European Parliament

Sustainable and smart transport in Europe

SUMMARY

Innovation will be critical for economic recovery – and the transport sector offers many opportunities for innovation to help drive the post-pandemic economy forward. The European recovery plan, centred around the Green Deal, places great emphasis on the growth potential of transforming the economy to a greener model and taking advantage of technological advancements and digitalisation to bolster European industrial competitiveness. The strategy for sustainable and smart mobility to be tabled at the end of 2020, as part of the Green Deal initiatives, will play a significant role in defining the way ahead, as well as in addressing pandemic-related concerns, in the field of mobility. Key priorities will include developing sustainable urban mobility, harnessing technological development and digitalisation, addressing transport emissions, ensuring resilience of the transport sector and ensuring movement of goods and connectivity. To feed into these discussions, this paper will survey the challenges presented by the pandemic for urban mobility, and the potential of new technologies and digitalisation to provide solutions as well as to support the 'greening' of transport. It will review the continued challenges of sustainability in the transport sector and trends in decarbonisation with the help of fuel and vehicle innovations. It will also outline EU actions to date in these areas and provide some suggestions for potential future action, including areas to consider for measures to boost the resilience of the transport sector.

Towards sustainable urban mobility by harnessing new technologies and digitalisation

State of play

Beyond the immediate impact of restrictions of movement, the pandemic may have a long-term impact on how the urban environment is used and on urban mobility. In some areas 'tactical urbanism' has closed roads to make more space for cafes and restaurants to allow space for clients while respecting social distancing rules. A number of cities have taken decisions to make greater space for cyclists on urban roads. Even with the lifting of restrictions, public transportation demand has been slow to pick up. This may be indicative of continuing health concerns, but mobility behaviour may also be changing because of the lessons learned from the large-scale, forced experiment in teleworking. Lockdowns revealed how advances in communications technologies now allow effective working from a distance and there is evidence that many employers will continue teleworking practices. There are also predictions that companies could shed as much as 30 % of centrally located real-estate, with a knock-on impact on demand for transport services. Some authorities have started to promote staggered school hours to reduce crowding during rush hour, with a further potential impact on transport demand, if introduced more widely. The pandemic has also accelerated the pace of e-commerce, which may lead to further 'de-densification'

of city centres. Lock-downs also gave urban dwellers an impression of a much quieter and emission-free urban space, which could lead to changes in their expectations of policy-makers.

These developments have sparked new discussions on urban mobility and will necessitate a wider reconsideration of urban transport organisation, but could also provide an opportunity to fast-track progress in sustainable urban mobility, helping to reach EU climate targets and improve living standards for city inhabitants. As over two-thirds of the EU's population lives in urban areas, generating up to 85 % of Europe's GDP, ensuring that the changes brought on by the pandemic are addressed in the urban transport system is fundamental to ensuring economic growth and that peoples' expectations are met. Furthermore, new innovations and services in urban mobility that will emerge have the potential to further drive growth, create jobs and boost sustainability.

New technologies and digitalisation have already been used to try to boost public confidence in transport services. While immediate measures focused on allowing greater distance between passengers by keeping seats empty between them, using screens in taxis, or using advance reservations in suburban rail systems to limit occupancy, transport operators have started using new ways to ensure decontamination of transport vehicles, such as ultraviolet lamps, contactless validation of electronic tickets, and have developed new features to their journey planning applications to show how crowded public transport vehicles are.

The pandemic will likely spur further innovation in areas formerly thought of largely in terms of boosting sustainable mobility. Mobility-as-a-Service (MaaS) applications, which can boost sustainability by allowing better links to public transport, greater use of shared mobility and micro-mobility, can further assist in alleviating health concerns by dispersing passenger journeys throughout the transport system and providing contactless ticketing solutions. New vehicle designs are likely to be developed to ensure distancing and avoid crowds. New models of electric buses have already been proposed with no-touch bells, smooth surfaces to ease cleaning, and removable seats to allow social distancing. Small occupancy, driverless electric shuttle buses were already being tested before the pandemic crisis, harnessing maturity in vehicle automation and electrification to develop eco-friendly public transport solutions, and may ease concerns related to crowding. Automated vehicles can offer alleviation of health concerns; improvements in transport system efficiency; and emissions reductions, especially in conjunction with vehicle sharing; provided reliable disinfection systems are developed.

During the coronavirus lockdowns, there have been examples of drones being used to deliver medicines to ensure contactless delivery. Other 'last mile' delivery solutions are being tested, such as package delivery robots, which would allow contactless delivery and offer alternative environmentally friendly freight transport solutions. New concepts have emerged, such as a driverless pod for moving patients and goods in cities. Meanwhile, several types of drone taxis are also being developed, with two demonstrator projects by Airbus and an air delivery drone already used by DHL between customer premises and the service centre in China. These and similar solutions may further reduce crowding and improve sustainability by shifting some of the volume of passenger and cargo traffic into a third dimension, and off the main roads to alternatively fuelled transport options.

EU action to date

The European Commission has long been a proponent of sustainable mobility plans integrated in urban planning, making use of active travel options, reducing congestion and promoting more sustainable modes of transport. Whereas urban mobility policies are defined at local level, the EU has supported these policies and has encouraged developments by fostering discussions with stakeholders, committing to new initiatives, funding studies and awareness raising campaigns and providing funding support for clean public transport. The 2013 urban mobility package outlined supporting actions by the Commission and aimed to foster replacement of silo approaches in urban transport planning with strategies that shift attention to sustainable transportation, such as cycling,

public transport, and 'new patterns for car use and ownership', by providing guidelines for sustainable urban mobility plans.

The urban mobility package identified focus areas of action, such as the use of intelligent transport systems (ITS) in improving efficiency in urban transport, for example in areas of automated traffic management. Among other things, this could prioritise public transport, sharing best practices and fostering a common approach to access regulations, such as low emission or car free zones or high occupancy vehicle lanes, to assist in reducing congestion and pollution. Smarter organisation of urban freight transport, such as better mode and vehicle selection and route optimisation, can also be very cost effective, reducing the cost of goods and services and cutting emissions.

To support technological development in the area of digitally enabled vehicle-to-vehicle interaction and vehicle-to-infrastructure interaction, the Commission issued a strategy on cooperative intelligent transport systems in 2016, and the 2010 Directive on ITS sets the legal framework for coordinated implementation of ITS in Europe. In 2018, the Commission released a strategy on the mobility of the future, focusing on connected and automated mobility, which lists supporting actions to develop technologies, services and infrastructure. For automated vehicles, EU rules already provide for the possibility of marketing of vehicles that are automated to a certain degree, while rule updates are required as the degree of automation increases. New rules have been adopted for safe use of drones, but drone flights in particular in urban areas will require measures for safe integration into urban space. Meanwhile, EU rules on vehicle emissions and targets for clean vehicle procurement, much of it done by regional and local authorities, will help drive take-up of cleaner vehicles.

A number of initiatives supported by the EU are in place to enhance cooperation and develop urban mobility plans and solutions in cities: CIVITAS supports cities in testing new technologies and concepts and promotes sustainable urban mobility plans. The Urban Agenda for the EU aims to contribute to developing sustainable and efficient urban mobility. The European innovation partnership on smart cities and communities (EIP-SCC) focuses on information and communication technology (ICT) enabled solutions for a number of policy areas, including mobility and transport. The Urban innovative actions initiative identifies and tests solutions for sustainable urban development. Initiatives such as the ITS Platform and C-Roads support harmonised deployment of of ITS. The European Green Vehicle Initiative, Fuel Cells and Hydrogen Joint Undertaking and Clean bus deployment initiative promote low and zero emission transport for cities. The ERTRAC technology platform and ECSEL Joint Undertaking play an important role in research into connected and automated vehicles.

EU financial support to sustainable and smart transport and urban mobility projects has been increasing over the years, with areas where the EU needs to boost innovation set out in the Transport Research and Innovation Agenda (STRIA). EU funding has also supported procurement of alternatively fuelled bus fleets, trams and trolleybuses, and the installation of recharging infrastructure.

In the area of urban mobility planning, EU funded projects are seeking to transform neighbourhoods into more liveable spaces (METAMORPHOSIS), assist cities in the development of urban planning (SUMP-PLUS), support small and medium-sized local authorities in taking up sustainable urban mobility plans (SUITS project), develop spatial and transport planning (HARMONY) and test and research urban vehicle access regulations in cities (ReVeAL). Ongoing and recent projects on cycling support the transfer of successful measures between European cities (Handshake), offer testing fleets of e-bikes and cargo bikes (ECCENTRIC, Growsmarter) and develop financial schemes to foster take-up of cargobikes (CityChangerCargoBike). Demonstration projects have also been funded on how electric light vehicles (e-bikes, electric scooters, quadricycles) can be used in urban areas and integrated into the existing urban transport networks (ELVITEN, STEVE).

EU funding has been used to advance the use and scalability of MaaS schemes as enablers for use of sustainable modes of transport and transport system efficiency (MaaS4EU, IMOVE) and to develop

mobility stations, which provide access to multiple options for sustainable transport in one location, including public transport, sharing services of conventional bikes and e-bikes and electric cars (GrowSmarter). For vehicle automation, projects have started to scale up testing on roads and the urban environment (L3PILOT) and research the interaction between automated and conventional vehicles and the urban environment, (Inframix, InterACT, ICT4CART). Several pilot demonstration projects for automated minibuses have been completed (CityMobil) and are ongoing (AVENUE, FABULOUS). Integration and demonstration projects have also begun on integration drones and drone taxis in the urban airspace and environment (SESAR U-Space demonstrators, HARMONY) and to develop drone delivery systems (AIRCARRUS).

The EU has funded electric charging infrastructure deployment (MEGA-E, ECCENTRIC Growsmarter), demonstration projects for new business models for infrastructure deployment (MEISTER, GreenCharge), and development of a smartphone application to help drivers locate alternative fuel stations and electric vehicle charging points (Growsmarter). Research in improving electric drivetrains for cars and electric/hybrid drivetrains for buses (e.g. ModuleED, Drivemode) and battery efficiency (Demobase). Funding has also been used to test electric vans in business fleets in the urban environment (ECCENTRIC), and to develop plug-in-hybrid trucks to cope with future emissions restrictions in urban areas (ORCA), and to test synchronisation of traffic signals to prioritise freight transport with renewable fuelled heavy vehicles (Growsmarter). To increase alternative fuel use in public transport, projects have supported the take-up of electric buses (ZeEUS) and demonstrations of hydrogen fuel cell buses (High V.LO-City, 3EMOTION).

Possible future measures

To take advantage of the possible step-change in urban mobility efforts, the EU could increase support for cities' adoption and development of sustainable urban mobility plans, promoting modal choice, micromobility, electrification, vehicle sharing and active travel options. To this end, the EU could develop a new urban mobility strategy. Such efforts should focus on promoting an integrated approach to land use in urban areas and urban mobility, addressing the changes that the pandemic is likely to incite in the use of vehicles; the location of economic and other activity and mobility needs; work, commerce and mobility patterns; and development of new business models.

The Green Deal, the European growth strategy proposed in December 2019, and the European recovery plan, recognise the potential of automated and connected multimodal mobility and digitalised traffic management to improve sustainability in the transport sector, especially in the urban environment, and the European Commission has indicated that the EU will support MaaS, as well as ramp up support for electrification of transport and use of alternative fuels and alternative fuel vehicles. This political ambition should be matched with significantly increased financial support, to achieve and maintain technological leadership, recognising the potential of urban transport industry innovation to support growth and job creation, while the EU transport research agenda should be updated to address considerations related to the pandemic.

To bolster modal choice, support should be allocated to promoting vehicle sharing, light electric vehicles, and demonstrating enabling solutions, such as MaaS and urban mobility stations. The EU should also reinforce support for development of cycling infrastructure and bicycle and e-bike sharing, scale up demonstration projects for the use of cargo bikes for freight, and amend existing transport vehicle specifications to allow greater use of bikes on buses and trains. To provide further focus and strengthen the coherence of the various EU-level and local initiatives, the EU could also develop a new EU active travel strategy.

Scaling-up funding for research and demonstrators in contactless 'last mile' delivery options, such as package delivery robots and drones, will allow development of technological leadership in a fast developing sector. For drones, EU support should be increased on improvements in on-board 'detect and avoid' systems and the insertion of manned and unmanned drones in urban airspace, including by multiplying demonstration projects. Meanwhile, EU aviation rules should be reviewed to identify areas where changes need to be made. Further support is needed for research into

technologies for vehicle automation, interaction of automated vehicles and conventional vehicles and the urban environment and infrastructure, as well as digitalisation of traffic management. Funding should also be allocated to supporting development of new vehicle designs, including materials that could assist in reducing the risk of transmission of diseases, and more demonstrations of autonomous minibuses. A legislative framework should be developed, including type approval, liability and traffic laws.

Reinforced action to increase electrification and alternative fuel use in urban mobility should include incentives for increasing the share of low- and zero-emission passenger cars and business fleets, construction of recharging and refuelling points and development of new business models for their operation, financial support for electric and hydrogen fuel cell buses in municipal fleets, and investments in urban rail.

Bolstering innovation in low emission transport

State of play

While emissions fell during the coronavirus lock-down, their subsequent resurgence renews the need to tackle climate change. As people appear to be increasingly returning to private-car use following the lifting of restrictions, possibly fuelled by health concerns, creating further pressure to decarbonise transportation, as cars and vans produce 15 % of EU CO_2 emissions. Meanwhile, CO_2 emissions from trucks, coaches and buses are still increasing and stand at 6 % of EU emissions, or 25 % of road transport emissions. Road transport is by far the biggest emitter, with 70 % of all greenhouse gas emissions coming from transport, and with the rail transport only responsible for 0.5 % greenhouse gas emissions due to the high levels of electrification. Rising emission levels from aviation and maritime activities are the two other areas of greatest urgency. According to pre-pandemic predictions, passenger traffic by plane was estimated to double by 2030 and air freight was expected to triple, while activity in container handling ports was predicted to quadruple. Maritime transport emits around 2.5 % of global greenhouse gas emissions, of which some 13 % is due to EU transport emissions. Direct emissions from aviation account for more 2 % of greenhouse gas emissions. Without mitigating factors, these levels were predicted to increase between 50 % and 250 % and by 300 % respectively by 2050.

Meanwhile, the pandemic has taken a heavy toll on the transport and vehicle and aircraft manufacturing industries. A number of airlines have declared bankruptcy, with a potential to harm connectivity, and with support from the public purse required for both operators and manufacturers. Consideration will also need to be given to the impact on transport of goods and transport infrastructure with respect to possible future trends of reshoring and amending 'just in time' business models, and as a consequence, the environmental impact of such changes.

In light of the twin challenges of returning to growth and tackling emissions, turning to innovation may offer a solution. Greater awareness of sustainability, its potential to attract customers and investors, and international and regional initiatives, have already been driving interest in alternative fuels and sustainability across transport modes. Further boosting alternatively fuelled transport could help stimulate economic growth and employment, enhancing EU industrial competitiveness in areas such as propulsion technologies, energy storage, and new vehicles and new services driven by these developments can provide a significant contribution to the efforts to tackle climate change.

The current state of play in alternative fuel use and availability differs across transport modes, with different levels of technological development in road vehicles, ships and aircraft using electricity and biofuels; and in the production of advanced biofuels and storage capacity of batteries. While renewable energy consumed in the EU transport sector is increasing, it remains in single figures, at 8.1 % in 2018, according to the European Environment Agency, with significant differences between EU Member States.

In the personal vehicle segment, electricity as a fuel is experiencing a high growth rate, with electrically chargeable new car sales rising to 6.8 % of total EU car sales and hybrid electric vehicles representing 9.4 % in the first quarter of 2020, compared to a drop in overall vehicle sales due to the coronavirus. In the road haulage sector, use of alternative fuel vehicles has been slower. In 2019, electrically-chargeable vehicles accounted for 0.2 % of total new truck sales, vehicles using alternative fuels, such as natural gas, liquefied petroleum gas (LPG), biofuels and ethanol vehicles, comprised 1.7 % of newly registered vehicles, with most new vehicle registrations running on diesel. For new buses registered in the EU in 2019, alternatively-powered vehicles combined accounted for 15 %, with electrically-chargeable vehicles making up 4 %, hybrid electric vehicles 4.8 % and buses using alternative fuels such as natural gas, LPG, biofuels and ethanol making up 6.2 % – with 85 % fuelled by diesel. While still low in market share, electric buses and electric trucks seem to be experiencing a surge in interest.

Most ships today use diesel engines, with about three quarters of the fuel consumed being a residual fuel, referred to as bunker fuel or heavy fuel oil. With regard to alternative fuels, liquefied natural gas (LNG) has garnered greatest interest to date. Of approximately 50 000 ocean-going ships worldwide in May 2018, it is reported that 122 LNG-fuelled ships were in operation and 132 under construction or ordered. A limited number of ships run on methanol, with the world's first 1 500 person and 300 car capacity methanol-fuelled ferry entering service in 2015. Hybrid electric ferries operate in a number of locations across the world. The world's largest hybrid electric ferry so far, the *Color Hybrid*, 160 metres long with capacity for 2 000 passengers and up to 500 cars, entered service in August 2019. Fully electric ferries are currently only used for short journeys; such as the 80 metre long *Ampere*, used in Norway since 2015; and the *Elektra*, with a five nautical mile range on one charge, used in Finland since 2017; with a number of new orders of similar vessels reported. On inland waterways, a small number of electric ferries are in use, including an electric ferry, the *Sankta Maria 2*, operating on the Mosel in Germany. Fully electric autonomous cargo barges have also been developed in the Netherlands.

For aviation, which currently mostly relies on conventional fuels, bio-based fuels are considered to have the greatest potential to boost sector sustainability. From its first use in normal business operations in 2016, to December 2019, more than 215 000 commercial flights using bio-based fuels have been performed. However, flights using bio-based fuels represent only 0.05 % of total jet fuel consumption in the EU. Production has also been low in Europe, but some production plants are planned. Research is ongoing into electrofuels, also known as power-to-liquid fuels, but demonstrator projects are small scale and the fuels are several times more expensive than kerosene. For electric aircraft, it is estimated the number of development projects grew by 30 % in 2019, with most projects focusing on small aircraft. In June 2020, the first worldwide type certification of a small electric aircraft, the two-seat Pipistrel Velis Electro, was announced. A retrofitted electric aircraft model was tested in May 2020, and a completely new design by a company called Eviation is to enter into service in 2022. For larger aircraft, difficulties will persist related to the energy density of batteries compared to conventional fuel. Easyjet and Wright Electric aim to design a 180 seat aircraft with a range of 500 kilometres, and put it into service by 2030. Hybrid-electric solutions may offer greater potential in the run-up to 2050, such as the 140 seat E-Fan X, which was scheduled for a test flight in 2020 before cancellation of the project due to 'new realities related to the coronavirus pandemic'. Radical aircraft design concepts using, for example, distributed propulsion to offer greater efficiency, have also been proposed, including E-Thrust, developed by Airbus, and N3-X developed by NASA.

Hydrogen fuel cell technology is also reaching maturity for various transport modes. About 90 hydrogen fuel cell buses currently operate in Europe. The first hydrogen trains have been tested in Europe and regular services are scheduled to start from 2022 in Germany, and the world's first hydrogen fuel cell cruise ship should be completed by 2023. There are also initiatives to develop hydrogen powered trucks, while the feasibility of hydrogen propulsion for aviation is being studied.

EU action to date

The European Union is a world leader on climate action. The [Effort-sharing Regulation](#) requires EU countries to cut emissions by 30 % by 2030 compared with 2005 levels, in a number of sectors including transport. The 2011 White Paper on Transport requires a 60 % reduction in transport greenhouse gas (GHG) emissions by 2050 (compared to 2005 levels), with specific targets for different transport modes. For road transport, there are CO_2 standards for [cars and vans](#). Rules for [trucks and buses](#) require that the CO_2 emissions of new vehicles do not exceed 30 % of today's levels by 2030, and incentives encourage the uptake of zero- and low-emission vehicles.

In 2019, a revised [Clean Vehicles Directive](#) was adopted to boost the procurement of clean vehicles by public authorities. To help drive a market uptake of alternative fuel vehicles and vessels, the Directive on [Alternative Fuels Infrastructure](#) obliges the Member States to put frameworks in place for the development of recharging stations and refuelling stations for electric and other alternative fuel vehicles and vessels. The [Energy Performance in Buildings Directive](#), revised in 2018, includes provisions to ensure that residential and non-residential building car parks will be progressively equipped with recharging points for electric vehicles. The new [Renewable Energy Directive](#) sets renewable energy consumption targets in EU countries and a 14 % target for 2030 for fuel suppliers to supply renewable energy consumed in road and rail transport, with a specific target for advanced biofuels. Renewable electricity is incentivised by counting four times its energy content towards the 14% renewable energy in the transport target when used in road vehicles, and 1.5 times when used in rail transport. A cap is set on fuels from food and feedstock. In [maritime transport](#), the EU has adopted a strategy for reducing emissions, which outlines a stepwise approach, starting with bolstering emissions monitoring and leading to emissions reductions targets and further measures, including market-based measures in the long-term. An EU monitoring and reporting system has been in place since 2018. Shipping emissions are also monitored by the International Maritime Organization (IMO), and an emissions reduction strategy was adopted in 2018 with the goal to reduce total annual GHG emissions from shipping by at least 50 % by 2050 compared to 2008 levels. Nonetheless, specific measures still need to be developed.

For [aviation](#), CO_2 emissions have been included in the EU emissions trading system since 2012, limited to intra-European Economic Area flights since 2016, in anticipation of the introduction of a system at international level. At international level, The Carbon Offsetting and Reduction Scheme for International Aviation ([CORSIA](#)) under the auspices of the International Civil Aviation Organization (ICAO), aims to stabilise CO_2 emissions at 2020 levels by requiring airlines to offset the growth of their emissions after 2020. The implementing modalities are currently being drafted. The EU has also made efforts to modernise air traffic management, with the potential to reduce fuel burn and emissions by allowing more efficient flight routes. However, progress has been slow.

A number of strategies and action plans have been presented by the European Commission that plot the path to reaching goals for low-emission mobility, and list supporting actions and funding priorities, including the [2013 European alternative fuels strategy](#), [the 2016 low-emission mobility strategy](#), the [action plan for alternative fuels infrastructure](#) and the [strategic action plan for batteries](#). The Commission has also promoted a number of partnership initiatives with industry and researchers, which have driven innovation and research in transport decarbonisation, including the European green vehicle initiative, Fuel Cells and Hydrogen Joint Undertaking, [Shift2Rail Joint Undertaking](#) and [Clean Sky 2 Joint Undertaking](#), and the [European Battery Alliance](#).

A significant share of EU funding for transport and innovation has been directed toward supporting the move towards low-emission mobility. EU support has been used for alternative fuel infrastructure development and the roll out of low emission public transport vehicles in cities. Recent and ongoing EU funded projects include the development of [cross-border electromobility](#), development of an [electric ferry](#), [retrofitting ferries to run on LNG](#), research into [hybrid electric propulsion technologies](#) for aviation, [distributed propulsion systems](#) for large aircraft, [battery](#)

development, demonstration of hydrogen fuel cell vehicle use, and improving electric propulsion in road vehicles.

Possible future measures

Presenting the European recovery plan and the EU multiannual financial framework (MFF), the European Commission recognised the potential of investments in clean transport, renewable energies and clean hydrogen to get the European economy growing and to accelerate the production and deployment of sustainable vehicles and vessels, as well as alternative fuels, and to help create more jobs. It reiterated its intentions to use the Connecting Europe Facility, InvestEU, and other funds to support development of electric charging infrastructure, clean fleet renewals and investments in rail infrastructure and inland waterways.

The roadmap tabled with the Green Deal, the EU's growth strategy at the heart of the recovery plan, lists a number of policy actions for the coming years. The revision of rules on vehicle emissions would provide an opportunity to further incentivise introduction of zero and low-emission vehicles. Investments and initiatives to develop rail transport and inland waterways and revision of Combined Transport Directive to boost multimodal transport will allow some of the 75 % of freight currently carried by road to shift to more sustainable transport modes. A revision of the alternative fuels infrastructure targets with binding targets and electric charging facilities for trucks, and investments in battery development and recharging and refuelling infrastructure would spur development in electromobility in road transport and alternative fuel use in shipping. The revision of the Emissions Trading System legislation will allow a reduction in the free allocations to the aviation sector and to consider the inclusion of maritime transport. In the revision of the Energy Taxation Directive, the EU can take a close look at the derogations afforded to aviation and maritime transport fuels. The Commission work programme for 2020 also envisages taking initiatives to reboot the production and use of alternative fuels in shipping (RefuelEU Maritime) and aviation (RefuelEU Aviation). This provides opportunities to consider incentives for production under the Renewable Energy Directive for sustainable aviation fuels, performance requirements on the carbon-intensity of energy used in maritime transport, as well as incentives and requirements to use the fuels in aviation and maritime transport. Reinvigorating discussions on air traffic route optimisation under the Single European Sky framework and road pricing would further help cut emissions from aviation and road transport.

A greater focus should be given to investments via the Connecting Europe Facility, Invest EU and the European Investment Bank (EIB) on supporting climate objectives and decarbonisation. An indication of how EU funds can help in decarbonisation efforts and in recovery is the Commission's June 2020 announcement of funding for 140 key projects to support recovery and jobs, which will aim at reinforcing rail links to ports and airports, inland waterway connections to road and rail networks, converting short-sea shipping vessels to run on LNG, and the installation of electricity charging points.

Boosting investment in research will help to develop new propulsion technologies and cleaner and more efficient vehicles. The Commission already announced the creation of the Clean Hydrogen Alliance with the presentation of the Industrial Strategy in March 2020, which seeks to focus on the investment agenda of the Clean Hydrogen Strategy tabled in July 2020. Reinforced funding for innovation could directed to developing advanced biofuels, electrofuels, batteries, hybrid and electric vessels and aircraft.

The transport industry recovery, as with many other sectors, will be linked to the aid available from state finances. Supporting fleet renewals with EU funding and national recovery plans will serve the twin purposes of bolstering the recovery of the transport manufacturing sector and putting cleaner cars, trucks and buses on the road and planes in the air. Linking public aid to operators and manufacturers to shift towards more sustainable transport modes and boost research in environmentally friendly propulsion, as is the case with the aerospace and aviation industry support package proposed in France, will offer further opportunities to boost competitiveness and

tackle environmental challenges. Consolidation, especially in air transport, may lead to a loss in connectivity and resulting negative impact for some regions, and efforts should be made to identify ways to resolve this issue, promoting where possible more sustainable transport modes. The potential impact of reshoring and changing supply chain models and their impact on the transport sector and the transport network should also be studied, including with a view to emission levels.

Beyond recovery, the health of the transport sector will also depend on its resilience if faced with a new crisis. With a view to boosting resilience to face future crises in the more critical transport operations, discussion should be promoted as to how to incentivise resilience in enterprises. Consideration should be given to ensuring vital intra-EU cross-border movement above and beyond guidelines such as the Green Lanes. As the health of the transport industry depends equally on operators and workers, the sort of shortcomings that emerged in providing key worker status to transport sector workers, including on cruise liners, will also need to be addressed to better withstand future crises.

Potential initiatives

	Project	Likely lead actor	What should be done?	
1	New urban mobility strategy	European Commission, local authorities	The Commission should boost development of sustainable urban mobility plans by adopting an urban mobility strategy. Local authorities should reinforce efforts to develop plans that focus on the integration of land use and mobility activity and the changes presented by the pandemic.	🟥
2	Update the EU transport research and innovation agenda	European Commission, European, Technology Platforms and other stakeholders	The EU transport research and innovation agenda should be updated to include considerations of health aspects vehicle design, potential for digitalisation and automation to address crowding aspects in the transport system.	🟥
4	New active EU travel strategy	European Commission, local authorities	The EU should develop an active travel strategy to help coordinate local authorities' efforts to boost cycling and walking. Funding should be ramped up to support development of cycling infrastructure, for development of business models for urban freight transport using cargo bikes, and bike sharing schemes.	🟥
3	Reinforce support for light electric vehicle demonstrator projects	European Commission	EU funding instruments should reinforce support for development of light electric vehicles (e-bikes, scooters, quadricycles), and their integration into the urban transport system and for testing business models, such as vehicle sharing to increase the choice of sustainable transport modes and encourage a dispersion of commuters.	🟨
5	Boost development of contactless delivery solutions	European Commission	The EU should amplify efforts in developing contactless delivery solutions, including further support research and innovation in small delivery vehicles and drones, including demonstration projects for integration of drones in urban airspace and a review of EU aviation legislation.	🟨
6	Support acceleration of automated urban mobility	EU institutions, national and local authorities	To accelerate automation in urban transport, EU research and innovation funding should be scaled up for autonomous car and minibus demonstrator projects, to foster research in automated vehicle technologies, interaction of vehicles, road infrastructure and the urban environment. The EU and national authorities should accelerate the development of an appropriate legislative framework, addressing type approval, traffic management and liability issues.	🟨
8	Electrification and alternative fuel use in the urban environment	European Commission, national and local authorities	EU funding should be increased to support for research in new vehicles, such as hybrid-electric trucks for urban deliveries, testing new business models for alternative fuel infrastructure providers. Local authorities should refocus on development of publicly available charging points and charging points in car parks and office buildings, local authorities could provide further incentives for the take-up of zero and low-emission vehicles and invest in public bus fleet renewals and urban rail.	🟨

9	Research and innovation in intelligent transport systems	EU institutions	EU funding should be reinforced for research and deployment of intelligent transport systems in areas such as optimisation of traffic management, including solutions that would allow preferential treatment of clean vehicles and public transport.	🟨
10	Develop multimodal transport	EU institutions, national authorities	Revision of the Combined Transport Directive is needed to improve resource efficient transport and logistics and investments should be scaled up in rail and inland waterways to help shift more freight onto more sustainable transport modes.	🟨
11	Include maritime sector in Emissions Trading Scheme (ETS)	EU institutions	Revision of the European ETS will allow the EU to consider inclusion of the maritime sector in the ETS, to incentivise take-up of alternative fuels in shipping.	🟥
12	Ensure effective pricing of aviation in ETS	EU institutions	Reducing the number of emissions allowances allocated for free to the airlines will encourage fleet renewals and use of sustainable aviation fuels and help reduce emissions from aviation.	🟨
7	Boost automation in freight transport	European Commission	EU funding should scale up for demonstrator projects in automated barges and truck platooning, to boost efficiency in maritime and road transport.	🟨
13	Incentivise production and use of sustainable fuels in maritime and aviation sector	EU institutions	The planned Refuel EU maritime and aviation initiatives should reflect the ambitions for decarbonising transport by providing robust incentives for production and use of alternative fuels.	🟨
14	Reinforce investments in battery development	European Commission	Investments in development of battery technology as an enabler for electrification of transport should be bolstered, to allow improvements in range in road vehicles and applicability to aircraft and vessels.	🟨
15	Boost alternative fuel infrastructure development	EU institutions, national authorities	The planned review of the Alternative Fuels Infrastructure Directive will provide an opportunity to set ambitious targets for developing alternative fuel infrastructure and to provide supporting measures to ensure sufficient coverage on European roads and cities and inland and seaports. Particular consideration should be given to infrastructure for charging and refuelling electric and alternative fuel trucks and buses, as well as hydrogen. EU funding for development of infrastructure should be reinforced to achieve sufficient coverage in light of the accelerating take-up of electric vehicles and development of electric heavy duty vehicles.	🟨
16	Ensure efficient air traffic management	EU institutions	An ambitious review of Single European Sky rules should take into account the revised climate targets, to accelerate to streamlining of air traffic routes and help cut emissions.	🟨
17	Review tax exemptions to maritime and aviation fuel	EU institutions	The planned review of the Energy Taxation Directive should include consideration of measures to reduce fragmentation and levelling the playing field for transport modes.	🟥
18	Increase investments in alternative propulsion technologies	European Commission	The EU should increase funding for research and development of methane, hydrogen fuel cell and electric ships, hybrid and electric aircraft, including new designs such as distributed propulsion and for retrofitting ships to run on LNG.	🟨
19	Sustainable transport in national recovery plans	National authorities	National recovery plans should reflect the potential of innovation in the transport sector to drive growth.	🟥

20	Fleet renewals to boost uptake of alternatively fuelled vehicles and more efficient aircraft	EU institutions, national authorities	EU and national authorities should support and incentivise fleet renewals by road freight operators and airlines.	🟨
21	Incentivise introduction of zero and low-emission vehicles	EU institutions, national authorities	The planned revision of emission performance standards should ramp up incentives production of zero and low-emission vehicles. National and local authorities should increase incentives for purchasing zero and low-emission vehicles.	🟨
22	Improve resilience of the transport sector to health crises	European Commission	Research should be undertaken in regard to options to bolster resilience in transport sector, including how to improve resilience of key transport sector enterprises to demand shocks and how to harmonise rules to provide key worker status and related guarantees for transport sector workers.	🟥
23	Ensure movement of essential transport services in health crises	European Commission, national authorities	The Commission and Member States should investigate long-term solutions to guarantee free movement of essential goods across intra-EU borders in case of a recurrence of pandemics.	🟨
24	Address impact of reshoring manufacturing on transport	European Commission	Research should be carried out in regard to potential changes to the transport sector, transport infrastructure demand and emissions in relation to a possible surge in diversification of reshoring of supply lines and changes to the 'just-in-time' supply model.	🟥

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