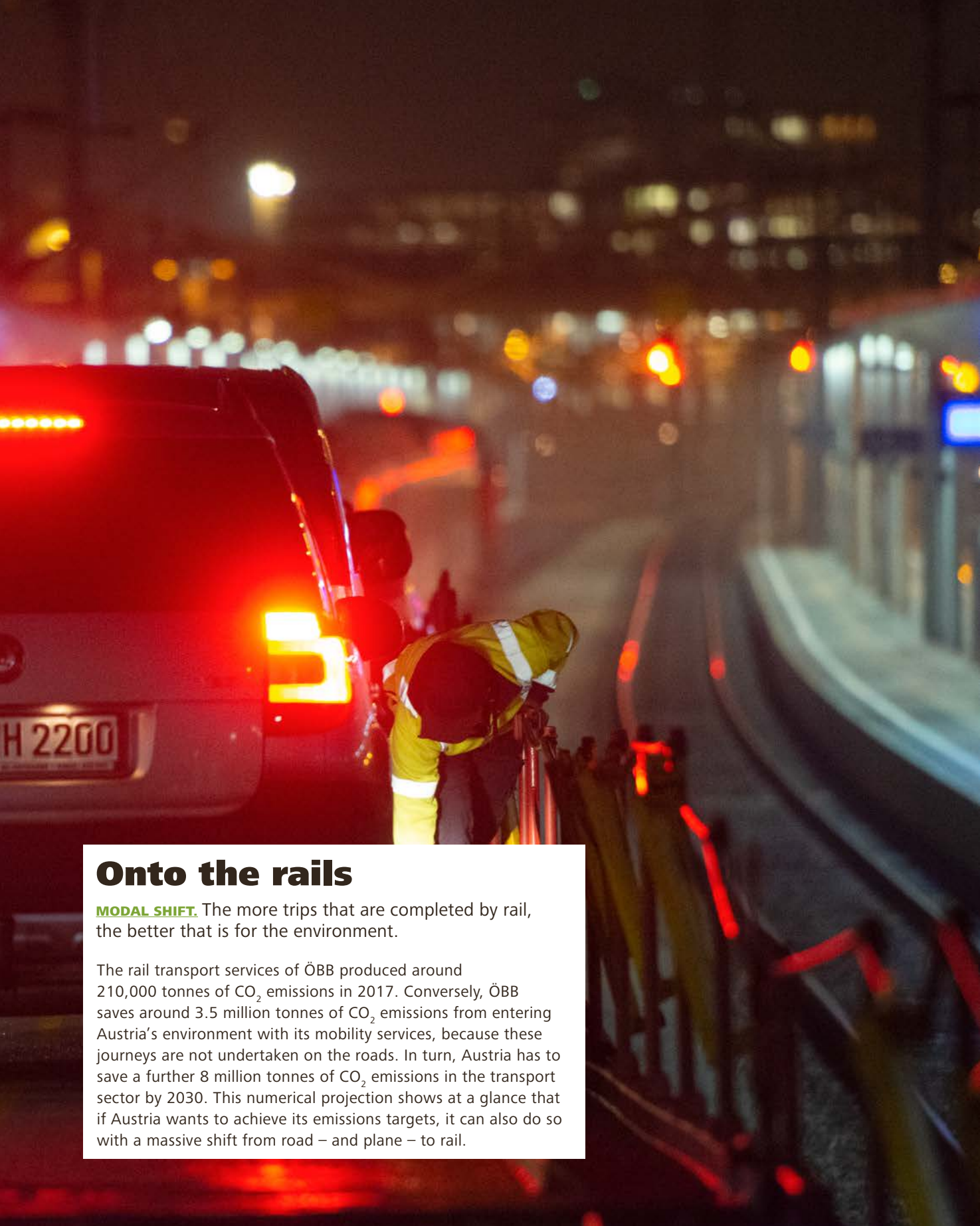
tonnes of CO₂ per year is roughly the volume produced by **flights on the Vienna – Zurich – Vienna** sector alone, which thus emits almost exactly as many greenhouse gases as all ÖBB rail transports combined.

15 times

less CO₂ than a car, 21 times less CO₂ than a lorry, 31 times less CO₂ than a plane – these are the CO₂ advantages of the railways (figures per pkm or tkm in an average comparison).

Expansion

Each investment in the **expansion of the railways and public transport** benefits our climate. The transport sector is part of the climate problem – **the railways are part of the solution**.



Onto the rails

MODAL SHIFT. The more trips that are completed by rail, the better that is for the environment.

The rail transport services of ÖBB produced around 210,000 tonnes of CO₂ emissions in 2017. Conversely, ÖBB saves around 3.5 million tonnes of CO₂ emissions from entering Austria's environment with its mobility services, because these journeys are not undertaken on the roads. In turn, Austria has to save a further 8 million tonnes of CO₂ emissions in the transport sector by 2030. This numerical projection shows at a glance that if Austria wants to achieve its emissions targets, it can also do so with a massive shift from road – and plane – to rail.

Climate-friendly railways

MODAL SHIFT. Moving significantly more traffic onto the rails is the central lever of the ÖBB Climate Protection Strategy. This will require the right incentives – a matter for politicians.



BACK ON TRACK. Shifting more traffic from road to rail is the central lever of

ÖBB saved Austria approximately 4.1 million tonnes of greenhouse gases with its transport services in 2017: around 3.5 million tonnes through rail transport and about 0.6 million tonnes through Postbus services. Austria needs to save a further 8 million tonnes of CO₂ in the transport sector by 2030 in order to achieve the targets of the Paris Climate Agreement and save itself from having to make large compensation payments. The message is clear: each additional shift from road and plane to rail and bus benefits our climate.

Additional modal shifts are therefore the central lever of the ÖBB Climate Protection Strategy. But how can these be achieved?

Each additional shift from road and plane to rail and bus benefits our climate and is therefore the central lever of the ÖBB Climate Protection Strategy.

More railway lines, more trains, suitable incentives

Politicians play a decisive role in the modal shift. Suitable framework conditions and incentives, i.e. fair competition between the modes of transport and true-cost pricing across all modes of transport, are needed – but are scarcely evident in the transport sector. For example, the external costs of road transport are paid by the taxpayer – in future, the polluter-pays principle should apply. True-cost pricing also covers the alignment of financing, funding and subsidy systems to climate-friendly mobility. Mobility that harms the climate must no longer be subsidised. Targeted investments are needed in infrastructure expansion, in new technologies for a “smart” increase in the capacity of the rail system

and in more powerful and more sustainable vehicles. Moreover, environmental, climate and mobility issues must be included in the spatial planning and, for example, the funding and financing designed around climate-friendly mobility concepts.



the ÖBB Climate Protection Strategy

Politicians are also asked to accelerate the expansion of renewable energies and to make them available for fair prices. This is because modal shifting only makes ecological sense when moving to climate-friendly modes of transport. The removal of tax obstacles or environmental levies on traction current generated in-house would help because although the kerosene used in aviation continues to be exempt from tax, the climate-friendly railways have to pay an electricity levy on the energy they generate themselves from hydropower.

Making the railways even more attractive

The railways will also need to be made more attractive. That means even better quality, even easier access to the train services and even more rail transport capacity. The integration of different modes of transport is another important point for shifting traffic. Good multimodal connections that give people quick and easy to access to different modes of transport are a basic prerequisite.

Our key requirement: modal shift

ONTO THE RAILS. Every kilometre by rail is good for the environment.

Passenger transport

Ending **tax privileges** for fuels that damage the climate (diesel, kerosene)

Freight transport

Master plan for "Freight transport in Austria": for optimal linking of transport modes for a sustainable reduction in CO₂ in the transport sector, incl. through the expansion of (multimodal) logistics facilities in Austria/Europe and through the seamless linking of rail, road and waterway

Further development of land-related subsidies: Austria is a model example for the whole of Europe with its land-related subsidies for freight transport by rail. These subsidies have kept the share of rail in overall transport activities at 30 percent, bucking the trend in Europe. The aim now must be to develop this successful Austrian state aid model further.

Infrastructure

Expansion of the rail infrastructure: to further strengthen Austria as a business hub and enable more traffic to be shifted to the railways, the rail infrastructure must continue to be expanded.

Target Network 2025+: the implementation of Target Network 2025+ (or a possibly accelerated implementation) must be ensured so that people can be offered even more attractive public transport services across the whole of Austria.

Target Network 2040: in order to be able to achieve the modal shift necessary for the climate protection targets beyond 2025, even more capacity will be needed in the rail network by 2040, above all for freight and local transport around urban centres. In order to achieve an optimal modal shift from road to rail in the medium and long term, the infrastructure of the future and the further expansion of the supply network must be planned now.

You can find further requirements on the following pages.

More routes – better trains

ONTO THE RAILS. Even more and better connections and comfortable trains should motivate additional passengers to make the switch.

A direct comparison shows that the railways are 15 times more climate-friendly than an average car and as much as 31 times better than flying. These are convincing arguments that clarify how important it is to move as much traffic from road and plane to rail.

ÖBB wants to achieve this above all by expanding integrated mobility and through new, attractive offers. ÖBB has set itself the goal of increasing the total number of passengers from 474 million at present to 500 million using a variety of measures.

Initial measures: modal shift to passenger transport

ÖBB-PERSONENVERKEHR AG. Measures for the lever of modal shift in the area of passenger transport (in accordance with current circumstances)

ÖBB nightjet – further expansion, by 2028

Equipment and load forecast: improved customer convenience in local and long-distance transport, by 2019

Smart journey: development of a post-payment ticketing application as a new feature in the ÖBB Ticketshop app, from 2020

Integrated mobility service: elaboration of a strategy for positioning ÖBB as an integrated mobility provider, by 2019

Conclusion of new buyer contracts in local transport and transport service agreements in long-distance transport (2020-2029), by 2020

New pricing strategy in passenger transport to optimise load factors on trains, by 2020

Multimodal mobility platform – Pathfinder: the goal is to increase ÖBB passenger numbers and modal split, by 2020

TALENT3: implementation of the new fleet in operations, by 2024

Public transport 2022: the goal is the further development of the sales and fare system across all modes of public transport, by 2020

Refurbishment/upgrade of Talent, Desiro and Dosto: 187 locomotives of the Talent fleet (electric) and 60 locomotives of the Desiro fleet (diesel), by 2022

DINO (the innovative local-transport vehicle for the eastern region): defining the basic requirements for the new vehicle series to be purchased, by 2020

DANI (Day and Night): introduction of the new passenger carriages for day and night transport, by 2023

Micro-PT Postbus: pilot project in Carinthia, since 2018, pilot project in Vorarlberg, since 2019. Preparation of further business fields, by 2023

Our requirements: modal shift to passenger transport

SWITCHING. Every kilometre travelled by rail instead of petrol or diesel car delivers further CO₂ savings.

Boosting night train services as a climate-friendly alternative to flying by optimising the basic economic conditions, e. g.: lower infrastructure usage charge for night trains, VAT exemption for night train tickets, special regulations for night trains in respect of passenger rights

Annual public transport ticket: introduction of an annual ticket for public transport based on the Swiss model or extension of the successful ÖBB ÖSTERREICHCARD to all modes of public transport (implementation for participating transport companies with no effect on income)

Uniform fare system for public transport: public transport (rail & bus) should be easier to access. This requires a uniform fare system for public transport and harmonisation of fare conditions or the efficient use of taxpayers' money.

Ending tax privileges for fuels that damage the climate (diesel, kerosene)!

Greening of the commuter allowance through a 50% supplement on the current commuter allowance as a green bonus for commuters who mainly use public transport

Create legal framework conditions for micro-public transport offers for further development of public transport services in municipalities.



AUSTRIA – THE LAND OF THE RAILWAY. Rising passenger numbers confirm an attractive offer

Optimally connected

CONNECTIONS. ÖBB's passenger numbers are growing strongly year by year – and that should continue, not only in local and regional transport but also nationally and on night trains.

In 2018 alone, ÖBB recorded 6 per cent more passengers than in the year before – and the trend remains upwards.

By the time the current transport service agreements expire, the number of kilometres offered by rail could be increased by 15 per cent; 4 million additional train kilometres are planned in 2020 alone.

The new Western Line from Vienna to St. Pölten, with a journey time of just 22 minutes, has led to commuters switching to the train en masse. Compared with 2009, around 80 per cent more passengers use the Western Line today (ÖBB and Western Line together). The same trend can be found at Austria's western

end. Since the introduction of the suburban railway system in Vorarlberg 12 years ago, the passenger numbers of ÖBB have more than doubled – to over 14 million a year. ÖBB is constantly expanding its connections, not only in Austria but also abroad. ÖBB is now the biggest provider of night trains in Europe. 1.4 million travellers use the night train services every year – and the trend is rising. Further destinations in Europe will be added in the future. For example, a Nightjet service to Brussels is being launched in 2020, with other destinations to follow.

Shuttle to the future

CLOSING GAPS. ÖBB-Postbus is also making itself climate-ready and sustainably boosting public transport – such as with the brand-new Postbus Shuttle.

Living in the countryside without a car can become a challenge: shopping, visiting the doctor or getting to work is often too difficult on foot.

ÖBB-Postbus GmbH wants to respond to this with an innovative service: the Postbus Shuttle – a mix of on-request bus and shared taxi. Minibuses operate in accordance with residents' wishes. That means: on request, no fixed timetable, flexible and needs-based like a taxi. Of course, the Postbus Shuttle can also run on an electric drive, making it even kinder on the environment. This additional service is intended to further boost the role of the Postbus, which already plays a key aspect in mobility, especially for people living in rural areas.



POSTBUS SHUTTLE. A mix of on-request bus and shared taxi

Train not plane

CLIMATE RELIEF. Travelling by plane is putting an increasing strain on the climate. Rail journeys are the environmentally friendly alternative.

The annual flights between Vienna and Zurich alone produce the same amount of CO₂ emissions as all of ÖBB's train journeys in Austria each year. Aviation greenhouse gas emissions in the EU have doubled since 1990, and in Austria, flying (acc. to VCÖ) is causing climate-damaging CO₂ emissions like never before – approx. 2.6 million tonnes (12% than in 2017). High time, therefore, to opt for the climate-friendly railways.

Saved time

The argument of the “shorter plane journey” doesn't always apply – so it's worthwhile taking a closer look at total journey times. In some instances, travelling by train is even faster when comparing total journey times (focus from/to city centre) (e. g. on the Vienna – Budapest, Vienna – Salzburg or Vienna – Graz routes) or at least just as quick (e.g. Vienna – Munich, Vienna – Prague or Vienna – Nuremberg). Even over longer distances, it makes complete sense to consciously decide in favour of the train as a climate-friendly means of transport. Indeed, destinations such as Berlin, Hamburg, Zurich, Venice or Rome can be reached easily and in comfort overnight with the ÖBB Nightjet. This allows the climate to relax at the same time.



CITYJET TALENT3. European pioneer in technology and quality

Service and comfort

RAIL BOOM WITH CONSEQUENCES. Train capacities must be increased to meet the growing needs of passengers. ÖBB is therefore counting on even more service and comfort.

Rail travel is booming. In order to push the upwards trend even higher, ÖBB is adding more trains every year and modernising its vehicle fleet. This includes the optimised use of mobile phones and WiFi on board the trains: ÖBB is investing a total of 100 million euros in the improvement of mobile network coverage alone.

A simple ticketing system is also encouraging even more customers to move to ÖBB. In recent years, ÖBB has developed a standardised booking platform for public transport as a whole and improved the range of combination tickets and special offers.

Getting from the railway station to the destination is also a big issue. That's why ÖBB is constantly expanding its own car sharing scheme. ÖBB is already the biggest car sharing provider in Austria with Rail&Drive locations in 29 cities –

currently including 32 electric cars, and the trend is increasing strongly.

New trains and carriages

In order to operate the additional routes in comfort, ÖBB is also investing massively in the quality and technology of its rolling stock. Around 350 new trains should be purchased by 2024.

ÖBB is the first railway undertaking ever to use the TALENT3 and is thus a European pioneer in technology and quality. The six-unit, barrier-free electric train offers about 300 seats – some 100 more than the previous model. The maximum speed has also been increased to 160 km/h (+20 km/h).



Freight transport is exploding

RAIL AS THE SOLUTION. The growing economy is making goods mobile. That contributes to our prosperity. If the goods travel by rail, that is also good for the environment.

30 percent more freight in Europe by 2030 – and most of it transported on the roads. So say the latest transport forecasts, which would not be good for the Paris climate targets.

Because this would add another million lorries to the 4.2 million or so currently on Europe's roads – a huge burden on the environment, the highway infrastructure and people's health.

Initial measures: modal shift to freight transport

ÖBB-RAIL CARGO GROUP (RCG). Measures for the lever of modal shift in the area of freight transport (in accordance with current circumstances)

TransANT: a special lightweight design enables four tonnes of additional load per wagon. Modular containers make the wagon more flexible in its use.

Mobiler – for rapid transshipment of containers and swap bodies between lorries and freight wagons.

Rolling road (ROLA): road and rail transport are combined. Entire lorries or semi-trailers complete sections of their journey by train.

TransFER: scheduled or customer-specific route connection

TransNET: TransNET is our total range of action on the Eurasian continent.

Feeder lines: direct access from the service siding to the European rail network enables efficient freight transport without changing mode of transport.

Y25 Lsif-C-K bogie: one tonne less tare weight through innovative technology. Advantages include: more transport volume, completed

Innovative semi-trailer handling: this system also enables non-cranable semi-trailers to be transported by rail for the first time, ongoing

"EcoTransIT": the enrichment and refinement of this emissions calculation tool with RCG production data will create added value for RCG customers. For individual consignments, this enables the CO₂ savings compared to transport by road to be surveyed for each national and international customer of RCG and sent directly to the customer.

Our requirements: modal shift to freight transport

GOODS TRANSPORT. Each piece of freight transported by rail rather than road saves CO₂.

Further develop land-related subsidies: Austria is a model example for the whole of Europe with the land-related subsidies for freight transport by rail. These subsidies have kept the share of rail in overall transport activities at 30 percent, bucking the trend in Europe. The aim now must be to develop this successful Austrian state aid model further.

Increase funding of the Rolling Road (ROLA) and Unaccompanied Combined Transport (UCT) to reduce lorry transits, especially over the Brenner Pass. As an alternative to this, ÖBB is proposing the awarding of public service contracts in regions of Austria particularly affected by transit operations.

More funding for feeder lines: the construction of rail connections by companies is currently limited to a maximum of 50 percent of the costs and should – just like the construction of feeder roads – receive more funding.

End tax privileges for fuels that damage the climate (diesel, kerosene)!

Accelerate the Digital Automatic Coupling (DAC) in European rail freight traffic as an important factor for modal shift and climate protection: Capacity increase of up to 30 percent and a sustainable productivity increase of rail freight transport.



CROSS-BORDER. Increasing rail's share in European freight transport

All Europe on track

RAIL FREIGHT FORWARD. European land freight transport is continuing to grow strongly, above all on the road. The goal of the European initiative is to make freight transport by rail the logistical backbone.

The numbers speak for themselves: Rail transport uses 6 times less energy than road transport; CO₂ emissions are even lower. These and many other advantages led to the birth of the European initiative "Rail Freight Forward". The integration of European freight railways aims at increasing the share of rail in freight

transport in Europe from 18 percent at present to 30 percent by 2030. Accordingly, the intention is to more than double the amount of freight transported in Europe by rail at present.

In this way, rail freight transport should become a powerful and sustainable backbone of a multimodal

"Transporting freight by rail is the only lever for reconciling transport and climate targets. Our strategy aims at being able to offer customers attractive rail logistics solutions with the corresponding framework conditions."

CLEMENS FÖRST, MEMBER OF THE BOARD OF RAIL CARGO GROUP



Modal shift to freight transport

European transport sector. Railway companies, infrastructure operators and political decision-makers throughout Europe will be brought on board.

Rolling road

ÖBB's Rail Cargo Group is a founding member of Rail Freight Forward and has been pursuing the goals of this initiative for many years. They include the ROLA (Rolling Road). Under this special transport system, entire lorries can complete certain sections of their route by train. This is particularly important in busy regions such as Tyrol, with its heavily frequented freight traffic corridor between Germany and Italy. More than 2.4 million lorries circulated on Tyrol's roads in 2018 alone – and the number is growing.

By riding on the ROLA, hauliers can complete sections of their transport chains by train – to protect the environment. The current gross capacity on the Brenner of 206,000 lorries per year should be increased in stages to more than double that volume by 2020. This would make the ROLA a practicable measure for the modal shift from road to rail.



Freight trains are becoming smart

INTELLIGENT SYSTEMS. A considerable amount can be done for the climate in the highly competitive freight transport sector. Digitalised solutions such as “Smart Cargo” are pointing the way.

Logistics customers should be serviced even better through digitalisation. They can look forward to intelligent trains with ultramodern telematics systems. ÖBB’s Rail Cargo Group (RCG) is setting a milestone for this with “SmartCargo”. In cooperation with A1, around 13,700 wagons will be equipped with telematics systems. Thus RCG freight wagons will have position detection, motion sensors, temperature monitoring and impact detection from the end of 2020. During the entire freight transport, customers will be provided with extensive information on their consignment – from the precise GPS coordinates to the 3D acceleration sensor for monitoring the transport of sensitive goods.



TELEMATICS with position detection, motion sensors, temperature monitoring



TRANSANT. The new platform wagon made from lightweight steel can load more freight

More, faster, quieter

CUSTOMER SOLUTION. Flexible logistics solutions and modern wagon systems are right at the top of the wish list of logistics customers. ÖBB’s Rail Cargo Group (RCG) is reacting with appropriate services.

Moving goods quickly and efficiently from A to B is what customers expect today. Industrial companies and hauliers expect more. RCG has put together an attractive range of services for logistics customers, specifically with regard to weight advantages and flexibility in the layout and use of the wagons. Some examples include:

Light, flexible and gentle on the environment

- The **TransANT** is a completely new platform wagon made from lightweight steel with less intrinsic weight, enabling up to 20 percent more freight to be loaded.
- With our scheduled or customised **TransFER route connections**, we set individual wagons as well as entire trains in motion to transport goods safely and reliably from point to point.

- We bring our well developed **TransNET** into play for logistics orders. TransNET is our total range of action on the Eurasian continent.
- **Feeder lines** open up direct access from service siding to the European public rail network as well as optimal connections to major European ports, terminals, industrial centres and business hubs without changing the mode of transport.
- Where a siding is not available, there is a solution for the first and last mile: the hydraulic lifting device **MOBILER** enables the quick and straightforward transfer of containers between lorry and freight wagon without a crane or dedicated feeder line.

Connecting people and markets

NETWORKED. Providing a capable and reliable rail network is the prerequisite for even more rail transport.

The transformation into an efficient and climate-neutral mobility system can only be achieved with a strong rail infrastructure – the use of fossil sources of energy must fall massively. This makes climate-friendly rail transport an important part of the solution. Within the scope of the

overall transport plan for Austria, Target Network 2025+ is the expansion strategy for developing the rail infrastructure. To this end, the federal government is investing more than 2 billion euros in the expansion and modernisation of the route network and railway stations.

Initial measures: modal shift to infrastructure

ÖBB-Infrastruktur AG. Measures for the lever of modal shift in the area of infrastructure (in accordance with current circumstances)

likely commissioning or partial commissioning

Greater Vienna

Vienna – Bratislava: Stadlau – Marchegg, 2022

Main line improvements, 2026 to 2028

Connecting line Hütteldorf – Meidling, 2026

Northern Line: Süßenbrunn – Bernhardsthal, 2028

Southern Line

Two-track expansion of the Pottendorfer Line (Vienna – Wiener Neustadt), 2023

Ebenfurth: Construction of loop, 2027

Eisenstadt Loop, 2024

Semmering Base Tunnel, 2026

Koralmbahn: Graz – Klagenfurt, 2025

Koralmbahn (section): Graz – Weitendorf, 2023

Feldkirchen – Weitendorf

(incl. connection to Weitendorf terminal), 2025

Western Line

Four-track expansion Linz – Marchtrenk, 2026

Four-track expansion Marchtrenk – Wels, 2026

Linz Shunting Station West – Linz signal bridge, 2030

Lake Constance

Expansion St. Margrethen (CH) – Lauterach, 2022

Brenner Line

Brenner Base Tunnel, 2028

Our requirements: modal shift to infrastructure

MODERN. An efficient rail network with high capacities and for high speeds is a basic requirement for making rail transport more attractive.

Expansion of the rail infrastructure: to further strengthen Austria as a business hub and enable more traffic to be shifted to the railways, the rail infrastructure must continue to be expanded.

Target Network 2040: in order to be able to create the modal shift necessary for the climate protection targets beyond 2025, even more capacity will be needed in the rail network by 2040, above all for freight and local transport around urban centres. In order to achieve an optimal modal shift from road to rail in the medium and long term, the infrastructure of the future and the further expansion of the infrastructure must be planned now.

Ensuring financing of this future infrastructure expansion and enabling investments in the next level of train protection; coordination with neighbouring countries with the goal of a smart capacity increase of 20 to 30%.



NEW SOUTHERN LINE. At the same speed to the south as to the west

Faster and more comfortable

RIGHT ON TIME. The expansion of the Southern and Western Lines offers further potential both for passenger and freight traffic in terms of speed and capacity.

ÖBB-Infrastruktur is currently working on more than 100 large and small projects along the Southern Line, a part of the Baltic-Adriatic corridor. 200 kilometres of railway line are being upgraded, 170 kilometres built from new. 80 kilometres of new tunnel and 150 new bridges are being constructed. Over 5,000 people are working on this major project. It is anticipated that by the end of 2026, trains will

speed from Vienna to Klagenfurt in 2 hours 40 minutes, and from Graz to Klagenfurt in just 45 minutes. The biggest projects along the Southern Line are the Northern Line expansion, the Vienna – Bratislava expansion, the new Vienna Central Station and the Wien Süd CCT (both already completed), the expansion of the Pottendorfer Line, the construction of the Semmering Base Tunnel, eight modernised railway

“In order to shift even more traffic off the roads and onto the rails, we are expanding the rail infrastructure further and making it easier to combine the train with bus, car and lorry.” **SILVIA ANGELO,**
MEMBER OF THE BOARD OF ÖBB-INFRASTRUKTUR AG



stations between Bruck and Graz, the modernised Graz Central Station (completed in 2015) and the new, 130 km-long Koralm Railway and Koralm Tunnel.

Western Line undergoing further expansion

Fast and in comfort between Linz and Salzburg: the Western Line already carries 32 percent of all trains, although it only accounts for around 10 percent of the Austrian rail network's total length. This is a reason for ÖBB to continue with the expansion of the Western Line to four tracks. The biggest rail project in Upper Austria to date commenced in September 2019 with the four-track expansion of the western side of Linz Central Station. ÖBB is investing a total of 1.3 billion euros in the Western Line, in the Linz – Wels section.

The outcome is impressive. Rail travellers on the route between Vienna and Linz now get to their destination quicker than taking the car. Since the 60 kilometre-long new section of track between St. Pölten and Vienna opened in December 2012, the journey time between Vienna and Linz has shrunk by 19 minutes to 1 hour and 14 minutes at speeds of up to 230 kilometres an hour. Passengers are convinced: the number of long-distance travellers has doubled in the last ten years.



ALL CHANGE. Over 2,000 car parking spaces are being added to railway stations each year

Shifting through networking

MULTIMODAL. In the future, infrastructure expansion should not only be able to cope with higher capacities but also simplify the transfer between modes of transport.

In order for the railways to further expand their pioneering role as the strong backbone of climate-friendly mobility, they also count on the sensible networking of different modes of transport.

And do so in passenger and in freight transport – such as with ever more offers for Park&Ride and with efficient freight terminals.

The magic word is intermodality, for which the infrastructure will be upgraded accordingly.

By car or bike to the nearest railway station and then in comfort by train to the destination is a popular combination for increasing numbers of Austrians. In total, ÖBB-Infrastruktur AG is investing almost 140 million euros in Park&Ride

facilities in the period from 2018 to 2023. There are currently already almost 116,000 Park&Ride parking spaces in Austria, of which about 67,000 are for multi-track vehicles. Over 2,000 car parking spaces and at least 1,200 covered two-wheeler parking spaces should be added each year.

Sustainable hubs

ÖBB also connects road and rail in freight traffic as a way of relieving the environment: With “Terminal Service Austria” (TSA), loaders, forwarders, shipping and railway companies have found an important partner for the efficient handling of freight.

Eight terminals at the most import-

Modal shift to infrastructure

ant national business centres – in Vienna South, Wels, Salzburg, St. Michael, Villach South, Wörgl, Brennersee and Wolfurt – offer the best connections in the country to road and rail. Four Combi Cargo Terminals (CCT) for unaccompanied combined transport are available, a further three terminals for the Rolling Road (ROLA) and one for combination cargo and for Rolling Road.

Full service

The core business is the handling of containers, swap bodies and semi-trailers. Here, TSA uses mobile handling equipment and gantry cranes to optimally support the transfer of goods to the railways. Further terminal services are also offered, from handling the load units to collecting and delivering trains and groups of wagons at rail handover points.

For the ROLA, TSA also organises the loading and unloading of trains. This enables lorries and complete semi-trailers including driver to be transported by train. For unaccompanied combined transport, TSA has state-of-the-art IT technology including D-GPS positioning at all terminals.

The magic word is intermodality, for which the infrastructure will be upgraded accordingly.



Straight up

BRENNER CORRIDOR. Quickly and in comfort by train from Tyrol to Italy and Germany or through Austria: the expansion of the Brenner Corridor makes this possible and is boosting the transport of passengers and freight across the border.

The Brenner Base Tunnel will be the longest underground railway connection in the world. It forms the heart of the new, 45 kilometre-long Brenner Railway between Munich and Verona and of the entire "Scandinavian-Mediterranean Corridor". The main work on the tunnel's construction began in 2009; commissioning is scheduled for 2028. Passengers will then be able to complete the 55 kilometre-long section from Innsbruck to Franzensfeste in only 25 minutes. The journey currently takes 80 minutes.

The new connection also offers big advantages for freight transport: the Brenner Base Tunnel enables more, longer and heavier goods trains to cross the Alps for the same amount of energy.



BRENNER BASE TUNNEL. Longest underground railway connection



RAIL POWER BOX. Using capacities better, reducing overall energy consumption

On track to the fully automated train

TELEMATICS. ÖBB-Infrastruktur AG wants to move more traffic to the railways in the future through digitalisation.

The introduction of the "Rail Power Box" is considered to be groundbreaking. The device, which has already measured the energy consumption per locomotive fully automatically, will in the future be capable of much more. The train's exact position will be transmitted in real time on the basis of satellite data – right down to within 10 centimetres. This will optimise the block separations between the trains, capacities can be better used and total energy consumption will fall.

More efficiency

All locomotives of ÖBB will be equipped with the system by the

end of 2020. That will also increase efficiency on the routes, because the dispatchers can pass schedule recommendations to the train driver by text message in order to avoid, for example, stops and delays. This promotes punctual and conflict-free travel. After all, stops necessarily mean higher energy consumption and lost time: it can take around two minutes for a heavy freight train to get going again.

The trend is generally continuing towards adaptive train guidance, which should be standard by about 2021 and will form the basis for energy and cost-saving measures.

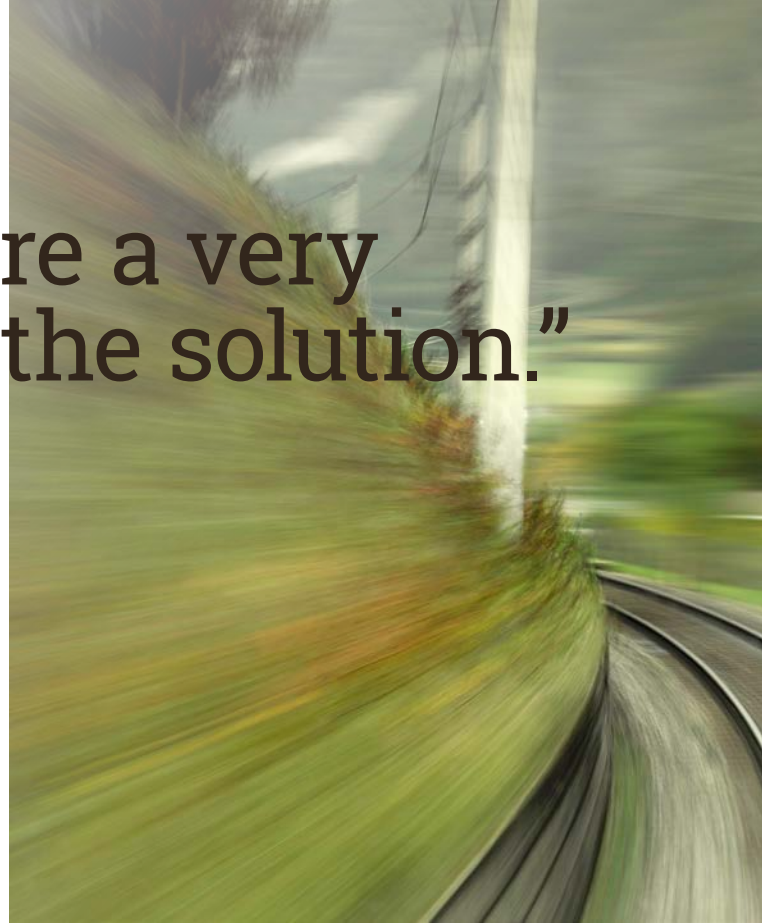
“The railways are a very central part of the solution.”

STATEMENTS. Mobility and climate protection do not have to contradict each other. We asked experts about the role played by the railways now and in the future for even more climate-friendly mobility.



“Travelling by train is the best form of mobility for me, right behind walking. I can use the journey time for all sorts of other activities. And I find driving really exhausting by comparison. Above all, I consider it to be a massive waste of time – quite apart from the ecological footprint.”

ELISABETH OBERZAUCHER, BEHAVIOURAL BIOLOGIST, UNIVERSITY OF VIENNA



BACK ON TRACK. Each additional shift from road and plane to rail and bus



“The railways are a very central part of the solution to the climate problem. There are two reasons for this: firstly, transport by rail is much more efficient than travelling by car or plane. And secondly, a high proportion of the energy for the railways in Austria comes from renewable sources. Without the railways, we won’t achieve the climate targets.”

GÜNTHER LICHTBLAU, FEDERAL ENVIRONMENT AGENCY



“Shifting even more car journeys to the railways will require an expansion of capacities as well as a seamless connection with regional public transport. In order to shift more freight to the railways, the obstacles to competing with transport by lorry must be removed. This is a political challenge.” **ULLA RASMUSSEN, VCO**



benefits our climate

“Climate protection will make even more customers switch to the railways in the future – in the passenger and freight transport sectors. A further increase in attractiveness, productivity and quality is essential here. The biggest CO₂ effects can be achieved through further shifts from road and plane to climate-friendly train. It is therefore about maximum utilisation. The biggest challenge lies in a fast and smart increase in the capacity of the rail system through new technologies.”



MARK TOPAL-GOEKCELI, HEAD OF SYSTEM TECHNOLOGY AND GROUP PRODUCTION, ÖBB-HOLDING AG



“Even more incentives must be created to make travelling by train more attractive. A consolidation of the offer of public transport and multimodal hubs, more offers for zero-emission e-vehicles with sharing possibilities are absolutely essential.”

WOLFGANG ANZENGRUBER, MEMBER OF THE BOARD VERBUND AG

“Travelling by train must become the new short-haul flying. It is not only totally irresponsible to fly distances of less than 1,000 kilometres, it is often also much more relaxing to take the train. That is why a European overall concept is needed for a comprehensive network of night trains. I would like to see ÖBB play a pioneering role in this.”

JOHANNES STANGL, STUDENT AND ACTIVIST FOR FRIDAYS FOR FUTURE



“In the future, the railways will increasingly cover the aspects of medium distances and long distances in an intermodal transport system.”

KARL STEININGER, WEGENER CENTRE, UNIVERSITY OF GRAZ





SAVINGS POTENTIAL of up to around 2.4 million tonnes of greenhouse gases

A bit more is also possible with support

POSITIVE EFFECTS. An overview of the additional greenhouse gas savings potential through the ÖBB Climate Protection Strategy 2030.

Should the measures of the six levers be fully effective and demonstrate the planned effects, an additional savings potential of up to around 2.4 million tonnes of greenhouse gases could be achieved through the ÖBB Climate Protection Strategy 2030.

Savings potentials

The indicated potentials were calculated by the Federal Environment Agency on the basis of the data for 2017 and primarily refer to the first big target of ÖBB – namely to offer a CO₂-neutral ÖBB mobility

sector by 2030 (concerns Scope 1 & 2 excl. buildings). ÖBB thus wants to draw attention to an additional GHG savings potential of rail and bus and to make an offer. The possible effects indicated per lever are essentially maximum values, which to some extent can be raised only under certain basic conditions and prerequisites – see also the requirements in the descriptions of the respective levers. Political assistance in particular is called for in this matter.

An overview of greenhouse gas savings potentials

0.044 mil. t

Electrification



0.082 mil. t

Alternative drives for rail



0.162 mil. t

Alternative drives for road



0.164 mil. t

Renewable energy



0.014 mil. t

Energy efficiency



1.900 mil. t

Modal shift



2.366 mil. t

maximum total greenhouse gas savings potential annually from 2030

Legal Notice

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Notice

For reasons of improved legibility, the male form has been used throughout. Both genders are always intended.

Disclaimer

This report also contains statements and forecasts about the future that we have made based on all the information currently available to us. These statements about the future are usually described with terms such as "expect", "estimate", "plan", "calculate", etc. Please note that the actual circumstances – and thus the actual results – may deviate from the expectations shown in this report due to a wide range of factors.

The information contained in this report has been prepared to the best of our knowledge and verified with great care as to its correctness. Subject to misprints and printing errors.

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