OliverWyman Forum

New Mobility Solutions For A Fragmented World

Human beings have a natural propensity to "truck, barter, and exchange one thing for another," Adam Smith observed in "The Wealth of Nations" almost 250 years ago. Mobility and transportation have been essential elements of that activity, connecting merchants and customers, allowing commerce to flourish, and helping raise living standards around the world.

Today's transport systems, of course, bear little resemblance to the barrows and buggies of our commercial past. Customers nowadays are offered an array of choices of mode (See Exhibit 1), destination, time, and service level. Commuters from Queens, New York, traveling to work in midtown Manhattan can use their own cars or a combination of taxis, car-hailing services, and e-scooters, as well as traditional buses, commuter trains, and the subway. The plan might change from day to day, and even mid-journey. Such customization can make the moving of people and products extremely complex to engineer and serve reliably at an affordable cost.

Fragmentation is one of the greatest challenges modern transportation businesses face today. Mobility value chains are converging around customer preferences — ranging, for a single logistics operator, from single-consumer urban shopping trips to multi-leg industrial component deliveries or leisure trips using a variety of transportation modes including rail, road, air, and sea.

And yet it's likely that still more changes will occur in the next 10 years than the last 100, as artificial intelligence continues to expand and Generation Z — who have different attitudes toward mobility than previous generations — account for a greater share of consumption. One structural, user-driven change already underway is many city dwellers' gradual abandonment of car ownership for shared vehicles, whether self-driven or through ride-hailing apps. But that's only the beginning. A selection of 13 new mobility services, complementary to public transport, will grow globally at an average of almost 10% a year over the current decade to reach $660 billion in 2030, according to a recent study by the Oliver Wyman Forum and the Institute of Transportation Studies (ITS) at the University of California, Berkeley.

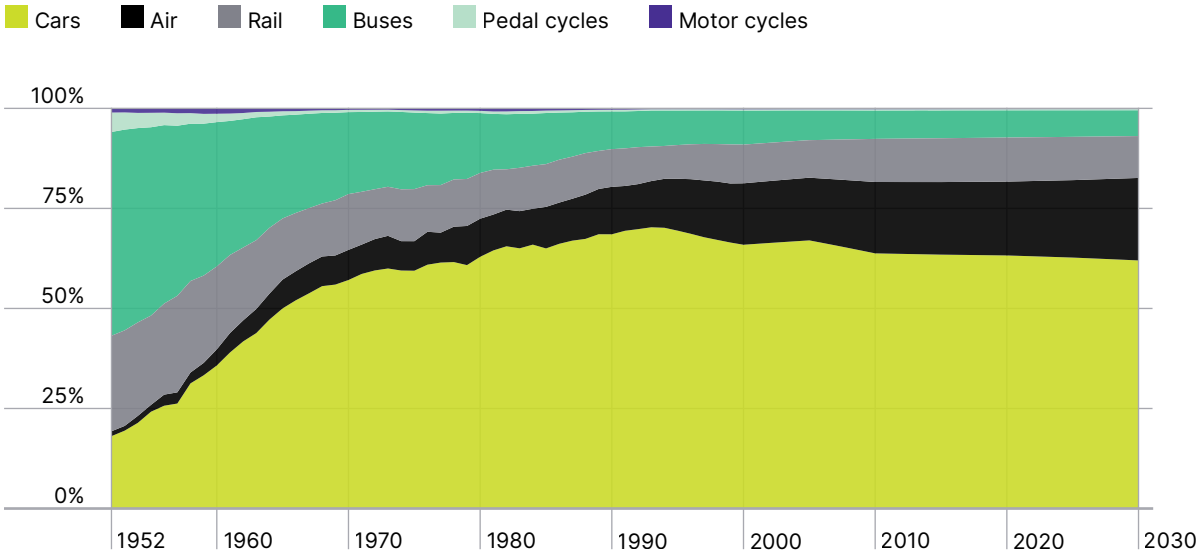
This paper provides a guide to the changes being unleashed and the implications for the long-term evolution of the mobility sector. It is based on interviews with more than 30 executives, experts, and financiers in a variety of global transport businesses,

complemented by research and insights from the Oliver Wyman Forum. The interviews covered trends and disruptions that I have both witnessed and helped shape over my three-decade career in transportation consulting. These conversations provided lessons on demand, regulation, strategic technology, governance, and leadership as we looked back over the recent past and toward an exciting future.

The findings point to potential winning solutions for transport operators, which in many modes have long struggled to sustain positive return on capital employed. Other critical questions include where value in mobility is migrating to and how far it is possible to decarbonize transport, the world's second biggest source of greenhouse gas emissions. A longer version of this paper will soon appear in book form.

Exhibit 1: Despite recent erosion, cars still dominate

Global modal split evolution (percentage share of each mode, 1952-2030)



Source: Oliver Wyman analysis

How infrastructure and technology have driven mobility growth

More than in most other industries, mobility systems are based on long-lived assets. Fixed infrastructure such as highways and rail lines can last 50 years or more, while aircraft and rail vehicles may have 30- or 50-year lifecycles. That implies large-scale investment, long-range planning, and an anticipation of the demand for and location of future residences, business centers, industrial zones, and goods flows. The US Congress first funded roadways in 1916, and by 2020 the Interstate Highway System had a total length of 78,465 kilometers. Europe now has about 75,000 km of motorway and China 130,000 km.

High-speed rail accompanied the rapid economic growth of the post-World War II era. Japan pioneered the shinkansen, or bullet train, in the early 1960s. France, meanwhile, developed a long-term high speed rail plan during the country's prosperous 1970s. Its Train à Grande Vitesse (TGV), a high-speed train produced by Alstom, offered an alternative to air travel and road traffic, which was exploding at that time. Electrification was becoming a priority in the wake of the first oil crisis in 1973. The new train cars were more rigid and less flexible, increasing stability, onboard comfort, and speed. To support commercialization, French rail operator SNCF acquired a license from American Airlines for a reservation and dynamic pricing system and adapted its distribution and yield management technologies to fill seats at the best possible prices. (This was well before low-cost airlines became a Europe-wide phenomenon). Similar high-speed rail systems are in place today in many European countries, with some variations — as well as in China.

In this century, China's Ministry of Railways has drawn up a multidecade plan to develop a high-speed rail network. Though TGV was considered the segment leader, Bombardier of Canada won an initial contract with a platform its Europe-based engineers had built for Swedish railways. It adapted this to the immediate demands of the Chinese plan, initially building new track for trains to run on at up to 200 kph. Bombardier subsequently developed a very-high-speed train platform, Zefiro, that reached speeds of up to 350 kph.

The first service from China Railway High Speed dedicated to passengers — the

Beijing-Tianjin intercity service — opened in 2008. China's network now covers 40,000 km, making up around 60% of the world's high-speed track. Building on this technology acquired and transferred from Europe, China is now presenting itself as a provider of high-speed rail systems to export markets.

But traditional mobility projects need long-term planning

High-speed rail is a prime example of a greenfield project. It requires dedicated infrastructure and rails, which need stable, long-term government support and financing. This is typically more easily available under a long-reigning consensus that the benefits are worth the huge costs, which go beyond financial to include environmental impact and the legal complications of compulsory land purchases. This is much easier to achieve in countries with little political alternation and centralized governments that implement long-term decisions from the top down.

Such conditions exist in state-controlled countries like China, as well as some emerging economies. Saudi Arabia, for example, is planning Neom, a futuristic city in the desert that will be made up of a number of regions and is slated for completion by 2030. It will feature a floating industrial complex, a global trade hub, tourist resorts, and a linear city — all powered exclusively by renewable energy sources.

But Western democracies tend to have shorter governance cycles, often leading to changing transport priorities, policies, and regulations. Usually, a number of groups come out in opposition: Political opponents claim the investment is unaffordable, competing modes lobby to halt the development, and environmentalists and property owners point to the damage the construction will cause. As a result, those governments find it hard to plan transport infrastructure over a very long period. Most senior practitioners interviewed said this is at the core of their leadership challenge. North America's struggles with high-speed rail are a case in point. Europe, too, has been plagued by stop-go projects, amid concerns over the environment, financing, city planning, and other issues.

Making matters trickier, in nations with dense cities and transport networks, a large number of new projects are "brownfield": They are constructed on top of — or around — existing structures. That is a far greater engineering challenge than building from scratch ("greenfield"), because projects have to take account of the complexities of current and legacy infrastructure. These projects can lead to multiyear disruptions to legacy systems, as experienced with the "Grand Paris" program or Toronto's GO Expansion project.

Common standards can unite networks

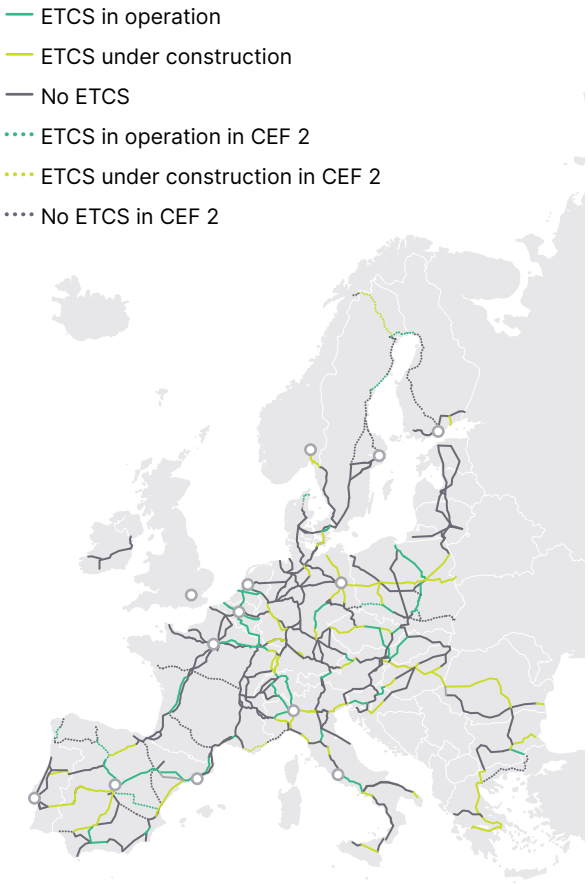
Legacy norms and standards are another form of brownfield problem, because they can prevent continent-wide or trans-continental services from emerging. Each European country, for example, has developed its own rail infrastructure and signaling system to ensure the safety of services, in part for reasons of national security — so that other invading countries could not easily use them in the event of a war — and in part to protect national markets. There are currently about 30 legacy signaling systems across the continent, and they are not interoperable. This has made international services less reliable and competitive in Europe.

Nations have made some temporary fixes, such as freight freeways in the early 2000s, in which interfaces and tariffs are coordinated among as many as seven countries to make possible a through international service — for example from Stockholm, Sweden to Bologna, Italy, a journey of 7,000 km crossing four borders.

To make rail seamless and competitive over the long term, the European Commission is pushing the single European Train Control System (ETCS). (See Exhibit 2.) It aims to deploy the equipment over 67,000 km of main rail corridors and a total of 123,000 km of track by 2050. To support it, the EU budget allocated approximately €3.9 billion between 2007 and 2020. But this EU funding can cover only a limited amount of the overall cost, and many infrastructure managers lack an individual business case to invest in ETCS equipment, as there is no immediate domestic benefit for them. As a result, less than 20% of European core routes have been equipped with ETCS so far. (See Exhibit 3.)

Exhibit 2: Deployment of the ETCS standard is still low

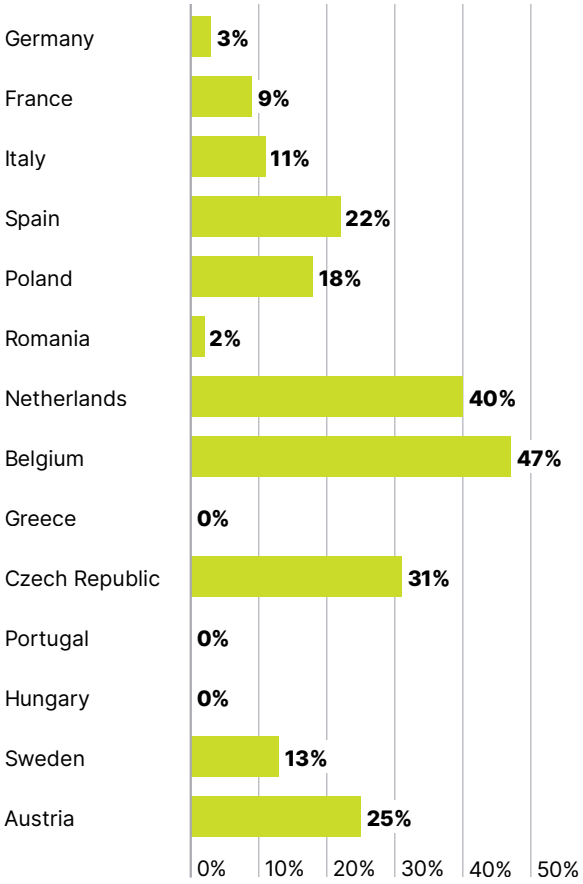
The map shows the current (as of June 2022) status of the European Train Control System (ETCS) deployment on the European core network corridor (CNC). The dotted lines are those added to the CNC by the CEF 2 (Connecting Europe Facility) extension



Source: European Coordinator for ERTMS (work plan 2022)

Exhibit 3: ETCS deployment varies widely by EU member state

Current ETCS in operation (km) as percentage of length to be equipped by 2030 (km)



How digital technology has transformed demand

Demand is also fueling competitive intensity, leading to fragmentation in mobility. In the past, technology pushed new services by creating new ways to transport people and goods faster, more safely, and in greater numbers or volumes. It was mostly a supply-driven market environment.

Now, digital innovators have reversed the value chain and put the end-customer first. They offer customers an array of choices, and parts of the journey can be carried out by a variety of modes and service operators, at different speeds and via a choice of routes. In the past, a traveler from the outskirts of Paris wanting to go to the island of Sylt in Northern Germany would have needed a travel agent to book a taxi, flight, train, and boat — by phone or multiple single-mode booking systems — with many operators and few itinerary choices. Today, travelers can do this by themselves in just a few clicks, and they have access to multiple itinerary and modal options.

Similarly, an online shopper can often choose from among multiple delivery options — to home or a pickup point, express or standard — at significantly different prices. The unprecedented personalization can make each shipment or trip complex to engineer and serve. A significant part of the value-added in the shipment lies in the coordination of choices, and the price paid by the end-customer is split among the operators that implement the delivery, hence often commoditized.

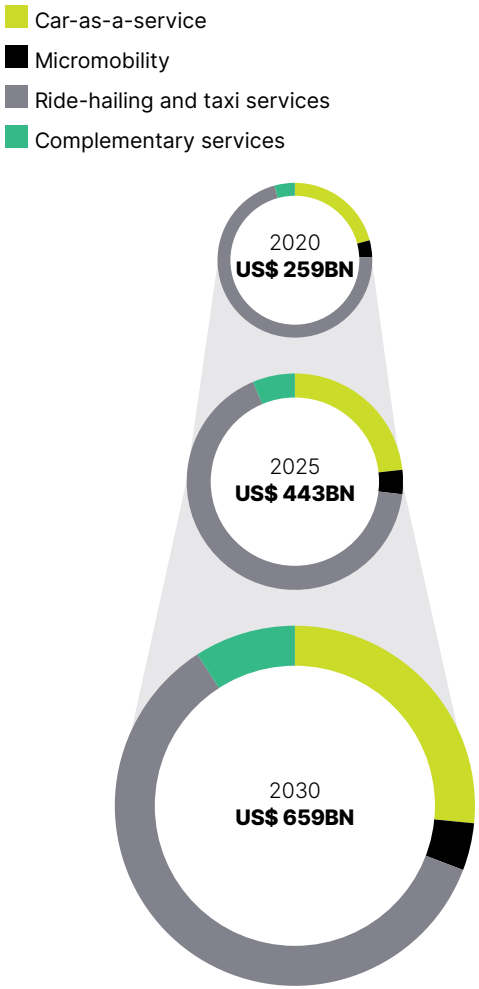
The trend toward personalization will likely increase, as Generation Z accounts for an increasing share of overall consumption. Nearly 60% of Gen Zers surveyed said they enjoy seeing and being offered personally relatable content on social media, according to Oliver Wyman Forum research.

Mobility's new era of digital solutions

Digital technology also represents an increasingly critical enabler for transport operators, helping them navigate complex value chains. It integrates components that were disjointed, coordinates various modes, and helps

Exhibit 4: Ride-hailing and car rental lead a selection of new mobility services

Global value pool sizes by mobility service



Source: Oliver Wyman Forum mobility value pool analysis

predict demand and capacity availability. Digital technology thus makes possible new customer propositions, improves the end-to-end experience, and reduces costs. It presents an opportunity to improve service levels and economics by bridging the gap from legacy infrastructure and operators to new services.

One example is the predictive models guiding last-mile logistics delivery, allowing operators to forecast a tight delivery time window and therefore alerting the end-receiver and preventing a delivery miss — a huge cost saving for the operator combined with impressive customer experience.

Ride-hailing and car sharing, on the passenger side, are conceivable in a world without apps or internet — and services such as car rental and cabs reserved by phone have existed for decades. But apps make it far easier to dynamically manage inventory and bookings, and shared cars make use of onboard computers to record distance and time traveled and thus calculate the price of a trip in real time. The global ride-hailing and taxi market is expected to almost double from its 2020 level to $347 billion in 2030, according to Oliver Wyman Forum analysis.

Car sharing is forecast to more than triple, to $24 billion. (See Exhibit 4.)

Major incumbents are now also gradually taking advantage of digital solutions, resulting in a convergence of the legacy and new mobility services. RATP, which runs public transport in the Paris region, invested in carpooling company Klaxit in order to complement its existing operations. Discussions are ongoing toward potential combination between Klaxit and Blablacar, which pioneered carsharing and has more than 100 million members, mostly in Europe and Latin America, and has a service for commuters called Blablacar Daily.

In high-speed rail, SNCF's distribution channels for passenger rail services were threatened in the early 1990s by disintermediation from online reservation services. At the same time, SNCF was challenging airlines with the 1993 launch of cross-channel service Eurostar. Global distribution systems had hit the airline industry two decades earlier, and the likes of Amadeus, Galileo, and Sabre were thriving. In partnership with online travel distributor Expedia, SNCF set up a separate digital technology unit to develop a direct online sales channel, voyagesSNCF.com. Now called SNCF Connect & Tech, it has become one of Europe's top online commercial sites, with €4.5 billion of sales in 2021, accounting for more than 60% of TGV sales and targeting as much as €6.5 billion by 2025.

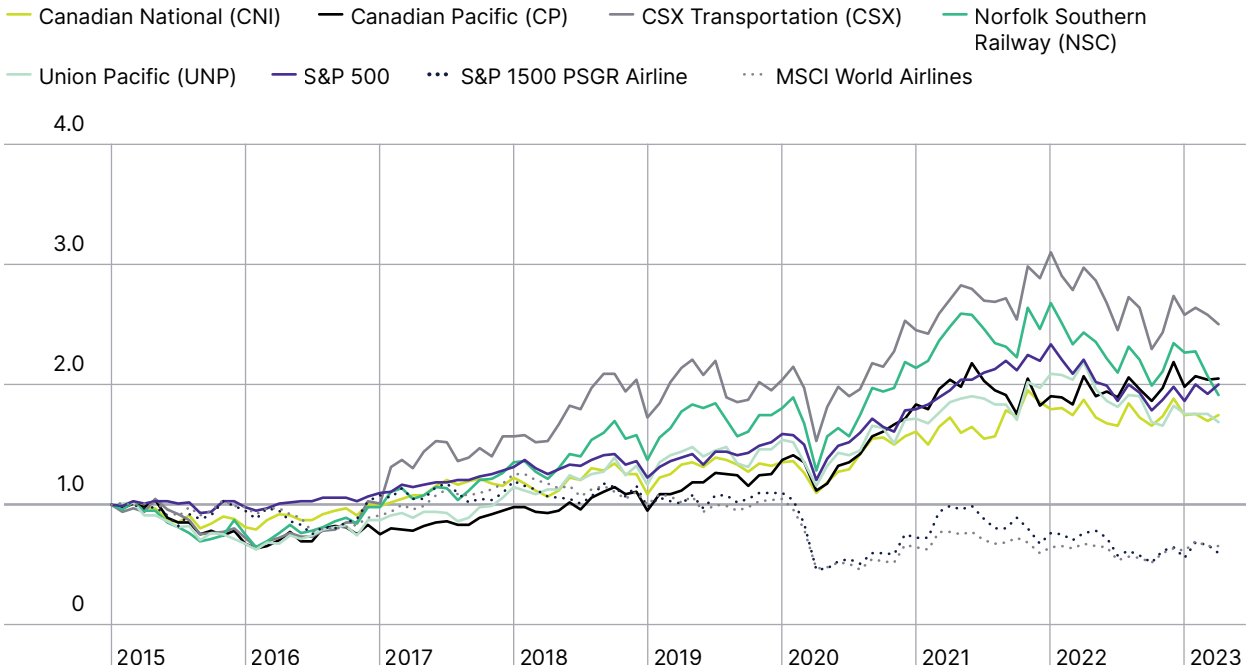
SNCF's TGV business came under threat too, as digitization bolstered low-cost services. Low-cost carrier flights, shared cars, and liberalized bus services after 2015 were permitted to serve long-distance intercity routes within France. To compete, SNCF in 2016 launched a low-cost, high-speed rail brand Ouigo ("Yes, go"), which leaned heavily on digital capabilities. Booking and ticketing were online-only, removing the costs of station sales desks, call centers, and travel agents. The cost of selling a ticket fell from more than €10 to less than €4. Digital monitoring of train components enabled predictive maintenance, reduced maintenance costs, and sharply increased the utilization of rolling stock. Ouigo became competitive in a price-sensitive market segment, and in 2018 SNCF set up a Spanish version, Ouigo España, which now operates in Spain's liberalized long-distance rail market.

Freight and parcels are also poised for a digital revolution. Today, some of the world's most profitable transport operations

may be found in parts of the North American Class I freight railroad industry, which earn their cost of capital or more, through a competitive yet oligopolistic ecosystem. They can thus re-invest billions of dollars annually in their networks to remain a vital backbone of the North American economy and trade. (See Exhibit 5.) In the future, autonomous-driving technology will let digitally connected trucks travel in combined fleets, increasing their freight density and reducing freight railroads' current cost advantage to motor carrier driver costs. That, plus the ability to serve

Exhibit 5: Class I railroads were resilient during Covid

Class I stock price performance indexed (Index: Base 1.0 in January 2015)



Source: Publicly available stock price data and Oliver Wyman analysis

point-to-point freight movements, could help trucks take market share from the currently profitable Class I railroads, especially in highly contested merchandise and intermodal segments.

The mobility sector is still just scratching the surface of digital technology's potential, especially in integrating legacy and new service providers, increasing and taking advantage of automation, and responding to customer demands. The sources of value are continuing to shift. The number of mobility startups increased 15% a year between 2007 and 2017, and in 2020 they attracted investment of $40 billion. The world's top technology firms, post-pandemic, are continuing to invest billions of dollars in mobility and autonomy projects, suggesting greater innovations in the years to come.

$40 billion

was invested
in mobility startups
in 2020

NET-ZERO TRANSITION

Will The Net-zero Transition Trigger A Mode Shift?

Transportation is the second largest source of greenhouse gas emissions after the energy sector, representing around a fifth of the global total, and all modes of transport are under pressure to decarbonize. But the shift will be uneven, raising questions: Will the energy transition simply mean a switch to new kinds of motor? Or will it also benefit those modes of transport that transform fastest?

The adoption of electric cars has been slowed by their price and the need for recharging infrastructure. But a push from regulators — especially in Europe — is expected to help them replace fossil-fuel vehicles in the coming decade or two. In rail, diesel is still used on 45% of Europe's network, but it will be replaced by electrification and alternatives: Battery-powered trains can now travel about 100 km on a single charge, and hydrogen-based fuel-cell locomotives up to 1,000 km.

But air and sea travel are still highly dependent on fossil fuels and hard to electrify, due to the weight of batteries needed to power large vessels and aircraft over long distances. Air travel in particular, is extremely carbon-intensive, and there are often lower-emitting substitutes available – sea transport in the case of freight and high-speed rail for some passenger routes.

That's already having an impact, at least in Europe. The French government has prohibited passenger flights on routes with few long-haul connections and where the equivalent rail trip is under about 2.5 hours. That has ended domestic point-to-point air traffic from Paris Orly Airport to Nantes and Bordeaux. Generation Z are highly sustainability conscious, and recent Oliver Wyman Forum research suggests that many would swap air travel for a longer journey by electric train. Further impact could come if carbon regulations raise the cost of flying.

Aviation has a rich history of technology innovation. Aircraft manufacturers have improved the aerodynamics and reduced the weight of aircraft, significantly cutting energy consumption. But these efficiency gains are not yet nearly enough to reduce the sector's total emissions: Global traffic has been

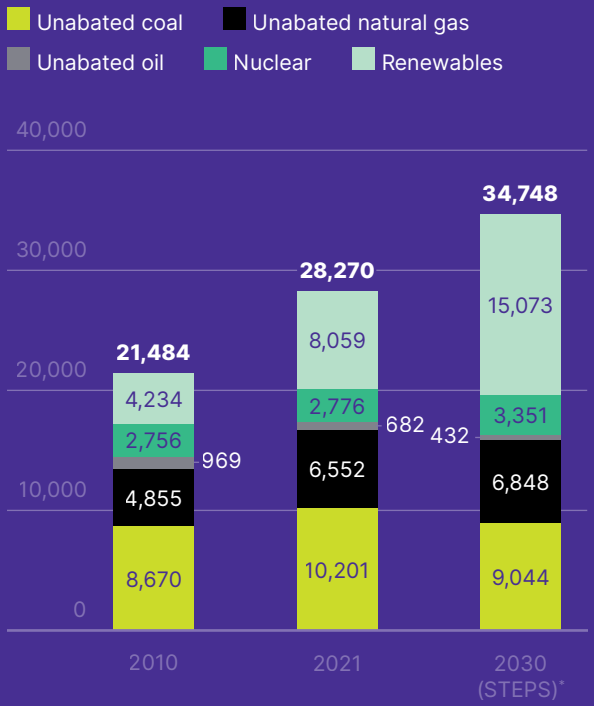
doubling every 15 years, a trend that is expected to be maintained.

While airlines have agreed to achieve net zero by 2050, a sustainable solution requires new technologies and alternative fuels, which are not yet in commercial use. The first electric aircraft will emerge before the end of 2025, but they will be limited in capacity and range. Fuel cells face questions over commercial viability: Hydrogen is expensive to produce, transport, and store, and it is also highly inflammable.

One way forward, practitioners suggest, could be an expanded R&D plan for alternative fuels and aircraft design, which would likely need substantial government funding. The administration of US President Joe Biden called in 2021 for sustainable aviation fuel (SAF) production of 3 billion gallons a year by 2030, to reduce aviation emissions by 20%. The EU wants 20% of fuels used at its airports to be SAFs by 2035. In the meantime, some long-haul freight might shift to the sea, while passengers increasingly take trains.

Exhibit 6: Renewables expected to overtake unabated coal as main source of electricity by 2030

Global electricity supply, in TWh per year



* STEPS: Stated Policies Scenario

Source: IEA (2022 World Energy Outlook)

CONCLUSION

Digitally accessed services define the new era of mobility

The biggest transformations in mobility used to come from large greenfield, or subsequently brownfield infrastructure developments, which followed long-range planning and were often part of the early development of a continent, country, or city. Today, mobility modes are increasingly intertwined, and demand is satisfied through digitally enabled intermodal connections. To support this integration, mobility coalitions will become more numerous, and digital technology will provide more choice and greater personalization.

Despite strong growth in micro-mobility and other new forms of transport, traditional road and rail modes will remain the backbones of mass transit systems. But digital technology will boost capacity: Connectivity will enhance intermodal connections, lowering journey times. And vehicle sharing will use road vehicles more efficiently, so that fewer are needed, and they take up less space in cities.

Alignment between governments and the private sector will become more important to secure funding and coordinate new infrastructure and services. The mobility ecosystem is also expanding to include renewable energy providers that power green transport equipment. Climate and sustainability requirements will be critical to lead mobility toward net-zero emissions.

One consequence of the changes will be shifts in the sources of value. End-customer data will become increasingly sought after, and control of them will steer market power. Infrastructure will define services less than in the past, and ownership will be replaced progressively by transaction-based asset sharing.

One thing will remain constant, though: Demand for passenger and freight mobility will continue to grow, and ports, cities, regions, and countries will continue to experience social and economic impacts. “Mobility generates value and economic growth, whether it is supporting daily commutes to the workplace or enabling people to work better globally as teams,” said the CEO of one leading global engineering and construction company. “Mobility is an essential need for human beings, and this fact is pretty stable in space and in time.”

Gilles Roucolle

Managing Partner, Co-Head of Europe

Gilles, who co-heads the European Region from Paris, sees his work as a logical outcome of his background. “I am a consulting lifer,” he jokes. “My engineering background awakened in me the intellectual curiosity and analytical skills that are necessary in consulting. This — together with an international MBA, which provided international exposure along with business acumen — has served me well in my role.”

With three decades of experience under his belt, most of Gilles’ client work is focused on transportation and transportation equipment manufacturing: He’s undertaken multiple high-stakes strategic and operational assignments in virtually all modes of transportation, including freight and passenger railroads, airlines, logistics, postal, shipping, and rail and aerospace supply. He has also worked on projects for financial institutions. “Moving passengers or moving goods is what my clients do, and it is now my 31st year serving clients in that space,” Gilles says.

Firms look to him for help in solving their most pressing and difficult problems, including operations strategy and management, M&A, post-merger integration, business strategy, and restructuring. “People seek me out for the trust they have in me as a person, in the capabilities and sector expertise of our transportation and services team, and for the total commitment we have demonstrated to them over many years.”

Beyond delivering a good business result, Gilles is passionate about mentoring the people around him and watching them succeed. “Seeing consultants I have hired, developed, or groomed being promoted to partner at the firm has been very meaningful to me.”

An upcoming book: “30 Years of Mobility”

To celebrate his 30th anniversary as a mobility advisor, Gilles Roucolle talked to 30 of the most influential transportation executives and experts he has worked with over the years in order to write a book. It will combine these interviews with research from the Oliver Wyman Mobility Forum and Gilles’ own experience. Gilles provides a perspective on the future of mobility, spanning all transport modes and all continents in the light of trends and challenges in contemporary technology and society.

The book will present new mobility concepts, such as the fragmentation of demand, the critical need for long-term infrastructure planning, and the shift from supply-driven to demand-driven growth.

It will also consider the role of regulation and standards in mobility sector growth, digitalization as a critical enabler to integrate the mobility value-chain, and the emergence of cross-industry coalitions. Other themes will include the decarbonization agenda and its potential impact on modal shares of transport and the effect of the COVID pandemic on the industry’s trajectory.

The book will feature observations and quantitative analysis, punctuated by reflections and quotes from 30 industry executives, including:
Bernard Amory, Alexander Bayen, Olivier Brousse, Paul-Marie Chavanne, James Cherry, Deepak Chopra, Barbara Dalibard, Alexandre De Juniac, Joris D’inca, Josef Doppelbauer, Rupert Duchesne, Xavier Huillard, Marc Ivaldi, Mark Joseph, Andrew Lezala, Pierre Lortie, Jean-Pierre Loubinoux, Frederic Mazzella, Jean-Marie Metzler, Andre Navarri, Guillaume Pepy, Hugh Randall, Adrian Slywotzky, Guillaume Thibault, and Laurent Troger.

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Gilles Roucolle

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About the Oliver Wyman Forum

The Oliver Wyman Forum is committed to bringing together leaders in business, public policy, social enterprises, and academia to help solve the world's toughest problems. The Oliver Wyman Forum strives to discover and develop innovative solutions by conducting research, convening leading thinkers, analyzing options, and inspiring action on three fronts: Reframing Industry, Business in Society, and Global Economic and Political Change. Together with our growing and diverse community of experts, we think we can make a difference.

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