

McKinsey Center for Future Mobility

Mobility's rebound: An industry recovers, but where is it heading?

Although the COVID-19 pandemic is far from over, mobility has returned to precrisis levels. But the industry faces changes in consumer preferences, technology, and regulation.



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The automotive and mobility industries have been among the hardest hit during the COVID-19 pandemic, yet mobility has recently reached precrisis levels again in many regions of the world.

While international travel is recovering slowly, regional and everyday mobility is returning to pre-COVID-19 levels. However, the situation remains fragile amid the ongoing pandemic, and the mobility industry must now navigate an emerging and potentially very different “next normal.”

This year has been characterized by uncertainty for not only the end user but also individual companies, first and foremost through a supply-chain challenge unseen in recent years. The supply of semiconductors—a central component to nearly every vehicle on the road today—has been shaky, with the auto industry being hit particularly hard. Moreover, sustainability and the decarbonization of the overall supply chain calls for a significant overhaul of existing industry processes and structures.

Yet 2021 has also been a year of unforeseen momentum for the mobility industry on several accounts: new forms of cooperation for expanding into adjacent areas of the supply chain are at the top of many board agendas, and there are a number of examples of newly found confidence in the move to the next normal in mobility:

- Disrupters launched long-anticipated models (for example, Lucid delivered the first batch of its Dream Edition vehicles in the fourth quarter of 2021) and aimed for strong IPOs (Rivian, for example, had a \$90 billion valuation at the company’s opening day in November).
- Chinese OEMs entered Europe confidently (for example, NIO launched in Norway at the end of September; similarly, Aiyas, BYD, Dongfeng Motor, Great Wall Motor, and SAIC Motor also entered Europe).

- Advanced air mobility saw a massive surge in investments, amounting to almost \$6 billion by October 2021.

What’s more, there were several acquisitions in the shared-micromobility space this year, totaling nearly \$700 million.

This tremendous momentum can best be observed in the solidifying shifts in consumer preferences, technologies in the market, and regulatory actions around the globe:

- **Consumer:** Mobility demand is picking up again, and many consumers around the world are beginning to travel more. However, about half of the consumers in McKinsey’s recent Global COVID-19 Automotive & Mobility Consumer Survey stated a clear preference to travel less than they did before the COVID-19 pandemic. Additionally, consumers’ mobility preferences going forward, including which modes of transport they choose, will also look different.
- **Technology:** New innovations in ACES (autonomous driving, connectivity, electrification, and shared/smart mobility) technology are back in play, with \$70 billion invested in the first half of 2021 alone. Meanwhile, the industry is wrestling with several challenges, from missing semiconductor chips to realizing net-zero vehicles.
- **Regulation:** Major world regions have set ambitious goals for decarbonization—for example, the European Union’s “Fit for 55” plan—that will require a holistic mobility shift from cars to other means of transport. Moreover, on the local level many cities are pushing ahead with stricter regulations on car usage.

Consumer behavior

While mobility overall is gradually recovering, not all modes of transport have returned to pre-COVID-19

levels in all regions. Usage of shared-mobility services and public transit is picking up significantly around the globe, but the recovery is slower in regions where commuters continue to work more from home. The following are some of the key findings around consumer behavior from the global mobility survey:

- About 51 percent of global respondents said that they intend to travel less than they did before the pandemic. However, mobility is increasing gradually and at different rates in certain areas, with the fastest recovery occurring in the United States.
- The regular use of public transport has picked up significantly compared with late 2020. Shared modes of transport (especially micromobility services) are now above pre-COVID-19 levels.

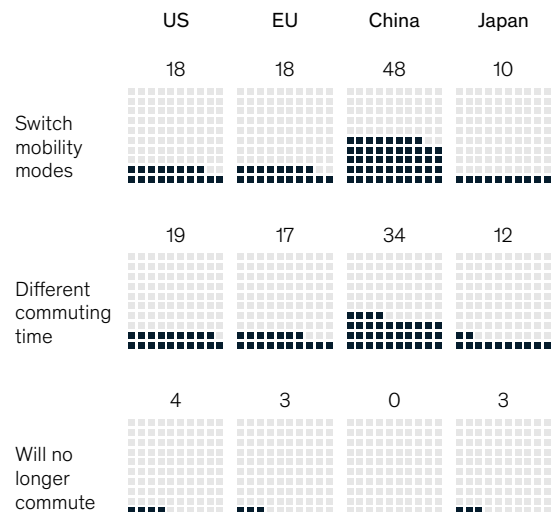
- Public transport and shared-mobility modes are considered more or less safe again with regard to COVID-19 infection.
- The frequency of commuting trips is recovering at different rates. Around the world, expectations differ about commuting patterns and workplace scenarios in the next normal (Exhibit 1).

Since the start of the pandemic, private transportation has been the preferred mode of mobility for many people around the world. This trend is still observable through 2021, although shared modes of transport have gained market share again. For instance, micromobility options—both shared and owned smaller vehicles, from e-kickscooters to e-bikes—have recently become more popular as many cities around the globe

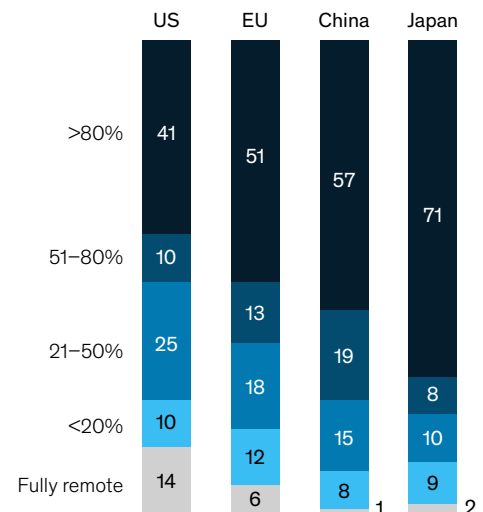
Exhibit 1

Respondents expect different commuting habits and workplace changes in the next normal, depending on the region.

Expected commuting habits, post-COVID-19, % of respondents



Expected share of time spent at workplace, post-COVID-19, % of respondents



Source: McKinsey Global COVID-19 Automotive & Mobility Consumer Survey, June 2021

have increased their efforts to reduce the number of vehicles. Robo-taxis, the big game changer in shared mobility, have seen pilots in 2021 and will likely gain traction in 2022.

Turning to private cars, there are two interesting developments. First, the electric vehicle (EV) has become more mainstream in 2021, partly the result of a wider range of available models, more consumers preferring greener options of transport, and greater public support for buying EVs. This trend is gaining speed. In September 2021, the best-selling car in Europe was, for the first time, a battery-electric one. And one pure EV player announced profit margins that have so far been seen only in the sports-car segment of the automotive industry. By 2035, the largest automotive markets in the world will be fully electric (Exhibit 2).

The second development relates to new forms of ownership, which are gaining ground in the

automotive industry. Consumers still value having constant access to a vehicle, so offerings such as short-term leasing and subscription models will see higher penetration levels in 2022.

Technology developments

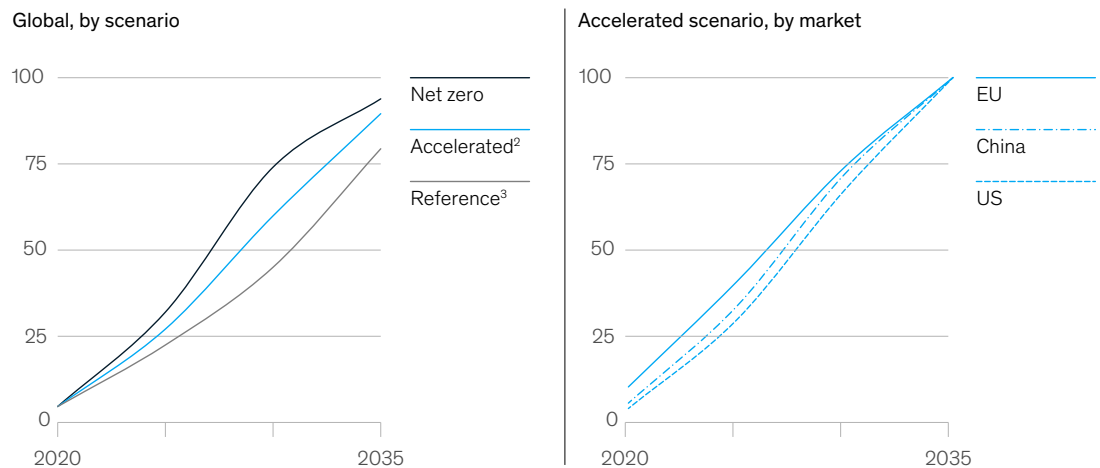
Technology played a substantial role in spurring innovation in the auto and mobility industries in 2021. Investors have poured more than \$300 billion in external investments into mobility technologies since 2010; and after a slight pause in 2020, 2021 has seen significant traction. In the first six months of 2021, almost \$70 billion was invested in mobility technologies, the highest value ever and twice the amount invested in the same period in 2020.

Three technology trends stand out. The first is advanced air mobility, where new and established players are racing to develop and win the market for future-air-mobility solutions. Funding has

Exhibit 2

By 2035, the largest automotive markets will be fully electric.

Electric-vehicle sales as a % of total new passenger-vehicle sales,¹%



¹Includes battery electric vehicles, fuel cell electric vehicles, and plug-in hybrid electric vehicles.

²Most likely scenario under which consumer adoption will exceed regulatory targets.

³Scenario under which currently expected regulatory targets will be met.

Source: EV-volumes.com; ICCT; IHS Markit; McKinsey analysis

accelerated tremendously in the past three years, with hardly a week passing without a new order, deal, or announcement from a special-purpose acquisition company (Exhibit 3).

The second trend, the push into digital-vehicle technology, has also accelerated, both in terms of software and the underlying hardware. As a result, the autonomous-chip market is growing rapidly (Exhibit 4).

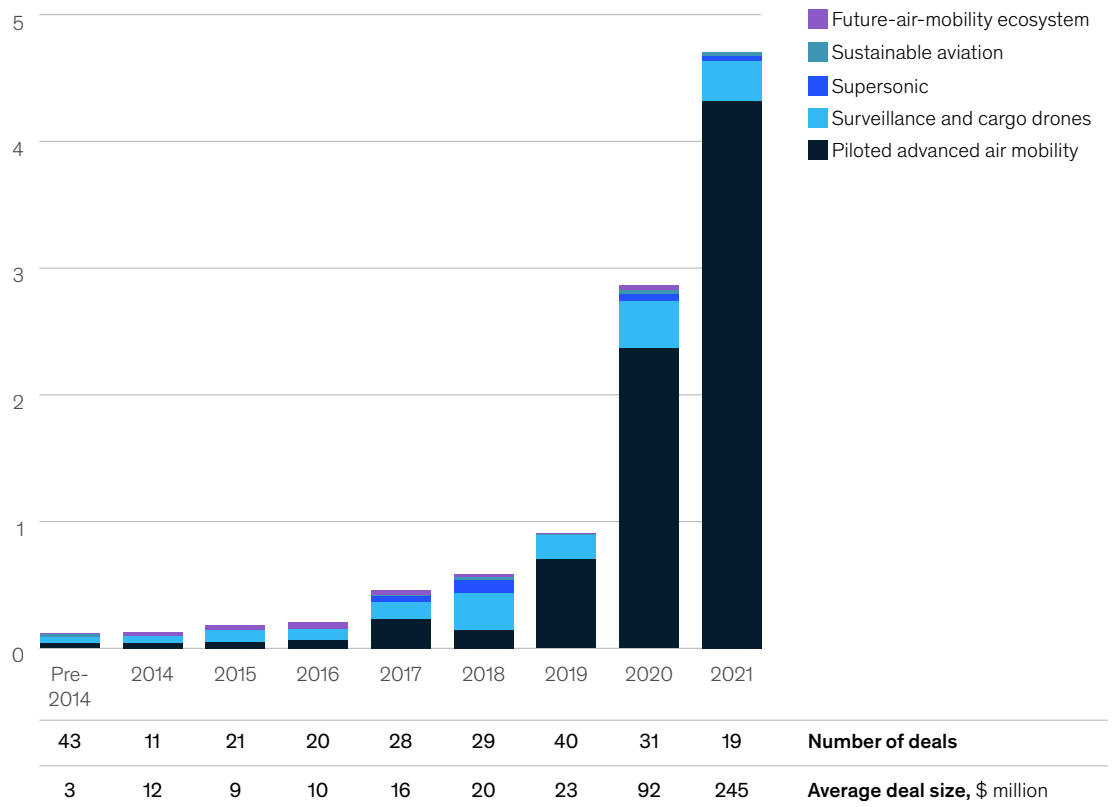
In a related shift, cars are increasingly becoming software on wheels, and the race toward unlocking the value potential from connectivity is also under way. By 2030, nine automotive use cases involving connectivity will have the potential to deliver \$250 billion to \$400 billion in value (Exhibit 5).

The third technology trend involves carbon emissions, since the auto industry has increasingly made decarbonization a priority, with a focus on decarbonizing not only the product (for example,

Exhibit 3

Funding for future-air-mobility solutions has accelerated significantly in recent years.

Total venture capital and attributed R&D funding, and announced SPAC mergers,¹ as of May 31, 2021, \$ billion

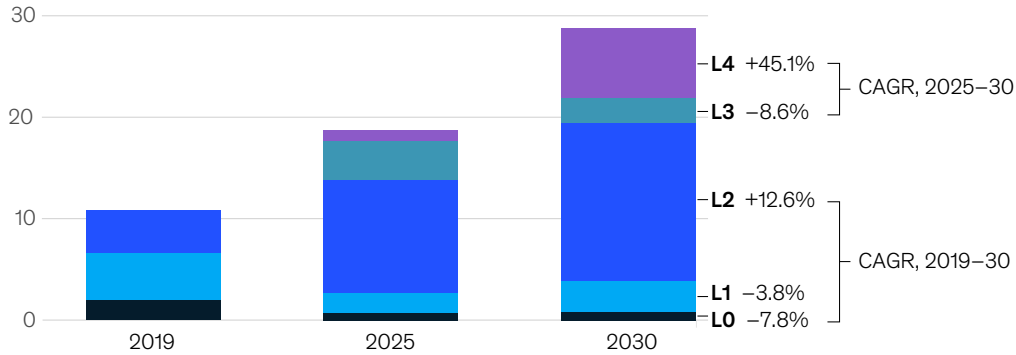


¹Total includes \$1.5 billion in internal investment from Hyundai in 2020. SPAC = special-purpose acquisition company. Source: S&P Global Market Intelligence; McKinsey analysis

Exhibit 4

The autonomous-chip market is expected to nearly triple by 2030.

Autonomous semiconductor market, \$ billion

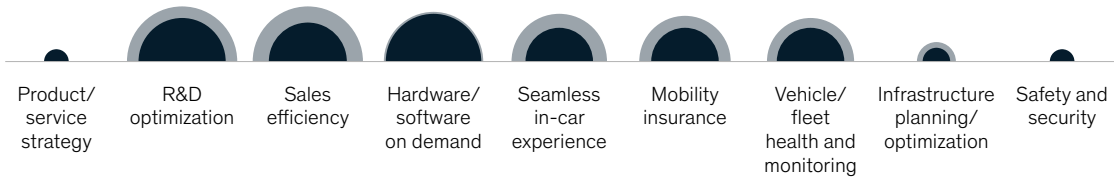


Source: IHS Markit; McKinsey Center for Future Mobility

Exhibit 5

Nine automotive use cases have the potential to deliver \$250 billion to \$400 billion in value by 2030.

Relative value pool in 2030, by use-case cluster



Source: McKinsey Center for Future Mobility

by creating more battery electric vehicles) but also the automotive production process for all vehicles. Efforts in this area could decrease emissions significantly (Exhibit 6).

Regulatory framework

Regulation has and always will remain a major driver for the mobility industries. In 2021, there was a massive acceleration in decarbonization efforts, from the European Union’s “Fit for 55” program

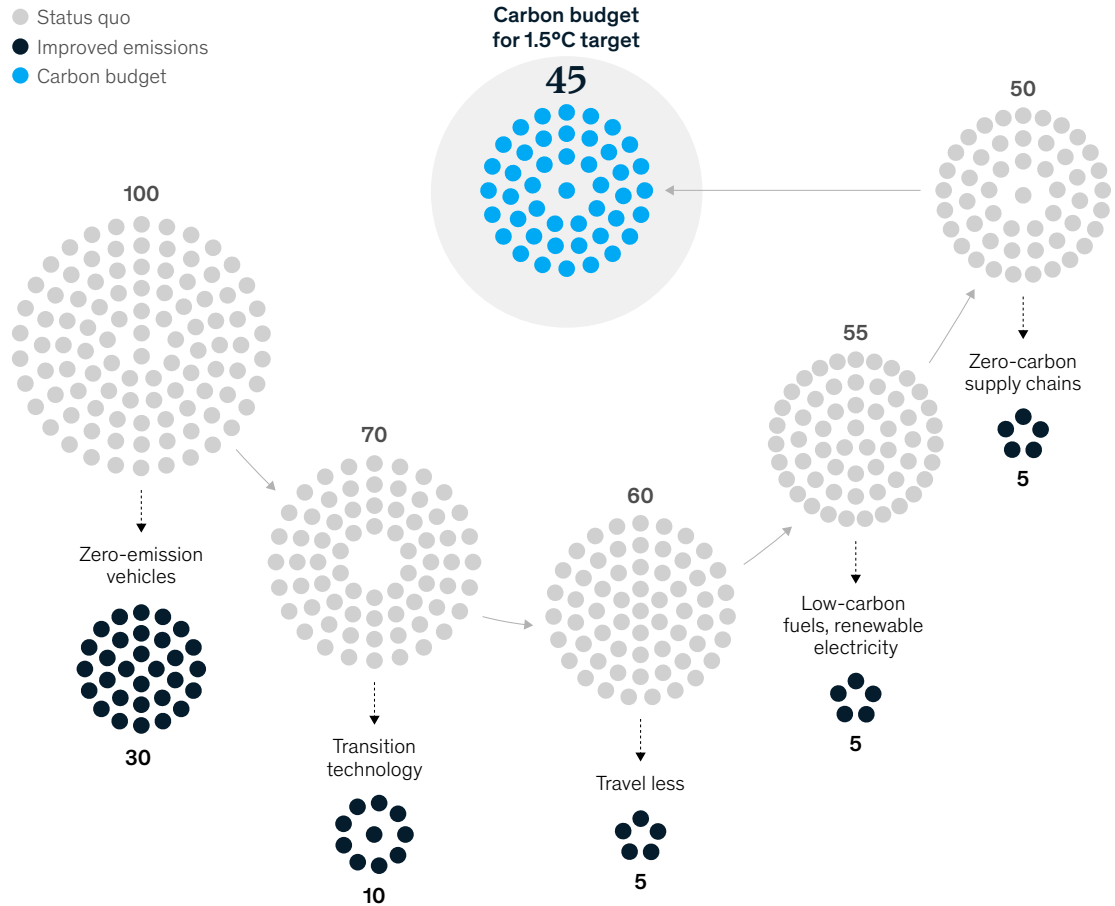
to plans by the new US administration to support the use of EVs. However, decarbonization is not a task for the automotive industry alone; society and regulators need to take a systemic view to get it right—from the battery value chain to charging infrastructure, as well as the needed reskilling of the workforce.

On a more local level, cities have intensified their push to disincentivize individual car usership, as they begin to more actively define their mobility.

Exhibit 6

Mobility players' efforts to reduce carbon emissions can help keep the global temperature increase under 1.5°C.

Cumulative CO₂ emissions from road transport, 2021–50, gigatons



Paris, for example, has announced that it will reduce the number of parking spaces on urban streets by 50 percent. The new mayor of Rome has published plans to increase parking rates and decrease free-parking space in an effort to decrease car usage. Other cities plan to incentivize micromobility—for example, London, which invited companies to bid to participate in e-scooters trials in 2020, or Copenhagen, which has overturned its e-scooter ban after launching new regulation. Moreover, many cities—including Paris, as well as some German

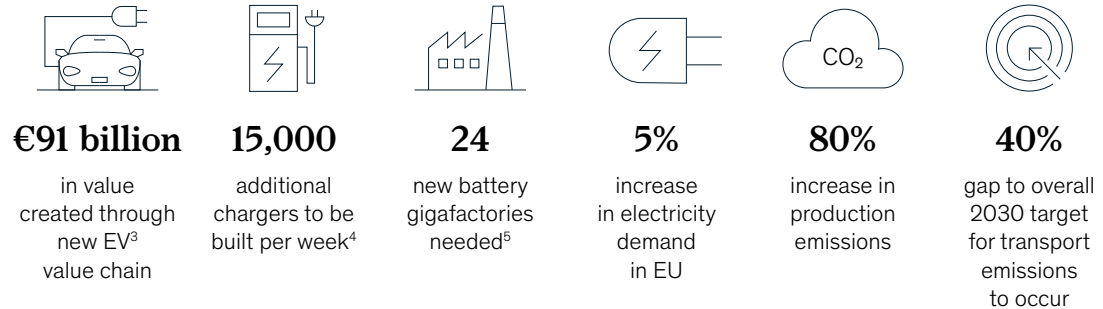
cities and Spanish municipalities—have announced efforts to decrease the maximum speed limit in dense urban areas from 50 kilometers per hour to 30 kilometers per hour.

The increased regulatory focus on climate change, including consumer incentives to purchase EVs, will have wide-ranging effects (Exhibit 7). For instance, more chargers will be needed, and electricity demand will likely increase as well.

Exhibit 7

The e-mobility transformation will disrupt more than the automotive industry.

Accelerated scenario for sales of passenger electric vehicles (EVs), EFTA,¹ 2030²



¹European Free Trade Association.
²Includes battery electric vehicles, fuel cell electric vehicles, and plug-in hybrid electric vehicles.
³Includes electric drive, battery packs, power electronics, and thermal management.
⁴Assumes an ideal EV-charger ratio of 10:1 and refers to public chargers, including chargers in multifamily homes.
⁵Assumes an average gigafactory with annual capacity of 25 gigawatt-hours.
 Source: EU Regulation 2019/631 amendments; McKinsey analysis

Other important regulatory issues involve cybersecurity and software. Mobility players must integrate security into their processes and build capabilities to react quickly to security incidents and to be able to fix issues through software updates (over the air or through dealerships). Under the World Forum for Harmonization of Vehicle Regulations (WP.29), part of the UN Economic Commission for Europe (UNECE), more than 60 markets have introduced mandatory cybersecurity practices in the type-approval process, starting in 2022.

Finally, automated driving is attracting increased regulatory attention. UNECE has issued some guidelines about this, including strict safety requirements for passenger cars that use automated lane-keeping systems (ALKS). When activated, these systems assume control of the car and thus must be extremely safe. The ALKS regulations represent the first binding international regulation on so-called level-3 vehicle automation.

Further developments

The mobility industry remains dynamic, even beyond the core trends laid out in this report. Incumbents in century-old industries (such as automotive and steel production) are working together with newcomers. For instance, H2 Green Steel, a new Swedish company aiming to produce carbon-free steel, has been supported by Daimler and Volvo. Similarly, European OEMs are partnering to scale up the much-needed infrastructure required for charging technology. Porsche and Croatian EV disruptor RIMAC have agreed to set up a joint venture that incorporates Bugatti.

New entrants are injecting considerable financing, enriching the industry. For example, consider the IPOs from special-purpose acquisition companies such as Arrival, Charge Point, Joby Aviation, and Lucid. The intensifying competition in this space is extending into more traditional parts of the industry. Chinese EV players, for example, are not only winning market share in their home market but also launching their models in other regions of the world.

Outlook for 2022

One thing is certain: mobility is changing. How the mobility industry responds to the ongoing trends shaping the industry will continue to evolve rapidly in 2022. Here are the key developments to expect.

- **Consumer:** Electric vehicles will gain even higher market shares in China, Europe, and the United States, outpacing ICE vehicle sales in many areas. Consumers will adapt to the new technology but will also demand better integration of EVs into the mobility ecosystem, especially when it comes to seamless charging solutions. Consumers will opt for more flexible forms of mobility access, from subscription models to micromobility solutions. This trend, however, will be more common in metropolitan areas in highly developed world regions.
- **Technology:** Next year will be a decisive period for the development of autonomous driving—for example, level-3 vehicles. At the heart of this technology—as with many other developments in the mobility industry—is software. More than ever, software and the ability to deploy software-enabled features at scale will become differentiating factors separating frontrunners from laggards in mobility. In e-mobility, there will likely be promising next steps in battery chemistry, and therefore performance. At the same time, raw-material use will be further minimized, answering both to scarcities in the supply chain and to environmental concerns. In parallel to the market take-up for EVs, the charging infrastructure will need to grow accordingly—a considerable task and one that will be at the center of discussions in 2022.
- **Regulation:** One clear takeaway from COP26 is that industries will be pushing ahead on sustainability topics just as much as regulators have and will continue to over time. Indeed, the climate commitments launched in Glasgow will reshape the agenda for global business. Executives across industries expect an acceleration of climate action across the real economy—at the system level, throughout industries, and within organizations. However, net-zero commitments are outpacing the formation of supply chains, market mechanisms, financing models, and other solutions and structures that will be needed to smooth the world's decarbonization pathway. For businesses, these conditions will create opportunities to innovate and to lead coordinated action by industry peers, value-chain partners, capital providers, and policy makers. In response, more and more cities will be pushing ahead with ambitious local decarbonization and future mobility plans.
- **Partnerships.** The growth of new technologies, business models, and opportunities will spur more at-scale partnerships between key players along the mobility value chains. This will be necessary to bring together the vastly different skill sets required to succeed across ACES vehicles, a trend that will even intensify in 2022.

The authors of this compendium are members of the McKinsey Center for Future Mobility. **Kersten Heineke** is a partner in McKinsey's Frankfurt office, **Philipp Kampshoff** is a senior partner in the Houston office, **Timo Möller** is a partner in the Cologne office, and **Dennis Schwedhelm** is a senior expert and associate partner in the Munich office.

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