

THE AUTOMOTIVE MARKET SHIFT

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Arval Consulting



ARVAL
BNP PARIBAS GROUP

For the many journeys in life

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01 – Introduction



The automotive sector depends on various industries working closely together - raw material extraction; shipping and transportation; motor and battery production; oil, gas, and other energy sources; and much more.

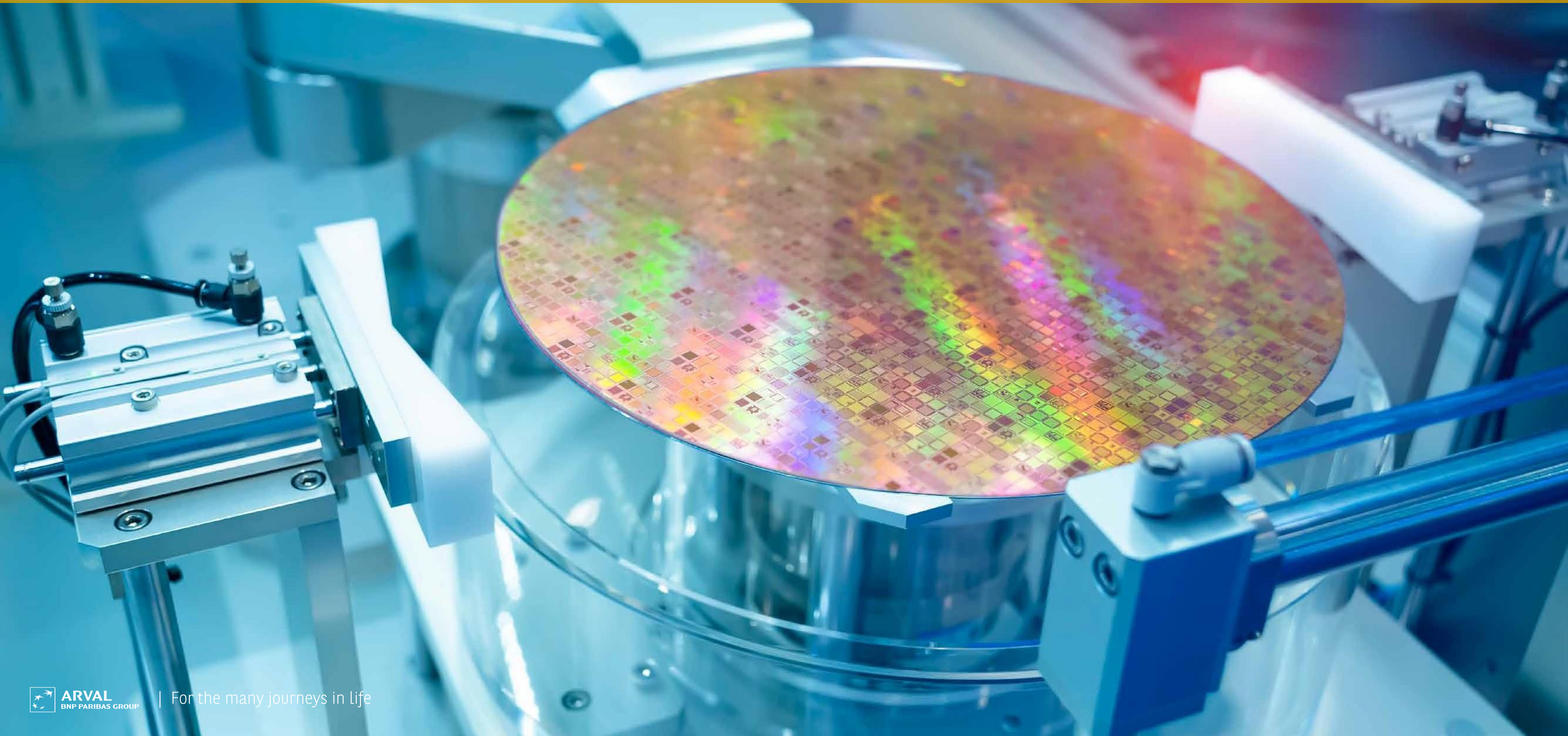
Following Dieselgate and the Covid 19 crisis, the industry now has new challenges to face that has seen the supply chains of these key industries disrupted across the world in different ways and to different degrees. Perhaps **the most visible part of this has been the semiconductor shortage** but, in truth, there are many other similar issues arising.

This document – written by Arval Consulting team - looks in detail at why these latest challenges to the automotive industry have emerged, **the impact it is having on manufacturers and others**, when we can expect its effects to start to fade, and the actions that fleets can take in mitigation.

We hope you find it useful and would be very pleased to discuss with you any of the many issues that it highlights.

Shams-Dine El-Mouden
International Consulting Director
Arval

02 – Why do vehicles need semiconductors?

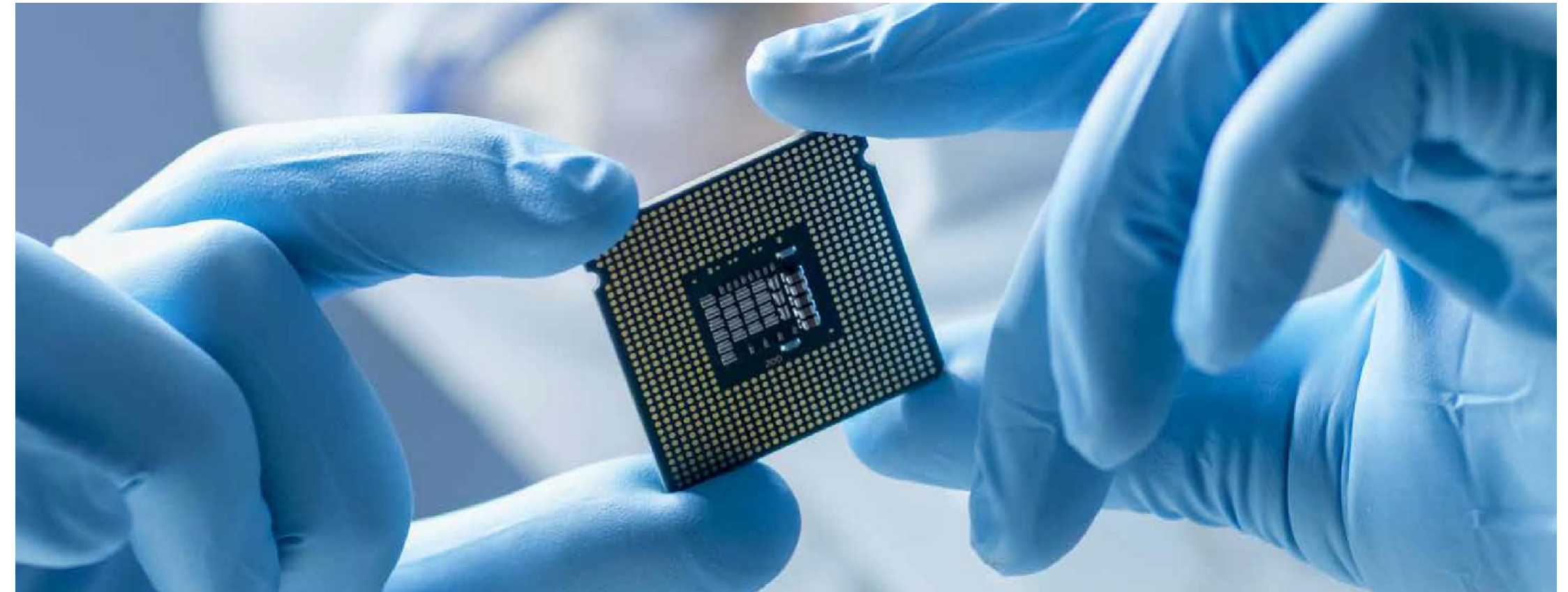
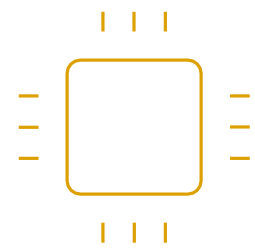


02 – Why do vehicles need semiconductors?

WHAT IS A SEMICONDUCTOR?

Semiconductors are components that allow the storage, processing and transmission of data. Most of them are integrated circuits, commonly referred to “chips” and are **used by almost all electronic devices in the 21st century.**

Each chip contains sometimes billions of minute electronic components such as transistors, diodes, capacitors and resistors on a thin wafer of material, usually silicon, in an area as small as just a few square millimetres.



WHAT ARE THEY USED FOR?

Almost every major sector of the economy makes extensive use of semiconductors – they can be found in probably every electronic device in your home and office from your mobile phone to your fridge and your laptop to your bedside clock. They are also extensively employed in industrial products, information and communications technology infrastructure, data centres, communication networks – and automotive.

02 – Why do vehicles need semiconductors?

WHAT IS THEIR PURPOSE IN CARS?

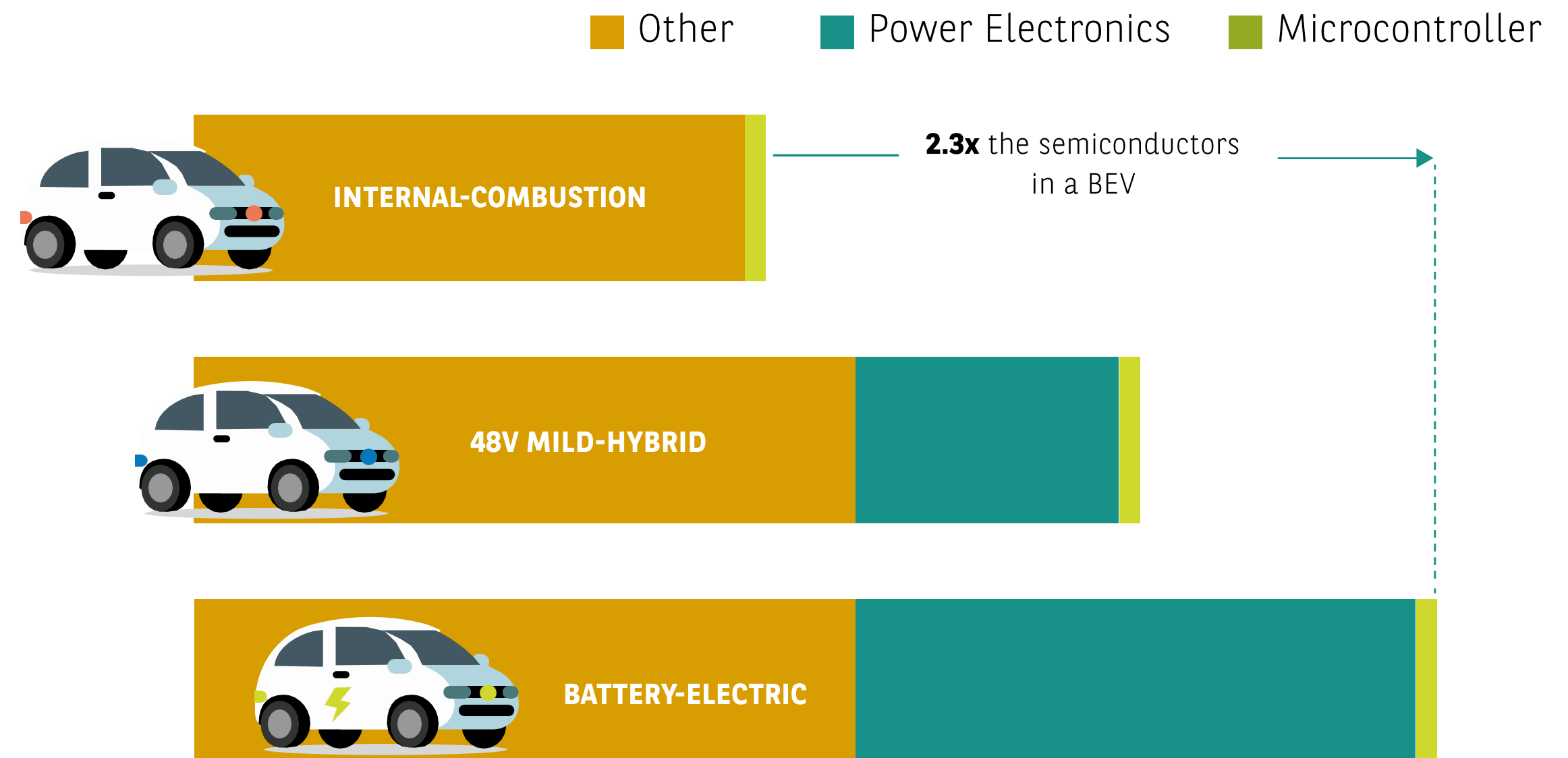
The average car often contains more than **1,000 semiconductors** and sometimes **up to 3,000**, used in everything from engine management systems to infotainment centres, and from dashboard displays to safety features. **It is no exaggeration to say that they are essential to the design and construction of modern vehicles.**

DO SOME TYPES OF VEHICLE USE MORE SEMICONDUCTORS THAN OTHERS?

Yes, as our graph shows, electric vehicles (EVs) **use on average 2.3 times the semiconductors** of an internal combustion engine vehicle.

► Average car semiconductor content by powertrain (\$)

Source: Infineon, IDTechEx "Power Electronics for Electric Vehicles 2022-2032"



03 – Worldwide semiconductor production



WHERE ARE SEMICONDUCTORS MADE?

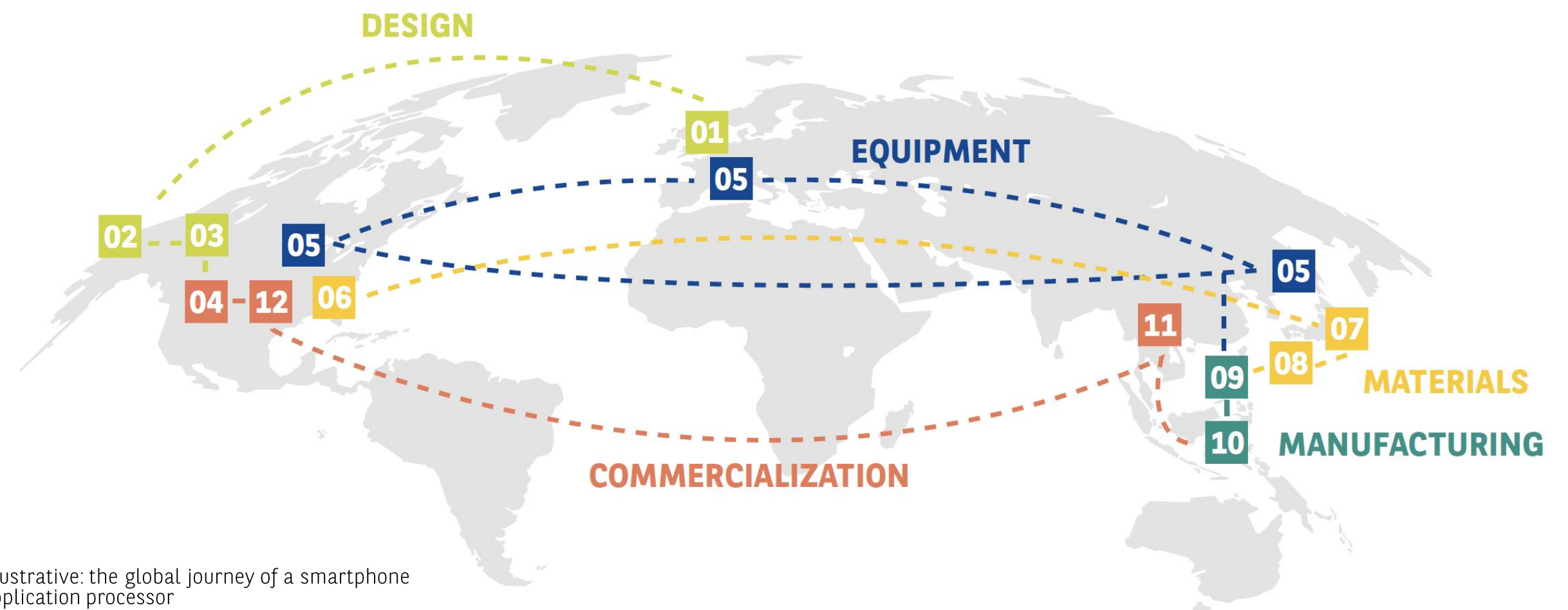
Six major regions account for almost all **global production** – the US, South Korea, Japan, mainland China, Taiwan and Europe. However, about **75% is concentrated in China and East Asia**, including Japan, South Korea and Taiwan.

China especially dominates materials production for semiconductors – **it is the leading provider of 9 out of the 17 critical rare earths that are needed.**

IS THERE A COMPLEX SUPPLY CHAIN?

Semiconductors are the world's **fourth-most-traded** product after crude oil, refined oil, and cars. A sophisticated global supply chain exists, featuring a large degree of geographic specialisation combined with **commercial interaction** and **collaboration across borders.**

► **The semiconductor value chain is truly global and relies on the specialized capabilities of different geographic areas**



Illustrative: the global journey of a smartphone application processor

ARE THERE ANY PARTICULAR RISKS TO PRODUCTION?

The BCG SIA report (April 2021) observed that a high degree of geographical concentration in certain semiconductor manufacturing activities creates two types of vulnerabilities:

- **Single points of failure that could result in large-scale supply interruptions** from threats such as natural disasters, infrastructure failures or cyberattacks.
- **Geopolitical tensions that may impair global access to suppliers or customers** through actions such as tariffs and export controls, or supply blockages resulting from broad embargoes or armed conflicts.

ARE SPECIFIC POLITICAL FRICTIONS CAUSING PROBLEMS?

Ongoing political and trade tensions between the US and China – the world's two biggest users of semiconductors – have escalated significantly in recent years.

This potential for instability is creating a desire for semiconductor self-sufficiency in China, Europe, Japan and South Korea. However, the investment required for these regions to become autonomous in semiconductor production is huge – **equivalent to an estimated six times the combined research and development investment and capital expenditure of the total semiconductor value chain in 2019.**



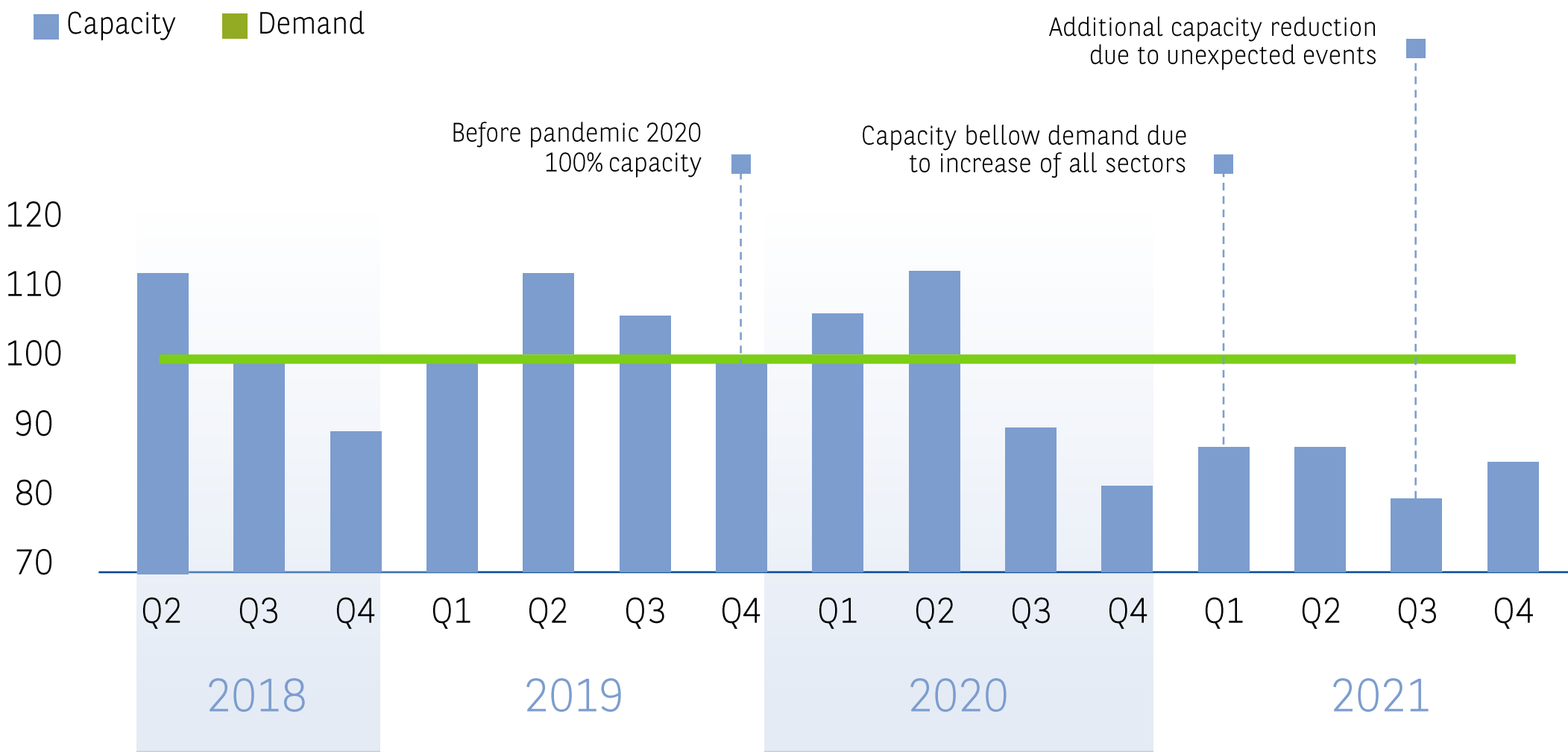
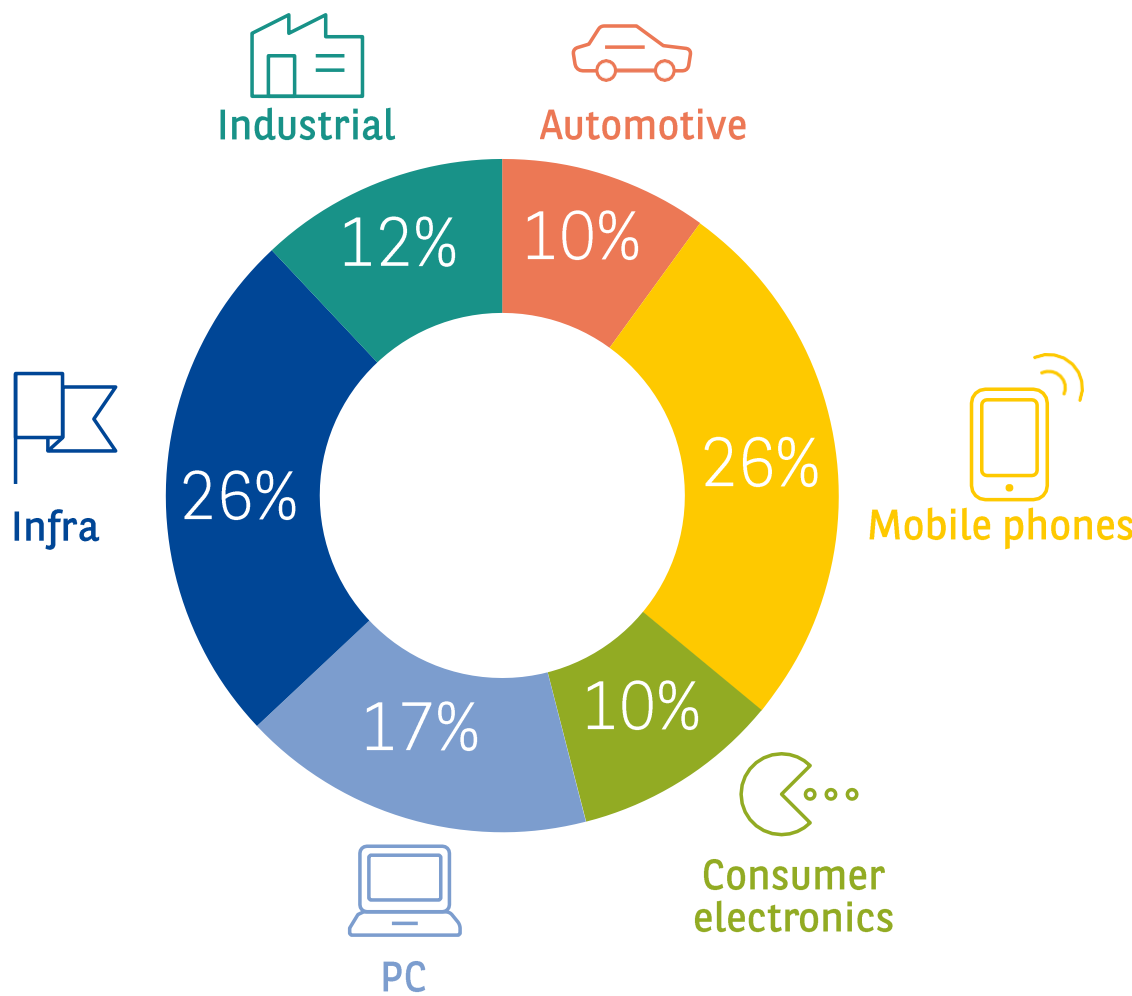
04 – What is causing the challenge in supply?

There is no single cause for semiconductor and other supply challenges. Rather, a combination of factors have caused an exhaustion of capacity while other issues such as energy prices, shipping costs, raw material shortages and even extreme weather are creating a further impact.

THE PANDEMIC

At the start of the pandemic, car manufacturers faced a substantial drop in new vehicle sales and, as the market recovered, **did not subsequently increase their semiconductor orders because of the continuing, uncertain outlook.**

At the same time, consumer demand significantly rose for personal technology products, largely driven by home working. That meant that even as car makers cut chip orders, other sectors faced an increased need – and the semiconductor industry shifted in that direction.



Source : Gartner; BCG analysis (Brief Perspective on the Auto semiconductor shortage, October 2021)

Source : Seat IFMI Fleet Europe

04 – What is causing the challenge in supply?

GEOPOLITICAL TENSIONS ARE HIGH

Because of potential political instability, some consumer electronics makers have considerably increased their chip inventory levels. **This stockpiling has caused a surge in semiconductor demand.**

CONTRACT CONDITIONS ARE WORKING AGAINST AUTOMOTIVE

In a complex and outsourced supply chain, chip sourcing commitments from the automotive industry tend to be short term, measured in weeks or months. **Now, semiconductor manufacturers have become committed to longer-term contracts from other industries.**

CHIPS ARE NEEDED TO MEET NEW EMISSIONS STANDARDS

In many major countries, **there is a growing emphasis on reducing vehicle emissions**, including the CAFE targets seen in the European Commission, bans on diesel use in some urban areas, and clean air zones being adopted in dozens of cities.

All of these mean **an increased reliance on semiconductor-driven technology that enables manufacturers to meet emissions demands**, whether through enhanced diesel and petrol drivetrain technology or the introduction of new, electrified options such as EVs.

5G ROLLOUT IS HOGGING CAPACITY

Unfortunately for the automotive sector, demand for chips at the larger sizes that it typically uses **is also coinciding with similar high demand for the global 5G mobile technology roll out**, as well as production of power chips needed to boot up servers and PCs.



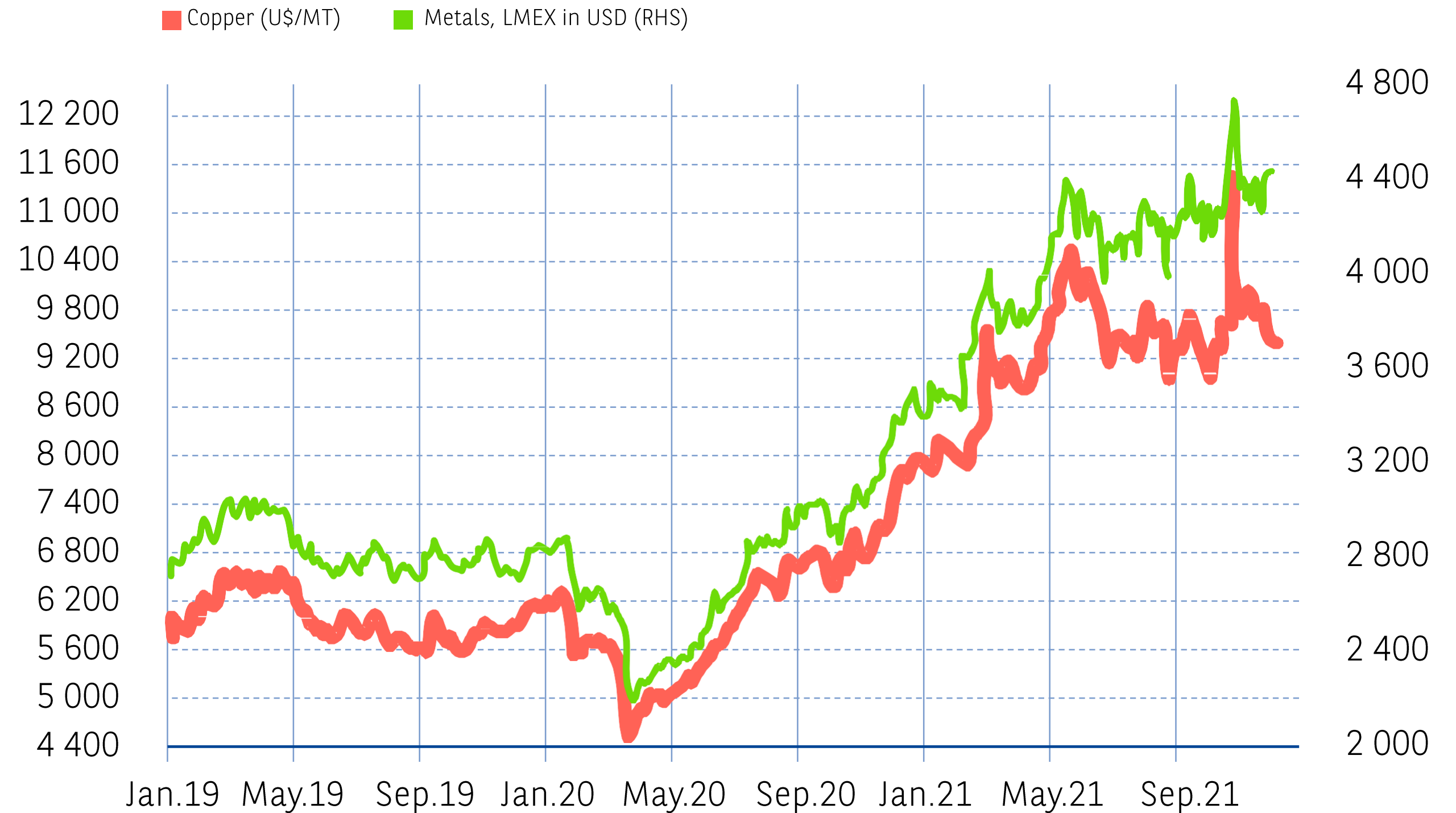
04 – What is causing the challenge in supply?

JUST-IN-TIME MEANS LIMITED STOCK

Just-in-time manufacturing practices are widely used in automotive to minimise waste and increase efficiency by keeping inventory low. However, the unexpected shortage in semiconductors means that **there has been immediate disruption of the entire supply chain**.

RAW MATERIALS ARE IN SHORTAGE

Across the world, there are shortages in all kinds of important materials. **The price of aluminium has reached a 13 year high**, **European magnesium stocks** have been affected by lack of supplies from China, **Copper prices have surged**, gaining access to a large range of **plastics is proving difficult** – and much more.



Source: Refinitiv, BNP Paribas

04 – What is causing the challenge in supply?

ENERGY COSTS HAVE INCREASED

According to the IMF, Spot prices for natural gas have more than quadrupled to record levels in Europe and Asia, an unprecedented **price spike**. Its expectation is that these prices will revert to more normal levels early in 2022 when heating demand ebbs and supplies adjust but points out that, if prices stay as high as they have been, **this could begin to be a drag on global growth**.

Also, **benchmark Brent Crude oil prices have reached a seven-year high above \$85 per barrel**, as more buyers seek alternatives for heating and power generation amid already tight supplies. Coal is also in high demand.



Source: Refinitiv, BNP Paribas

SHIPPING COSTS HAVE RISEN

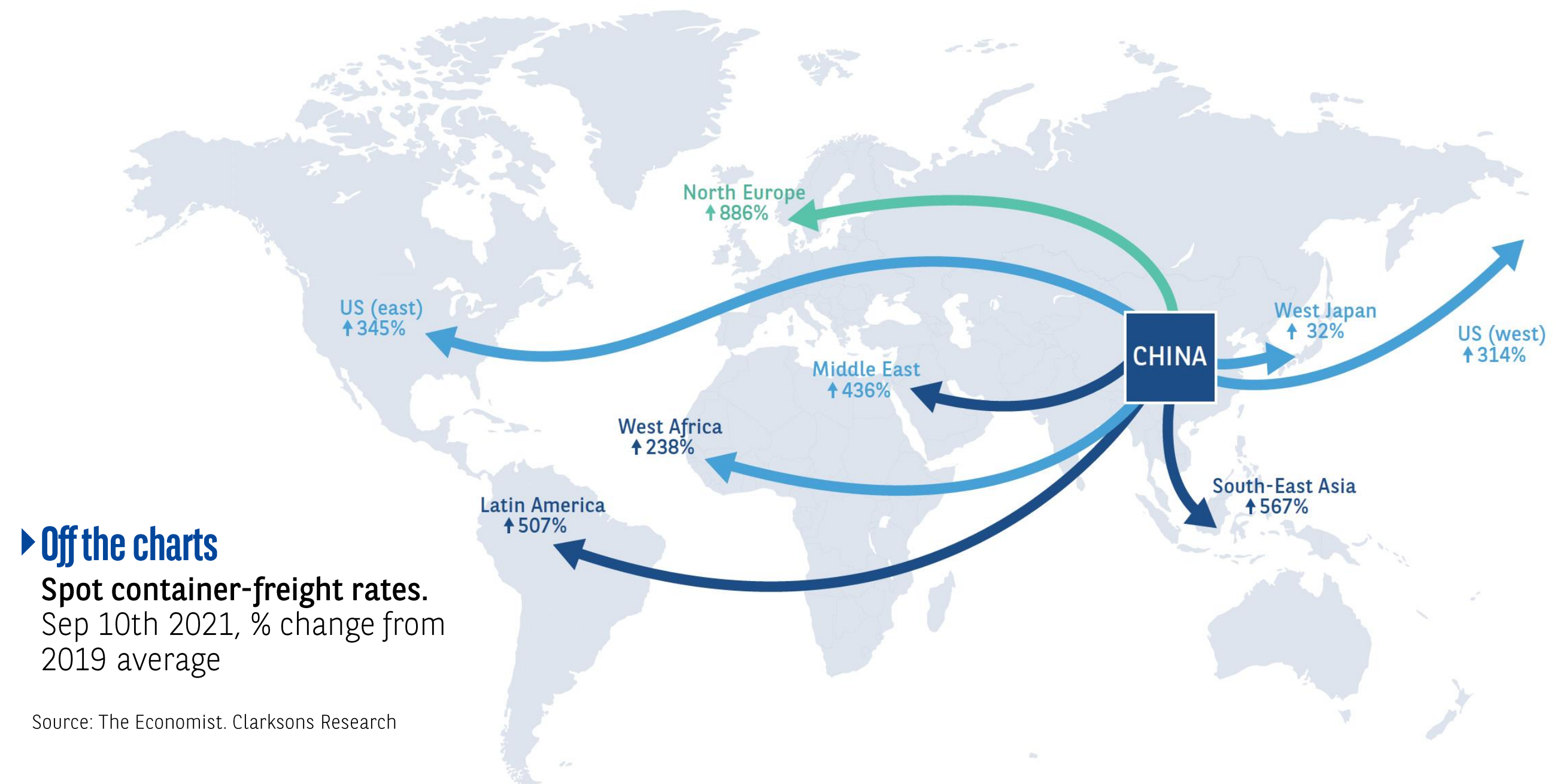
Shipping prices have been rising rapidly in response to demand.

According to the OECD, higher commodity and shipping costs now account for around **three-quarters of a 2¼ percentage point change in G20 consumer price inflation** since the latter half of 2020.

It is expected that shipping costs will rise by a little over 25% in the fourth quarter of 2021, in line with the growth rates seen in the second and third quarters, before stabilising in the first half of 2022 and then moderating towards their pre-pandemic levels.

MISCELLANEOUS FACTORS

Other issues — from weather disruptions to the Suez Canal container ship blockage — have all contributed to the semiconductor shortages. For example, a winter storm in the US caused the loss of two weeks of polypropylene production.



► Off the charts

Spot container-freight rates.
Sep 10th 2021, % change from 2019 average

05 – What is the impact on the automotive industry?

Disruption of supply chains is having a wide-ranging impact across the automotive sector with almost every part of the industry touched in some way. These are some of the most significant trends.



05 – What is the impact on the automotive industry?



ASSEMBLY LINES HAVE SLOWED OR STOPPED

Although it is difficult to separate the effects of the semiconductor shortage from other recent issues such as the pandemic, **the most noticeable impact of the situation has been the closing or slowing of production lines**, with almost every manufacturer affected to some degree.

The IHS Markit global light vehicle production forecast for 2021 has recently been cut by **6.2% to 75.8 million units**, while the 2022 forecast has also been reduced by 9.3% to 82.6 million units. **Even in 2023, production is only expected to reach 92.0 million units.**

NEW VEHICLE PRICES AND WAITING TIMES ARE INCREASING...

Rising material costs and increasing demand mean **new car and van prices have begun to rise** and the level of discounts often offered to fleets have correspondingly begun to fall.

Unsurprisingly, order times for new vehicles have also increased massively. It is not unusual to be quoted up to 12 months delivery time for some mainstream models in major markets and longer waits are far from unknown. This trend has clear implications for fleet buyers who rely on structured vehicle replacement cycles to implement their policies.

...AND USED VEHICLE PRICES, TOO

The lack of new car and van supply is also causing a knock-on effect in the used vehicle market, with many countries seeing prices pushed to record highs as fewer vehicles are defleeted. While values in most places now seem to be in the process of stabilising, **used prices are much higher than before the pandemic and seem set to stay there for some time to come.**

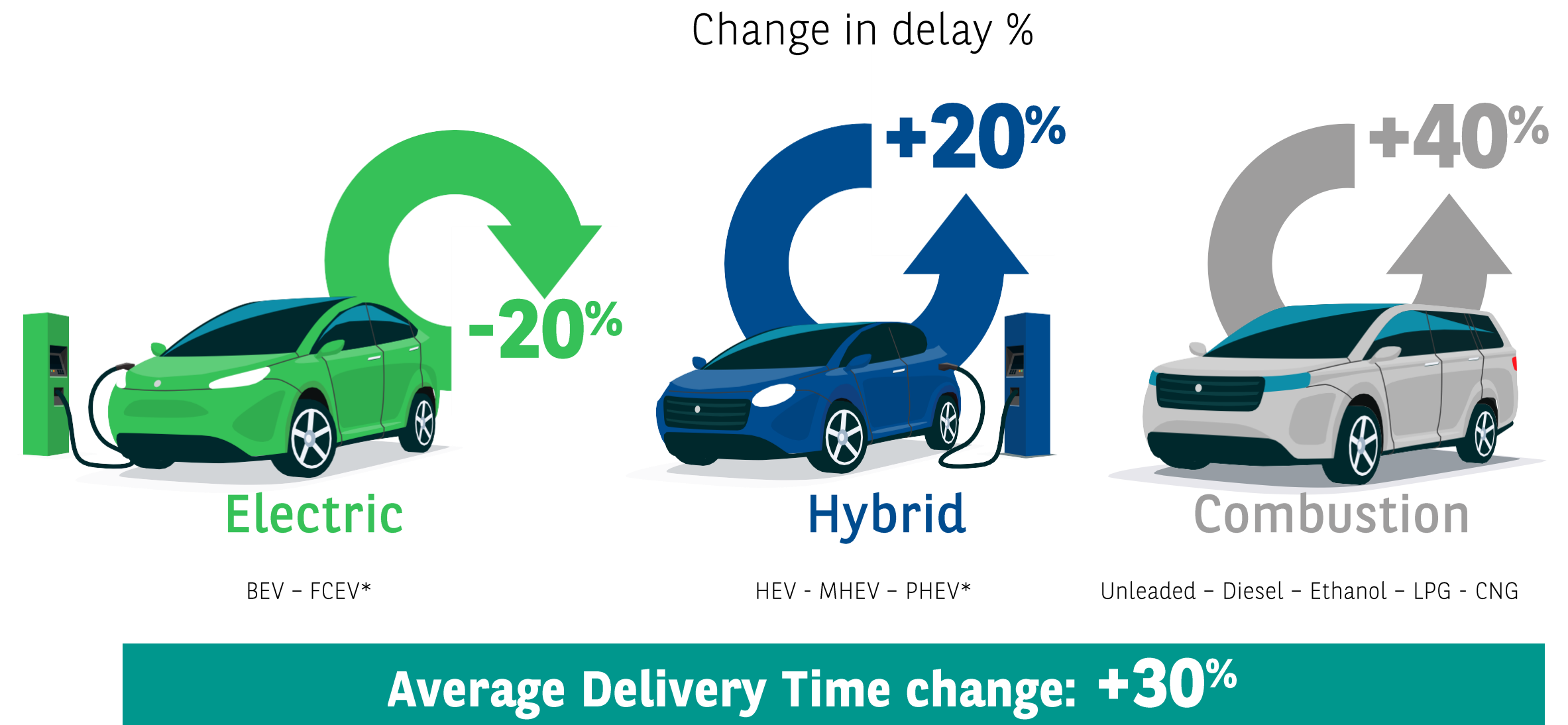


PRODUCTION IS BEING SWITCHED TO EVS

In spite of the fact that more semiconductors are needed for EVs than petrol and diesel vehicles, **manufacturers appear to be switching production towards electrification**. At Arval, we have noticed that **delivery delays for EVs have decreased between Q1 2020 and Q4 2021** while those for ICEs have increased. In Q1 2020, an EV had on average, a **40% longer** lead time than a petrol or diesel vehicle but In Q4 2021, it is now **20% lower**.

Additionally, there is evidence that production is **being switched towards more profitable models**, which is an understandable reaction from a motor industry under huge financial pressure.

► CHANGES IN DELIVERY DELAYS Q4 2021 VERSUS Q1 2020



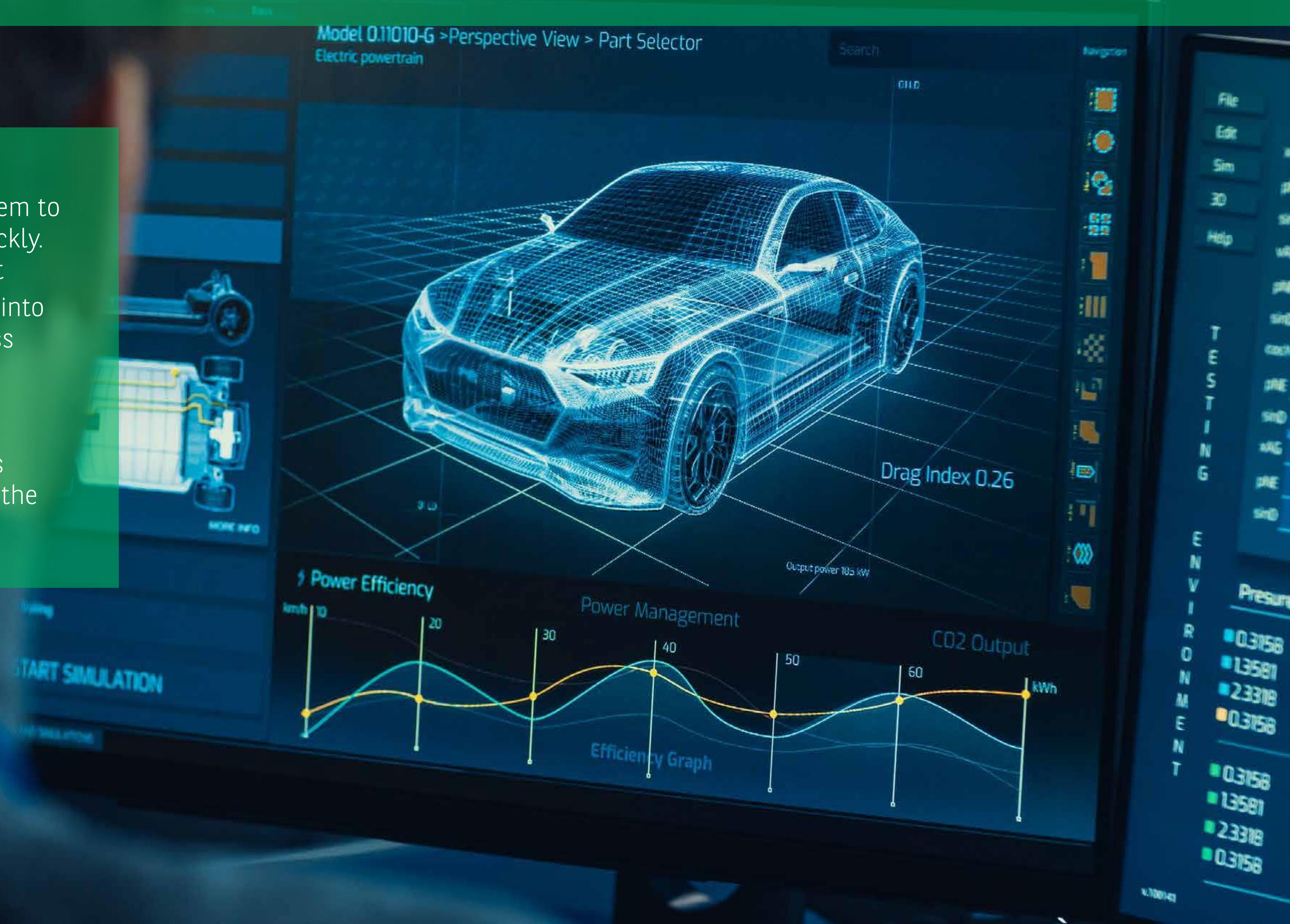
SOURCE: ARVAL - Delivery delays index: evolution per fuel type

*: BEV = Battery Electric Vehicle | FCEV = Fuel Cell Electric Vehicle (Hydrogen) | HEV : full Hybrid Electric Vehicle | MHEV = Mild Hybrid Electric Vehicle | PHEV = Plug-in Hybrid Electric Vehicle

06 – What actions could manufacturers take?

The current disruption is not a problem to which the answer will be found quickly. The consensus of the market is that the semiconductor situation could extend into 2023, although the shortage should be less severe by then.

However, there are a range of short and longer term strategies that manufacturers may potentially adopt to mitigate against the crisis.





FINDING NEW SUPPLIERS

Finding new sources of semiconductors might seem like the most obvious course of action but, in truth, this will not have an effect for some time to come. That is because typical lead times for **semiconductor production can exceed four months**, while increasing capacity by moving a product to another manufacturing site usually **adds another six months**, and switching to a different manufacturer typically **adds another year or more**.

06 – What actions could manufacturers take?

USE OF SUPPLY ANALYTICS

Some motor manufacturers are believed to have established dedicated “**war rooms**” that collate their supply and demand intelligence to create greater transparency over their semiconductor purchasing. Analytics could especially be used to match supply with demand to reduce dependence on previous manual processes. **The goal would be to provide clear and accurate data communication internally and to suppliers and customers.**



NEGOTIATING LONGER TERM CONTRACTS

Solving the shortage problem in the longer term, the automotive industry might **rethink the way it structures contracts for semiconductor-related sourcing**. A good place to start would be for manufacturers and tier one suppliers to make binding, upfront volume commitments designed to guarantee capacity among suppliers.

PRODUCING CARS WITH FEWER SEMICONDUCTORS

Some manufacturers are reacting to the shortage by **removing non-essential semiconductors from their vehicles**. This has seen, for example, conventional dashboard dials returning to replace their digital equivalent, and stop-start engine mechanisms being removed from drive trains. In some cases, more advanced safety systems are being made unavailable such as lane departure and blind spot systems – although critical core equipment such as airbags remain.

07 – Four strategic actions to manage the automotive market shift

At a time when all kinds of resources are in short supply, planning ahead and making the right choices becomes more relevant than ever for fleet decision makers.

It should be clear to look at your current fleet now, to identify which vehicles need to be replaced immediately. Beside considering **alternative solutions**, whether used car leasing or mid-term rental contracts **we present you the four key strategies to initiate today.**

01 | START THE NEW VEHICLE ORDERING PROCESS **MUCH EARLIER**



02 | RECONSIDER YOUR SOURCING STRATEGY



03 | EXAMINE **TOTAL COSTS OF OWNERSHIP AND CONTRACTS**



04 | CONSIDER **CONNECTED SERVICES**





01 | START THE NEW VEHICLE ORDERING PROCESS MUCH EARLIER

We recommend beginning the process of replacing existing vehicles **nine months** before the end of the existing lease in order **to maximise the chances of taking delivery of the right vehicle at the right moment** – ultimately causing the minimum disruption to your operations and your objectives whether related to finance or sustainability.

02 | RECONSIDER YOUR SOURCING STRATEGY

There are a number of ways that you could rethink which cars you add to your fleet.

Introducing new brands into your choice lists could allow you to meet budgets, match your employees' expectations and hit sustainability targets. Arval can provide expert guidance on manufacturers and models that meet your needs and may be available at shorter lead times.

You could also take a fresh look at your car policy on vehicle equipment. As mentioned earlier, some manufacturers are removing features

from vehicles in order to enable production to continue. In certain cases, this may affect options that are mandated under your current fleet policy and making changes to this document may mean that **you can more easily get hold of vehicles in the future.**

Finally, and potentially most importantly, **you could embrace the fleet energy transition.** Many fleets have already adopted comprehensive electrification strategies and this could be the moment to create your own. If you are going to have to wait a year for a vehicle instead of weeks, then there is a strong argument to

make that choice an EV. On top of that, **you have time to set up your infrastructure as it helps to reduce the energy cost.**

It may sound counterintuitive but **new car delays could help you ultimately accelerate electrification** as EV will be delivered faster than ICE. Moreover **governmental incentives/subsidies as well as tax avoidances are also a key driver to reduce your Total Cost of Ownership.** On a side note, The automotive market shift is a clear sign that you should **accelerate your path towards carbon footprint reduction.**

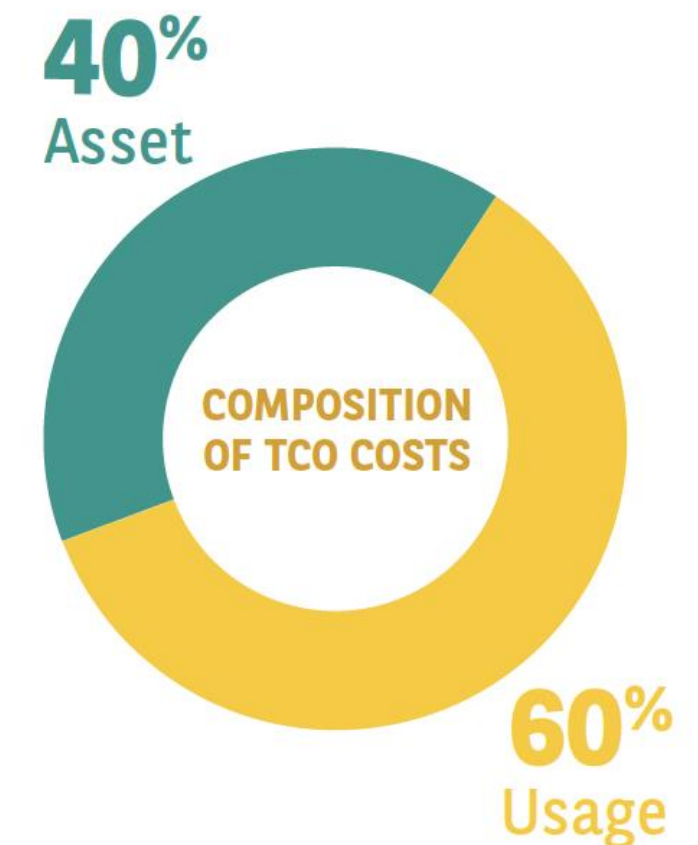


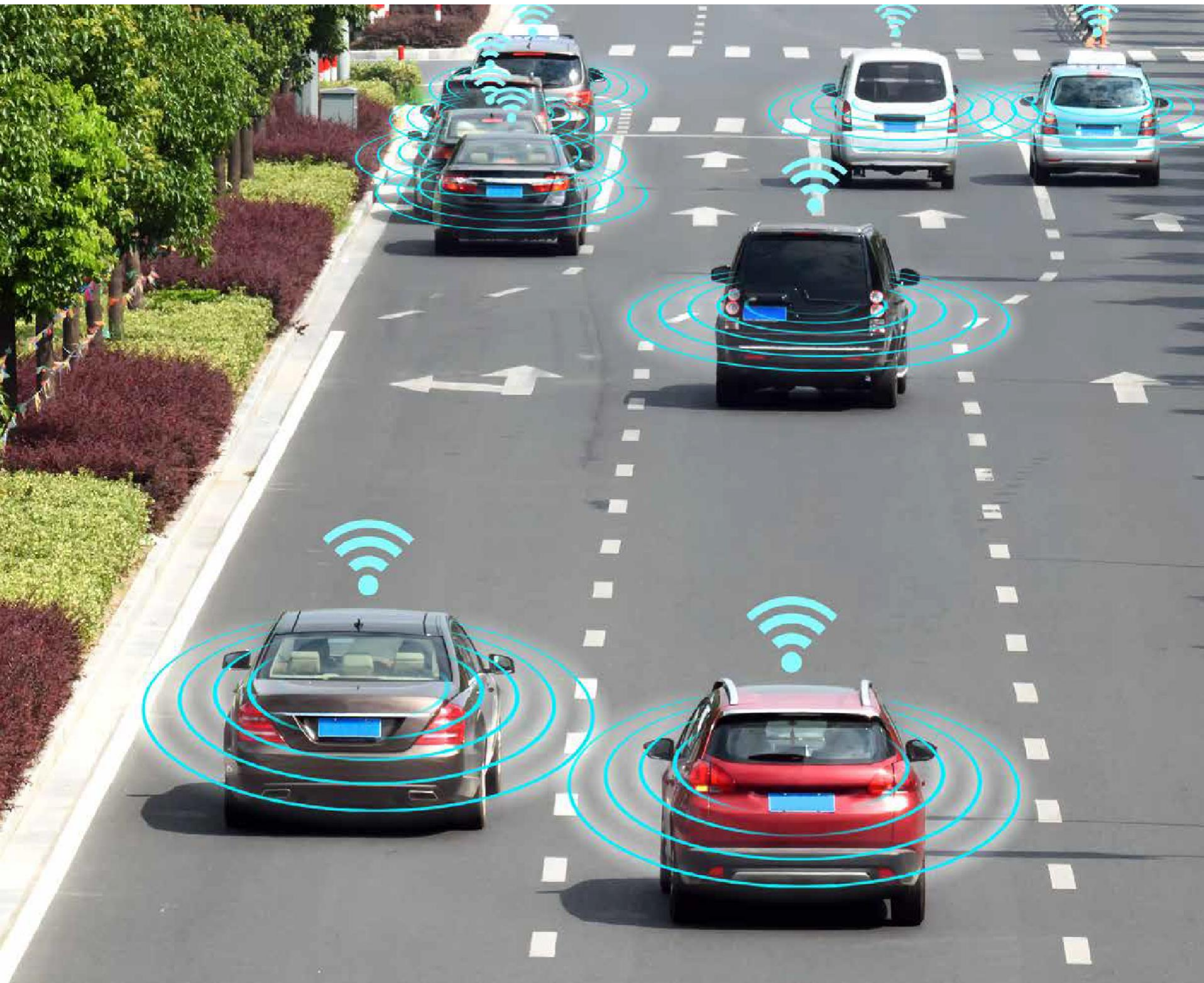


03 | EXAMINE TOTAL COSTS OF OWNERSHIP AND CONTRACTS

New vehicle prices are increasing and likely to rise yet further. One way to offset this trend is to **look closely at your Total Cost of Ownership (TCO) in detail with the help of Arval**, identifying areas where savings can be made and new benefits realised. Of course, these ideas can also be applied to your current fleet operations.

A further, useful operational exercise is to **ensure your contract terms are in line with your fleet usage**. Now is a good moment to undertake an exercise to ensure that this is the case, especially to access the significant opportunities represented by under-mileaged cars and vans. By extending the time you keep these vehicles, **you can create savings while still guaranteeing that the contract will not go above your mileage limit**.





04 | CONSIDER CONNECTED SERVICES

Telematics services are a very effective solution to monitor your current live fleet as well as your future vehicles.

Detailed data about driver behaviour in real world conditions can bring a high level of benefit at a time of rising prices and scarce resources.

Being able to gain insight into how driving styles are impacting on areas such as fuel use, which typically represents **30% of your TCO**, will enable you to potentially cut your spend on petrol, diesel and electricity. **Telematics can also help you reduce accidents, cut your carbon footprint, and also minimise your repair costs.**

08 – Conclusion

The automotive market shift
Has been caused by a range
of highly disruptive

**factors including shortages
of semiconductors and raw
materials, alongside increased
shipping and energy prices.**

In response, manufacturers have
adopted mitigation strategies
such as list price increases,
production adjustments to
optimise their supply of chips,
and focusing their production
on electrified vehicles and their
most profitable models.

Arval believes that, although
this potentially long-lasting
situation is expected to continue
to lengthen lead times and
increase vehicles prices, there
are solutions that can help to
transform these challenges into
opportunities.

**The four strategic actions we
have identified should help to
overcome negative impacts**,
accelerating the trend towards
flexible and sustainable mobility
strategies, influencing your
approach towards Total Cost
of Ownership, allowing you
to hit your CSR targets, and
ensuring the satisfaction of your
employees.

Thank You!

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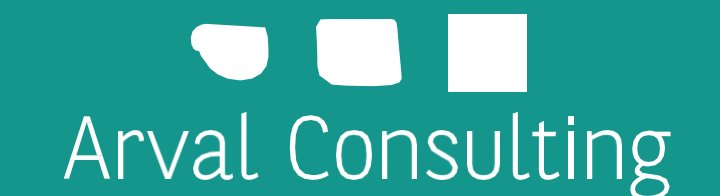


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IN ADDITION TO THOSE NAMED IN THE REPORT:

- Coping with the auto-semiconductor shortage: Strategies for success, McKinsey& Company, May 2021
- BCG SIA report, April 2021, Strengthening the global semiconductor supply chain in an uncertain era
- <https://ihsmarkit.com/research-analysis/major-revision-for-global-light-vehicle-production-forecast.html>
- <https://blogs.imf.org/2021/10/21/surging-energy-prices-may-not-ease-until-next-year/>
- EV Power Electronics: Driving Semiconductor Demand in a Chip Shortage | Electric Vehicles Research



For the many journeys in life