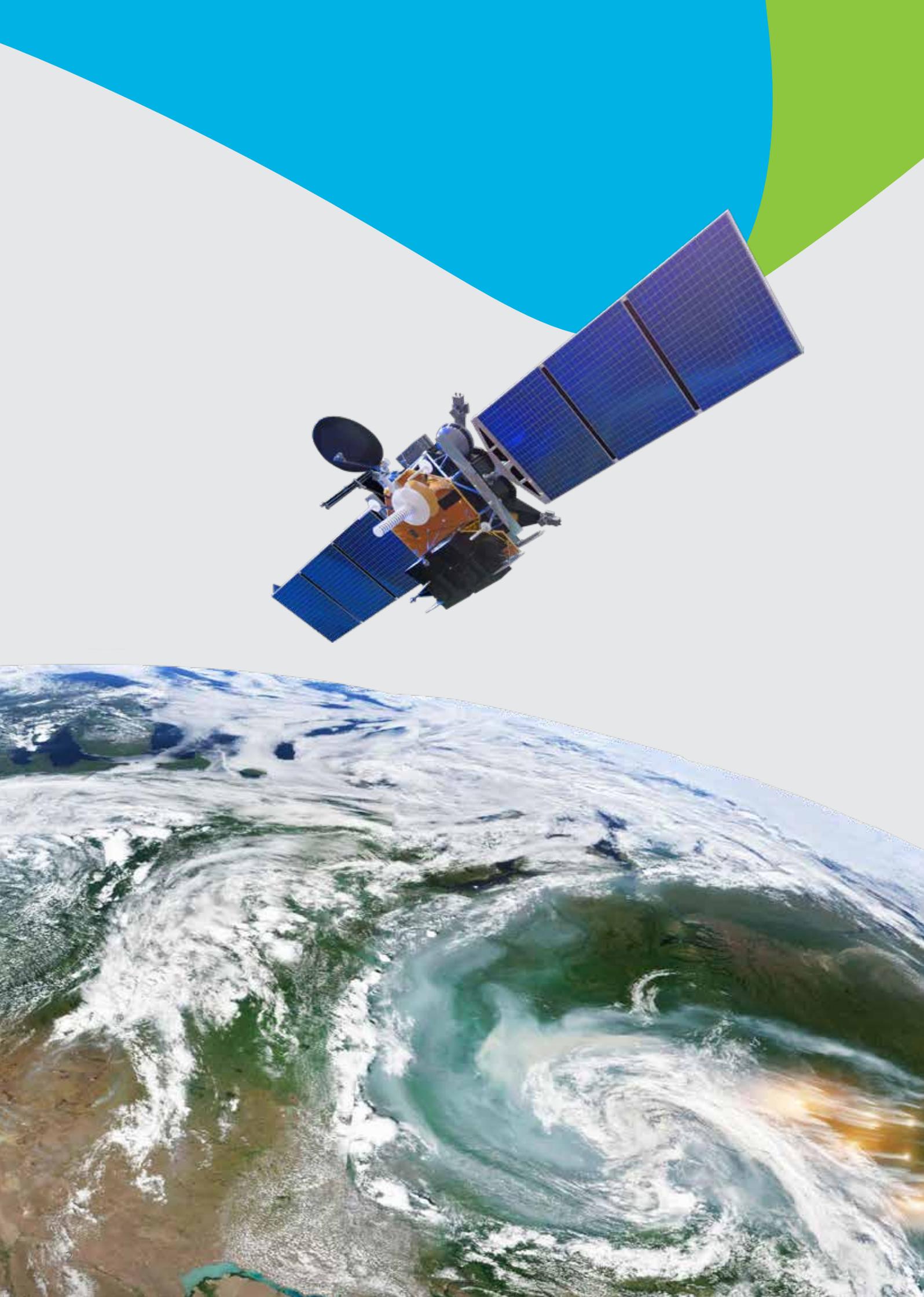


Sustainable Business Revolution 2030

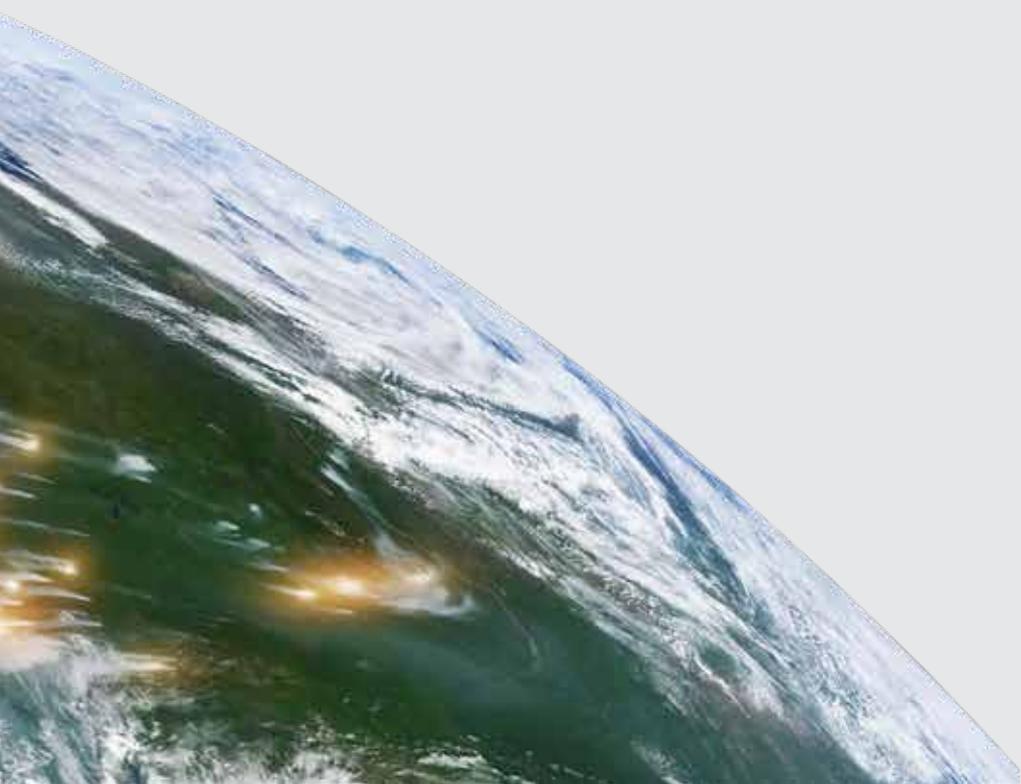
Radical reinvention of business models, open collaboration and sustainability-driven technology choices are urgently needed to stem the destructive impact of carbon emissions on our planet.





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1. Foreword: The disrupted decade ahead



Will you still be in business after 2030? It's a valid question, with the decade ahead set to be characterized by disruption and reinvention in business to tackle the climate emergency.

Unless organizations collaborate with one another and with their stakeholders to deliver the significant carbon reduction targets recommended by the Intergovernmental Panel on Climate Change (IPCC), business as usual may not survive beyond 2030. Even the Governor of the Bank of England Mark Carney joined the debate, saying: "Firms ignoring the climate crisis will go bankrupt."¹

That's why business leaders must act now. They need to start reinventing their business models and developing the ecosystems that will drive sustainable business success. The IPCC's 2030 target gives us all just 10 years to radically transform how we operate within the global economic system. To this end—and with a core mission to help organizations reduce their carbon emissions—at Capgemini, we work with our clients to reinvent their businesses, using technology as an enabler.

There is no time to wait. To reach the carbon outcomes required by 2030, the transformation must begin today.

A handwritten signature in blue ink that reads "Cyril Garcia".

Cyril Garcia,
CEO Capgemini Invent

2. Climate emergency: The global call for action, and the challenge for businesses

Global business is a major contributor to today's escalating levels of atmospheric carbon emissions, with just 100 companies responsible for more than 70% of all emissions². Consequently, business also has the biggest opportunity to be part of the solution.

In September 2019, during more than a year of protests, thousands of school children and students took to the streets across the world to express their concern about climate change. They were protesting about the lack of action being taken to deliver the necessary reduction in greenhouse gas emissions required to keep our climate in balance. This was a scientific fact-based revolt, one that was in line with the changing mood in much of society today. No organization, commercial or governmental, can afford to ignore these signals—these voices will be the voters, consumers and employees of tomorrow.

Of course, many businesses are already recognizing these trends and are starting to act. In an extensive piece of research conducted at Henley Business School, Dr James Robey, Global Head of Environmental Sustainability at Capgemini, explored the drivers behind corporate motivation to invest in becoming more sustainable. Based on inputs from 170 of the world's largest companies, the ability to attract and retain the best employees topped the list of drivers, alongside the expectations of customers.

In addition to these reputational drivers, businesses are already facing the hard implications of climate change today—insurance costs are rising as claims for extreme weather events escalate, resource costs continue to rise and increasing demand is outstripping

the abilities of the energy sector to deliver. These pressures on the bottom line are augmented by the potential for stiff financial penalties for non-compliance with tightening environmental standards. A much-needed price on carbon would, if implemented, add to these costs.

There is absolutely no doubt that carbon emissions are a business-critical issue going well beyond short-term profitability. At Capgemini, we firmly believe that those organizations failing to grasp the sustainability agenda will cease to operate in the hard realities of the environment beyond 2030.

This is, of course, the target date set by the United Nations Intergovernmental Panel on Climate Change (IPCC) by which global net human-caused emissions of carbon dioxide (CO₂) must fall by about 45% from 2010 levels³ on the path to reaching net zero emissions by 2050.

The first target is 2030. With business reputations—and the future of our planet—depending on a strong environmental stance in the coming years, how many organizations thriving today will still be here beyond that date?

Economy versus environment: The role of government

Economic success breeds more emissions in many sectors.

In our 2019 World Energy Markets Observatory⁴, we noted that energy consumption, which is the largest source of carbon emissions, had grown globally by 2.3% in 2018, driven by a robust global economy. At the same time, fossil fuel remains dominant, with oil, gas and coal accounting for three quarters of the growth in energy demand in 2019.

This link between growth and energy demand creates a very real environmental predicament. How do businesses continue to grow without worsening this situation? In Southeast Asia, for example, primary energy consumption is on an upward trend, with the growing demand being met by fossil fuels⁵. Thus, governments face the daunting task of producing large amounts of reliable energy to meet the ever-increasing demand for electricity. In some developing economies this dilemma has prompted an evaluation of the structures of their energy sector, including power market design, and of the opportunities for augmenting government investments towards sustainability.

Tackling climate change

Here we can see that government intervention, as well as business, is playing its part in tackling climate change. Some governments are more bullish about this than others. For example, the Danish Government has an objective to meet at least 50% of its energy needs through wind and solar energy by 2030⁶. This is viewed as a possible target thanks to the efficient Nord Pool grid interconnections. Such interconnections—or ecosystems of partners—will be essential on the journey to net zero carbon emissions.

Elsewhere, the Australian Government is making significant progress in renewable energy projects through the Renewable Energy Target (RET) scheme that is targeted to deliver at least 33,000 gigawatt-hours (GWh) of Australia's electricity from renewable sources by 2020⁷. Both the Federal RET and other state policies have offered incentives and investments to ensure the country is on the right track to meet the RET ahead of schedule. And in Southeast Asia, the World Bank reports⁸ that a rapidly increasing number of countries are implementing a carbon tax or reforming their environmental taxes with a growing number of initiatives reflecting their countries' climate commitments. In Singapore, for example, a new carbon tax came into force at the beginning of 2019, while Vietnam is looking at different options for carbon pricing⁹.

New approaches being adopted

The climate challenge has also given rise to more sustainable transport models on the part of some local authorities in recent years. Many cities are pushing to make electric vehicles a more attractive option for urban travelers using tax incentives and green driving schemes. We also expect national regulatory regimes pertaining to climate change to continue driving new business models and product development in industries by 2030.

Broader legislation and mechanisms such as the European Battery Alliance (EBA) will steer progress to global carbon reduction targets. Overall, however, the progress towards lower carbon emissions globally has been slow. For example, the EU failed to reduce its CO₂ emissions between 2015 and 2018¹⁰. Even more worryingly, and taking a

longer-term retrospective, there was a 41% increase in the world's CO₂ emissions between 2000 and 2017.

Economically, it makes better sense to start the radical overhaul of carbon emitting industries, technologies and cities today, not in 10 or 25-years' time. Energy expert Hal Harvey¹¹ has calculated the higher cost of achieving net zero carbon if the transformation is delayed due to the growth in the volume of infrastructure in the ensuing years. "If you're going to go to zero, go to zero now," he urged at a What's NOW San Francisco event.



If you're going
to go to zero,
go to zero now





3. Reinventing business models: Doing things differently, with technology

The climate change challenge presents both wide-ranging threats and opportunities for the private sector. Yet it is not enough to simply do things better, or to operate more efficiently.

The threat of climate change demands that organizations do things in a wholly different way. Just as the digital revolution has driven massive disruption for business, now the climate crisis must be the next catalyst for widespread reinvention and transformation. Businesses must set up ambitious transformation journeys that enable them to reach a level of full sustainability.

This demands new business models as companies adapt to survive and complete the reshuffling of their portfolios of activity to ensure they are linked to sustainable development. Business leaders must keep this sustainability at the forefront of their thinking, aligning their products, services and delivery models with the changing lifestyles of today's consumers—who are increasingly conscious of their environmental footprint.

Envisioning the future

This move towards something completely different is part of the future visioning process underway amongst many of our own clients. Schneider Electric, for example, which recently repositioned itself as a provider of “energy and automation digital solutions for efficiency and sustainability”, makes a point of communicating the fact that green business is good business.

We are already seeing the impact of a shift towards consumer lifestyle

choices and experiences, rather than simply product purchasing. Consumers don't necessarily want to buy a car, they're seeking a hassle-free, cost-effective way to get from A to B. A sharing economy and environmental concerns are disrupting car ownership models and pushing drivers towards new mobility solutions, including ride sharing and renting. Of course, from a sustainability perspective, it would be even better if these new mobility solutions were supported by electric vehicles and local electric vehicle charging points (when the electricity is low carbon), which, in turn, suggests a whole new business model. In the energy sector too, we are working with clients to manage a transformation in the way in which energy will be generated, distributed, accessed, stored, protected, regulated and valued over the coming decades.

A green Utopia

In Sogeti's recent report 'Utopia for Executives'¹², renowned researcher, lecturer and consultant Professor Carlota Perez describes what she calls smart green growth and its implication of “a paradigm shift in both business and consumption”. She continues: “It involves creating an incentive framework that moves business to invest and innovate in a green direction, not only because it avoids climate change but because that is the best path to find dynamic demand and profits.”

In the Utopian world envisaged by Perez, recycling and upcycling would be the norm with a shift from products to services leading to a gradual dematerialization of gross domestic product (GDP). This Utopian green ideal, in which “waste would be embarrassing and durability highly desirable” has



the potential to bring in additional sources of revenue for companies, creating jobs and social benefits. This corresponds with the concept of a circular economy, whereby reuse, sharing, repair, refurbishment, remanufacturing and recycling come together to create a closed-loop system, keeping products, equipment and infrastructure in use for longer. This has both environmental and economic advantages, with one estimate suggesting adopting circular-economy principles could generate a net economic benefit of €1.8 trillion by 2030¹³.

To this end, companies must pivot to a new model, one that ensures success, while reducing energy consumption and fossil fuel-hungry travel. We are currently working with several organizations across diverse sectors to investigate and roll out the new sustainability-centric business models and technology that will make this happen. This requires reinvention enabled by the lever of new technologies, especially platforms and data.

This is already happening in certain instances as some pioneering companies use their resources to roll out and scale solutions to today's climate challenges. Capgemini Invent's design agency Idean has developed a planet-centric design approach that moves clients from the traditional end-user design effort to a focus on sustainability and circular business models. This requires organizations to reshape how they approach transformation projects by designing for humanity and planetary needs, rather than just to get a product or service to market.

CASE STUDY

SK GROUP

Many visionary companies, like global energy, chemical, petroleum, semiconductor and telecommunications conglomerate SK Group, are identifying their 10+ year roadmaps. With this in mind, Capgemini Invent has been working on a future vision over an even longer timeframe for SK Group, looking at a 30-year horizon.

Energy, connectivity and data are coming together like never before and SK Group is determined to seize the opportunities that this presents. Our research and proposals for transformative future innovation at SK Group reached into every corner of the energy value chain, from demand response and energy efficiency to battery networks in homes, microgrids and exponential connectivity in a world where energy demand is expected to triple through to 2050.

We identified a gameboard of multiple areas of transformation with the opportunity to ignite new business models, which will inform SK's innovation efforts in 2020 and beyond.

Technology: From villain to savior

In the ongoing drive to reduce carbon emissions, technology is viewed as both villain and savior; as both a contributor to the problem and part of the solution.

The energy consumption in inefficient technology solutions (such as heat producing data centers requiring energy-hungry air conditioning) is a cause for concern. As is the impact of streaming, which in 2018 emitted as much CO₂ as a country like Spain¹⁴, according to Joseph Tarradellas, honorary professor, École polytechnique fédérale de Lausanne (EPFL).

Yet for some, the inefficiency is a reason for hope. It offers the prospect for transformation. And, as we focus on programs that advance environmental sustainability, the promise of technology as a means to reduce emissions becomes increasingly attractive.

The right IT choices

At Capgemini, we view technology as one of the key levers available to address the mounting challenges posed by climate change. While technology has its own carbon footprint, research suggests that the right IT choices can make a 9.7x greater impact on the carbon output of a system than the system itself¹⁵.

We believe that by working together and embedding technology within sustainability strategy and targets, we can all collectively make a difference. Further, all technology investment must be considered through a sustainability lens. Business leaders have a responsibility to identify how technology can enable new lower impact consumption, business and sales models, as well as greener products and services.

We have identified three domains of technology influence on the response to the climate challenge:

- The IT estate—minimizing the environmental impacts of a business's own IT systems through consolidation, virtualization and cloud solutions, as well as by deploying energy saving solutions across the hardware landscape.
- Wider operations—employing technology as an enabler to drive efficiency across a business's entire operations.
- Society—going upstream or downstream beyond the boundaries of the organization to drive wider systemic changes with suppliers, customers and partners that enhance sustainability.

Digital and artificial intelligence (AI) are already proving crucial enablers of innovation in the area of sustainability, for example in a game-changing project to protect Sweden's forests — see facing page. They also have the potential to help our clients engage and influence their customers in line with a greener agenda. Solutions might include the use of smart labelling, consumer analytics, marketing, advertising, and active engagement through digital means. All of which requires data collection and architecture systems to be in place, thus a transformation of the underpinning technology landscape is needed.





CASE STUDY

SVEASKOG

In the drive towards 2030, the huge value of trees for absorbing harmful carbon from the atmosphere makes preserving the world's forests vital. Sogeti in Sweden has developed a Geo Satellite Intelligence (GSI) solution that is being used to help halt the destructive annual march of the spruce bark beetle. In 2019 alone, the bark beetle destroyed 7 million cubic meters of Sweden's forests, double that of 2018.

Sogeti is working with state-owned Sveaskog, Sweden's largest forestry

owner, to track and contain the progress of the beetle. The solution uses artificial intelligence, with advanced cognitive image analysis, Machine Learning and Deep Learning, to produce detailed maps that visualize the movements of the bark beetle. Drone technology is used to verify the accuracy of the data relating to affected forest areas, enabling Sveaskog to move fast to contain the progress of the bark beetles.

CASE STUDY

METRO FRANCE

METRO France has defined a strategy for greener, more sustainable operations. The French arm of international wholesale and food service specialist METRO AG established an internal Energy Department in 2014 to manage energy consumption and costs. It has an ambitious target to achieve a 40% reduction in the amount of energy it needs to operate by 2030. To date, several initiatives have already delivered a 25% reduction. This includes allocating a proportion

of annual investments to energy efficiency projects in lighting, cooling and heat recovery. A metering system enables energy consumption to be monitored at all stores, and the business is a proud holder of ISO 50 001 certification for the store energy management systems at all but the most recently opened stores (yet to be certified).

METRO France has also adopted a sustainable sourcing strategy built on two pillars: to produce as much of the energy it needs itself; and to agree new green sourcing Power Purchasing Agreements (PPAs) with local and regional energy producers.

The business has targeted 20% of its energy consumption to come from on-site green sourcing, with solar systems planned for all stores. The first pilot store installation was funded by METRO itself, but the business believed it could accelerate rollout by bringing in third-party investors. With the support of

Cappgemini Invent, a tender to install, finance and operate solar systems on the rooftops of 22 stores resulted in 20-year leasing contracts being awarded. This has given METRO France its own green electricity resource with no capital investment. New tenders will be requested to develop projects on all remaining stores.

The PPA pillar of the sourcing strategy took a major step forward in March 2019 with the first PPA ever signed in France. A wind energy producer has been contracted to deliver 20% of energy consumption. This will diversify risk on electricity prices (at competitive prices), whilst meeting sustainability ambitions. METRO France is now looking for other PPA opportunities with different producers.

4. Why ecosystems are needed

The scale of the transformation needed to meet emission reduction targets demands a huge level of investment from business; one that very few organizations will be able to make on their own.

Organizations must find their place in an ecosystem of new partnerships, through which they can combine their investments and leverage their specialist strengths to achieve more than they could by working alone. These ecosystems will touch on every aspect of a consumer's life, requiring businesses to re-imagine a more sustainable and joined up response to customer demands.

What do ecosystems look like?

In traditional sustainability terms, a marine, desert, or rainforest ecosystem comprises large communities of interconnected plants, animals and other organisms both taking from and feeding the natural world and atmosphere around them. Similarly, in the ecosystems discussed in this paper, businesses, industries, public bodies, academia, social enterprises, non-governmental organizations (NGOs) and consumers connect and feed into a radically transformed business landscape in order to drive long-term sustainable outcomes through to 2030 and beyond.

Where currently separate companies and even industries operate in silos, an ecosystem represents a shared responsibility to delivering on both business and climate change objectives. To this end, we are urging our clients to look beyond their own operations, to collaborate with all stakeholders (customers, investors, partners, start-ups, academia and government) to accelerate our collective journey towards achieving a net-zero economy.

Ecosystems are already reshaping markets and the way we consume products and services. They are enabling the paradigm shifts that are part of the answer to climate change. At Capgemini, we work within a number of ecosystems, collaborating with our clients and with global institutions, such as the United Nations and the World Climate Summit, to find solutions to the challenge of climate change. These solutions don't aim to dismantle the world of business, rather they focus on how to reinvent business models, drawing on ecosystems that are collaborative, open and digitally enabled.

Turning the spotlight on three ecosystems

Electricity and heat production, transport, residential buildings and commercial/public services are among the biggest carbon emitters globally. This means they also have the biggest potential to make a significant contribution to sustainability in the decade ahead. For that reason, we have identified three ecosystem types that we believe will be part of the climate change solutions of the future. There is a clear connection between all three, with both the energy and mobility ecosystems flowing into the concept of smart cities.

- **Energy**
- **Mobility**
- **Smart cities**

Built on trusted relationships, these ecosystems will enable the end-to-end environmental impact to be measured and managed, for example through data sharing and the installation of reporting platforms or supplier collaboration systems. In all of this, technology will be an important enabler as organizations use AI and digital to reduce carbon emissions and create new, greener business models.

New mobility ecosystems

Ecosystems are already yielding unexpected partnerships and the pooling of investments with the potential to drive more sustainable business models:

- Daimler and BMW formed a carsharing joint venture. They have merged their two platforms Car2go and DriveNow into SHARENOW, enabling them to scale their opportunities and to improve their business model. SHARENOW offers consumers a diverse and flexible way to move around the world's city centers. Cars are available on the street or in designated parking areas and can simply be dropped off within a Home Area rather than being returned to the pick-up point.
- Volkswagen and Ford are collaborating on the development of self-driving and electric cars. VW chief executive Herbert Diess said the tie-up "improves the positions of both companies through greater capital efficiency, further growth and improved competitiveness."
- In 2018 Honda invested in the driverless unit operated by rival General Motors with a view to launching a fleet of unmanned taxis.

“**Technology will be an important enabler as organizations use AI and digital to reduce carbon emissions and create new, greener business models.**”



CASE STUDY

INNOENERGY

In October 2017, the European Commission launched the European Battery Alliance (EBA) to allow all Europeans to benefit from less-polluting vehicles, while creating a competitive manufacturing value chain in Europe with sustainable battery cells at its core.

InnoEnergy, a European innovation fund for sustainable energy, has been mandated by the EC to steer the initiative and support this ecosystem of 250+ industrial, academic and institutional players in capitalizing on the job, growth and investment potential of the battery market.

Our Capgemini Invent business is working with InnoEnergy to structure and support the activities of the EBA250 initiative: from identification of business opportunities to implementation

of innovative projects all along the value chain, from mining to recycling. In this context, 200+ start-ups active in one or more fields of the battery sector have been identified and contacted, with more than 50 business opportunities studied, several of which are in the process of applying for the next investment round.

A strong cross-sectoral approach has been followed, initiating dialog between academics, large companies, start-ups and research centers across Europe on various research and industrial projects. All projects identified and discussed have the creation of a competitive European battery sector as their main purpose, but with an unprecedented emphasis on the environmental impacts of such industrial activities.

5. Energy—the 2030 vision

The 2030 energy sector will be radically different to how it looks today.

Traditional carbon-fueled utility models will be a thing of the past in 2030. Instead, as renewable costs decline over the coming decade—e.g. solar module prices dropped by nearly 30% in 2018¹⁶—the decarbonization of the sector will have gathered momentum. This is already underway. In 2018 there was a jump in the EU's clean energy investments, driven by solar and wind, while Singapore has been leading the way in Southeast Asia by embracing a greener energy mix with solar photovoltaic panels and its Open Electricity Market that enables consumers to opt for green energy¹⁷.

By 2030 we expect to see the current centralized utility model to have been replaced by a more decentralized, distributed, technology-enabled set of new business models. Energy companies will no longer be the sole providers of heat and power. Rather, they will be managing supply and demand dynamically, operating as energy management platform companies. We are already seeing some companies working within an ecosystem of new market entrants, technology vendors and other partners, which is something that will be the norm in the future. This is a major shift for traditional utilities,

which need to change their business models from owners of large assets with predictable cashflow toward being portfolio managers with uncertain long-term cashflow.

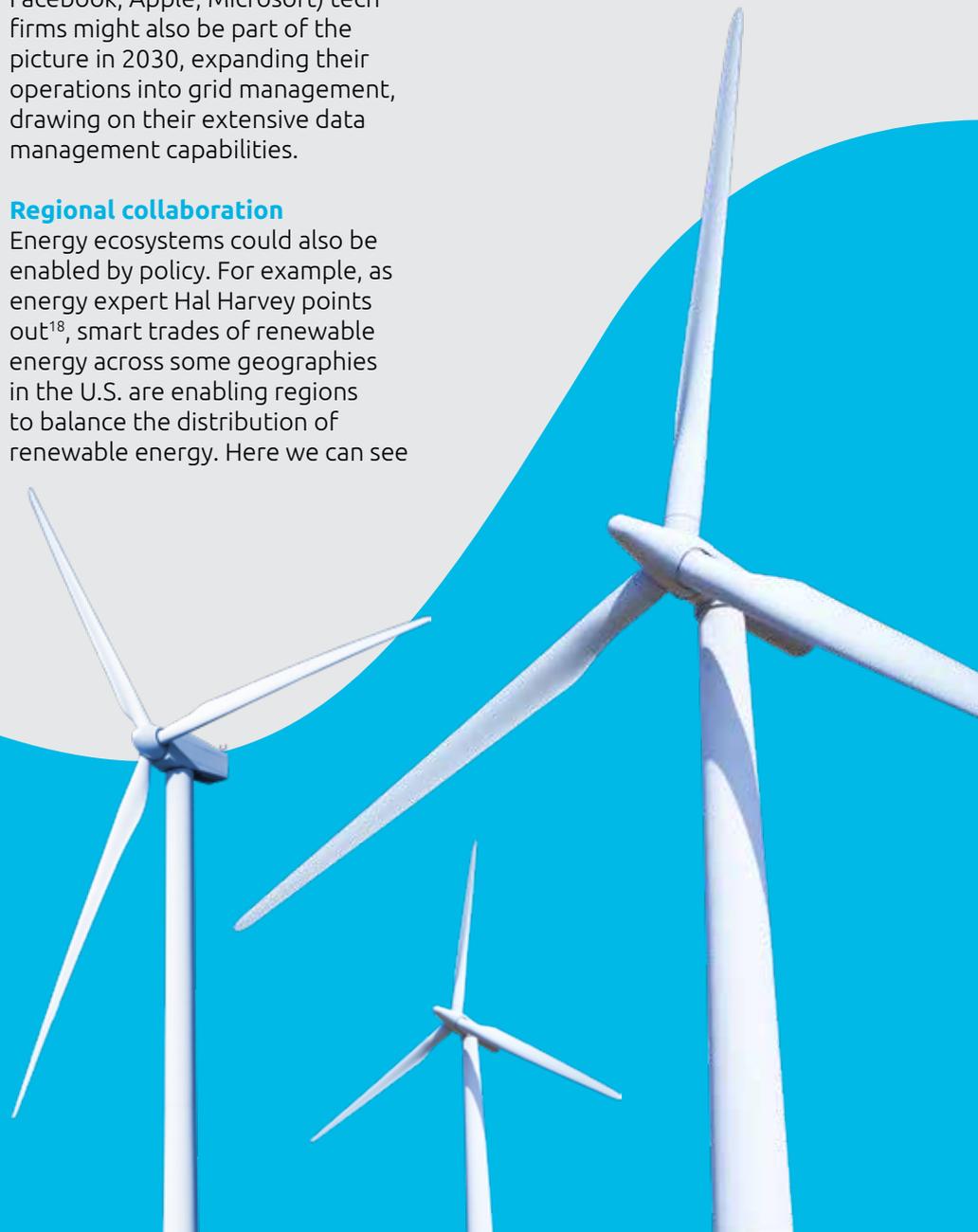
One reason for the increase in players in this industry is that electrification and digital will have lowered barriers to entry, enabling new startups to challenge or partner with incumbents. For example, the deployment of smart grids at scale will demand expertise in data collection, data mining and AI to improve forecasting and operations. The big GAFAM (Google, Amazon, Facebook, Apple, Microsoft) tech firms might also be part of the picture in 2030, expanding their operations into grid management, drawing on their extensive data management capabilities.

Regional collaboration

Energy ecosystems could also be enabled by policy. For example, as energy expert Hal Harvey points out¹⁸, smart trades of renewable energy across some geographies in the U.S. are enabling regions to balance the distribution of renewable energy. Here we can see

the grid of one region with a lot of wind energy connecting with the grid of another region with a lot of sun to mitigate the risks of shortage inherent in the unpredictability of renewable resources. In February 2019, Portland General Electric (PGE) and NextEra Energy Resources in the U.S. developed a major energy facility co-locating wind (300 MW), solar (50 MW) and energy storage (30 MW). PGE is able to meet about 50% of its customers' power needs with emissions-free generation¹⁹.

Energy ecosystems already include the end consumer and we expect



this to continue to grow. Through initiatives such as microgrids and home-generated energy, including solar and photovoltaic (PV), customers will be suppliers themselves. New technologies, such as blockchain, will enable domestic energy generation solutions to connect to trading platforms and, in this new disaggregated landscape, we expect to see more peer-to-peer marketplaces for energy trading.

Microgrids are already part of the energy mix, with some utilities selling new services related to their management. In 2030 many more microgrids will be operating separately from the main grid, characterized by small networks of electricity users. According to one report²⁰, the global microgrid market is expected to reach USD 17.51 billion by 2025, growing at a CAGR of 17.0%. These microgrids will be powering small areas, such as a municipal district, or facilities like a university campus, hospital complex, industrial site, or prison.

Another interesting business-led dynamic in the 'greening' of the energy sector is emerging in Southeast Asia. Here, investors are becoming aware of the regulatory and climate change risks associated with coal-fired power, and some of the region's biggest financiers of power projects, including leading banks, are withdrawing finance from new coal projects²¹.

Surviving the transformation

Who will thrive in this new landscape? Forward-thinking companies are acting now. They know that they will only survive by reinventing their established business models, pivoting towards sustainability and growing their ecosystems. For example, in North America, a surge in the installed base of smart home systems has seen the emergence of a new business model based on generation and storage at home²². Another new model emerging is that of as-a-service, such as microgrid-as-a-service and smart mobility services and infrastructure. As they transform into energy management platform companies,

energy firms face the task of balancing production and consumption points, and optimizing value based on energy price, CO₂, peaks in demand, and availability of renewable energy. Technology is driving many of the changes needed to monitor, measure and reduce carbon emissions. For example, we will see greater use of smart meters and smart grids, as well as investment in new, carbon-friendly battery storage and EV charging points.

The successful companies will be those open to collaboration with all the players in this new-look market, including the hardware and software solution providers that will enable the integration of new energy resources with existing grid infrastructure. Some established companies have already expanded into, or acquired businesses in, new, renewable markets. Others are buying or collaborating with technology partners in areas such as e-mobility, energy-efficient storage and the fast-growing EV market. Reinvention is key. For example, Capgemini Invent worked closely with National Grid in the UK on a major project to transform a core part of its business. This will ensure it can deliver a sustainable, secure, and affordable energy future, with the target to operate the UK's electricity network with zero carbon by 2025.

CASE STUDY

NATIONAL GRID

National Grid System Operator (SO) sits at the heart of Great Britain's energy system, running the electricity and gas system networks safely and efficiently, while enabling and accelerating progress towards a low-carbon energy future.

2019 marked an historic year for the organization in terms of its commitment to sustainability, with more electricity generated from zero carbon sources than fossil fuels. In May this year, National Grid Electricity System Operator (ESO) also achieved its first ever coal-free fortnight; the first time since the Industrial Revolution.

2019 also saw the culmination of a two-year transformation program, supported by Capgemini Invent, to separate National Grid's ESO business from its main operations—"Legal Separation". The objective

of this major transformation was to establish a new legally separate entity (National Grid ESO) that could adapt to changing customer and industry expectations, remove any actual or perceived conflicts of interest and provide greater ESO independence and market transparency. To bring the separation project to fruition, National Grid supported by Capgemini Invent worked with government and the industry regulator to define, design and implement the transformational journey.

Sustainability is a key feature in the new ESO mission to enable the transformation to a sustainable energy system and ensure the delivery of reliable affordable energy for all consumers. To support this mission, the ESO has outlined success criteria for

2025, which include an electricity system that can operate carbon free, and a strategy for clean heat. The ESO today is financially and operationally independent from the wider National Grid business and is facilitating competition in the onshore transmission market. The National Grid ESO will be responsible for working with the energy industry to tackle some of Great Britain's most pressing energy challenges. This will require a whole system (gas and electricity) approach to support decarbonization of heat, transport and industrials to support the 2050 net zero target.

6. Mobility—the 2030 vision

The widening scope of environmental legislation means that regulation will be a primary driving force in the automotive sector’s approach to carbon emissions by 2030.

The automotive industry has been on an ongoing sustainability journey dating back to the 1990s with the introduction of increasingly stringent legislation and standards around particulates, carbon monoxide (CO), nitrogen oxides (NOx), hydrocarbons and, of course, CO₂. Bringing the regulatory landscape up to date, we saw the introduction of the Worldwide Harmonized Light Vehicle Test Procedure (WLTP) in 2017 and, in August 2019, the first ever EU-wide CO₂ emission standard for heavy duty vehicles entered into force. By 2030, truck manufacturers in the EU must have reduced the CO₂ emissions of their annually sold truck fleet by 30% based on their actual CO₂ emissions.

Why the need to legislate to bring about change? Despite higher CO₂ standards, there was a 4.2% rise in energy use across the world transport sector between 2014 and 2016²³ Further, just 7.6% of transportation in Europe came from renewable energy sources in 2017.

While currently there is a long journey ahead in pursuit of the UN IPCC carbon reduction target, we expect to see a very different picture emerging in this sector by 2030. Indeed, the EU standard for heavy duty vehicles is expected to reduce CO₂ by around 54 million tonnes through to 2030.

Governments and policy makers will also find ways to incentivize greener manufacturing and consumer mobility behaviors, as well as innovation around sustainability.

A broader sustainability target

Propelled by regulation and incentivization, the business imperative in the automotive sector to transform rapidly will have resulted in organizations embracing new technologies by 2030, such as AI, blockchain and 5G, alongside new partnership models. Together, these will have pushed a more sustainable agenda and, where needed, rebuilt trust in the accuracy of manufacturers’ emissions controls and reporting.

However, at Capgemini, we believe that this agenda must extend beyond simply meeting carbon emissions targets to embrace a far broader context, including other greenhouse gases and the end-to-end supply chain. In our 2030 vision for the automotive sector, new technology makes it possible to track a vehicle from the supply of raw materials, such as aluminum and plastic, through production, sales and after sales. By 2030 manufacturers will be able to



benchmark the sustainability of their car lines, using blockchain to give traceability of parts.

The role of the consumer is also part of this mix. Consumers are adopting new, greener and more flexible approaches to getting from A to B. This will be more of a mobility 'experience', rather than just being about vehicles. Over the coming decade, original equipment manufacturers (OEMs) will be forced to shift from being product-centric companies to being product and service oriented, offering incentives and new ways in which consumers can get from A to B sustainably.

Mobility ecosystems and electric vehicles

New partnerships are being forged to drive innovation in the face of escalating costs and reducing margins as a result of tougher emissions legislation. The development of these mobility ecosystems will enable OEMs to exploit new possibilities and deliver new more carbon-friendly use cases. These include multi-modal transport and car-sharing, both of which offer the end consumer low-carbon, easy-to-access transport options.

More sustainable transport will also require a rethink on the part of consumers about how they travel. In a What's NOW San Francisco presentation in March 2019²⁴, Tim Papandreou points out that

two thirds of all trips in the U.S. are of five miles or less, which could easily be achieved without a personally-owned car via a mix of walking, scooter hire, sharing, public transport, etc. And, as we will see in our discussion on smart cities, greener intermodal transport will be a feature of urban transport models in the coming years. However, Papandreou notes that in many cities the public transport options are not yet reliable enough to get people out of their cars, so transportation policymakers must think harder about this.

We also cannot expect the internal combustion engine on which the bulk of today's global industry is built to disappear by 2030—if at all. The challenge will be to get the right balance, perhaps by legislating on sustainable inner-city transport and with eco-friendly taxation in more advanced economies, while accepting that delivering mobility in currently under-represented regions, such as Africa, cannot be achieved purely with electric vehicles.

In 2030 OEMs will be working with many new market entrants, described in our Connected Vehicle Trend Radar report²⁵ as including "established players from six industries: automotive, technology, energy and utilities, financial services, and increasingly telco and retail". This is analogous to the current iPhone platform on which

external developers share apps and new services.

The OEMs will be collaborating with companies specialized in telematics, remote services (e.g. diagnostics), infotainment and navigation, hardware, software and data, as well as safety and security (e.g. advanced driver assistance systems). With such a broad ecosystem, the successful OEMs will be those able to reinvent themselves with a strategic vision to create the e-mobility business of the future. To this end, they should look to provide and orchestrate open platforms where third parties can develop and offer services that will be seamlessly integrated in a connected ecosystem.

Electrification is the green option

Driven by regulation relating to emissions targets, electric vehicles (EVs) will be a key feature in this world. Market forecasts suggest that electric cars will increasingly dominate global sales, jumping to 55% by 2040 from just 3% in 2020²⁶. In China, for example, more than one million EVs were sold in 2018 alone, while in Norway, EVs reached a 32% market share of sales in 2018²⁷. Thus, from a carbon emissions perspective, electrification will have accelerated the transition to greener e-mobility solutions by 2030—if complemented by the use of green energy to charge the cars, and low-emission production values. This move to more e-mobility requires radical rethinking and redesign of core business models in order to find new and sustainable sources of value and ensure survival through electrification.

“By 2030 manufacturers will be able to benchmark the sustainability of their car lines, using blockchain to give traceability of parts.”



The end-to-end ecosystem enabling an EV charging infrastructure will be broad. It will extend from energy producers and distributors, to charging infrastructure providers, battery management and geo-services. Pivoting business models to embrace collaboration is thus essential. We believe that in the years through to 2030 and beyond, companies operating in connected e-mobility ecosystems must define a sustainable green energy offering. They should consider the incentives and change measures that will enable private and fleet vehicles customers to switch to electric mobility. This is important because going green comes at a cost. Indeed, while 66% of consumers would accept vehicle interiors made from

renewable resources for a moderate price increase²⁸, they are not going to pay a premium for these green components.

Until recently, the focus of EV production has been on premium mobility, where the cost to the consumer is high. This is beginning to change with some manufacturers turning their attention to more affordable e-mobility and the production of volume segment vehicles. To promote mass adoption over the coming decade, OEMs and their partners must minimize the cost and infrastructure barriers to e-mobility. Further, OEMs can actively strengthen the green value of their EVs by providing solutions, such as green electricity tariffs, that

enable their customers to operate sustainably and with very low emissions.

At the same time, as the business model pivots to something more sustainable, there will be social implications that cannot be ignored. The impact on those suppliers and employees currently focused on traditional fossil-fueled mobility will be huge. Greener manufacturing processes enabled by automation and AI will also have an impact on the future workforce. Business success will be shaped by a company's ability to position itself as a provider of eco-friendly mobility solutions, while addressing the need to transition employees and, where possible, suppliers.





66% of consumers in the automotive sector would accept vehicle interiors made from renewable resources for a moderate price increase.



CASE STUDY

AUDI

Car giant Audi is one of the leading industry players driving the shift towards electric mobility. It has announced ambitious targets for the conversion to electric vehicles. By 2025, Audi plans to offer 30 electrified models, 20 of which will be purely electric, with 10 more offered as hybrid models.

At the same time, Audi aims to be a pioneer in terms of climate protection. By 2025, all production sites should be CO₂-neutral, and the company wants to be completely CO₂-neutral by that same year at the latest.

This demands new manufacturing approaches and new business models. As part of the automotive manufacturer's e-mobility transformation journey, our Capgemini Invent business has been working with the company to develop new concepts, business models and solutions enabling new approaches. This includes economic and process frameworks for the market adoption of intelligent charging solutions that are linked to home energy management systems, and which integrate photovoltaic facilities or energy storage systems. Among the new business models

already up and running is Audi's e-tron charging service, launched in February 2019. Audi developed the service to offer its clients the best experience when it comes to public charging of electric cars based on one of the biggest charging networks in Europe. The service grants drivers (B2C and B2B) access to more than 110,000 charging points in 21 countries around Europe. Audi's e-tron charging service continues to evolve and the manufacturer is working on solutions for B2B customers to make charging and related management of electric vehicles a more seamless experience.

7. Smart cities, better cities—the 2030 vision

Two thirds of the world's population live in cities.

According to the United Nations, the urban population grew from just 751 million in 1950 to 4.2 billion in 2018²⁹. That's a phenomenal rate of growth. The UN believes that understanding the key trends in this urbanization over the coming years is crucial to the implementation of the 2030 Agenda for Sustainable Development.

In developing countries, urbanization has seen power demand continue to exceed supply, growing 5-7% per annum as countries urbanize at record speeds³⁰. Further, a 2018 study of 13,000 cities³¹ found that the 100 highest-footprint cities worldwide drive roughly 20% of the global carbon footprint. For this trend to be reversed, local authorities must become smarter, more connected with partners on open platforms, and more digitally enabled. Technologies can help cities make both moderate and significant progress towards their sustainable development goals.

Platforms and data solutions as part of a smart cities approach could also help them regain control over their infrastructure and better coordinate with different stakeholders in the local territories. Of course, in parallel with this, any organization capturing, sharing and storing citizens' personal data in this digital world has an obligation (both moral and regulatory) to put in place the systems and processes needed to protect that data.

All of this demands a complete and urgent rethink of how cities are managed. Without this rethink, the IPCC's 2030 target will not be achieved.

Meeting changing citizens' needs

A growing urban population will put huge pressure on urban transport systems and energy grids at peak times, as well as demanding appropriate housing infrastructure, secure public spaces and modernized public services. New partnerships and digital innovations will help to attract citizens and visitors, improve citizens' quality of life and reduce

their environmental footprint. They will, for example, enable faster and greener journeys to work and ensure citizens can communicate in real time, using smart data as they pursue new city transportation modes, such as bike rental and shared transport.

This is happening right now and will have given rise to the steady growth in the smart cities concept across the world by 2030. Already being rolled out in many urban areas, the concept was developed to use and leverage new and emerging technologies, as well as data, to respond to the environmental and social challenges that urban living has given rise to. From 5G to strong internet of things (IOT) deployment, technology is already the main driver, but in the coming decade it must be leveraged correctly to take cities to the next level.

From ideation to implementation

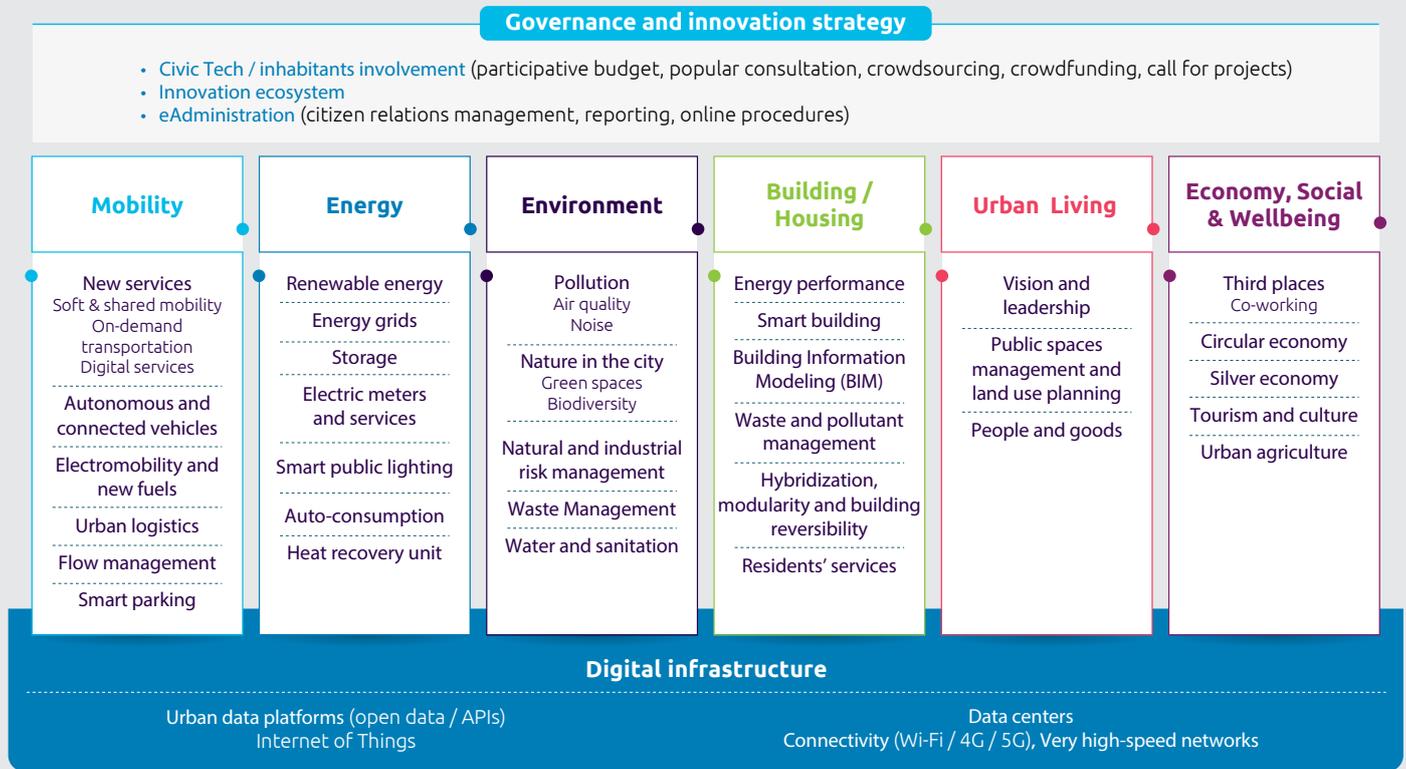
Smart cities have begun investing in these technologies and will continue to do so in the coming years. By 2030, they will be entering a new phase, in which smart



cities will be even more inclusive, efficient and collaborative—in a nutshell, ‘better cities’. Technical innovations will continue to be developed to optimize urban traffic flows (intelligent transportation management systems), energy consumption (via smart meters

and blockchain), e-government applications, etc. Cities will have transformed the management of their complex systems and infrastructure to reduce emissions, enabled by technology, in areas such as those depicted here:

Capgemini’s Smart Cities services framework maps the potential space of needs and offers



Smart Cities develop a multiplicity of innovative services for citizens (inhabitants and visitors), companies, public agents and elected representatives

Adopting an ecosystem approach is the only way to make this transition. Local governments must bring on board external partners and integrate different sector expertise, technologies and business models to further develop the evolving smart city landscape and scale their urban data platforms. For example, projects centered around complex systems (EV charging stations, network automation, and advanced communication systems) will use the operations and infrastructures typically owned by energy and utilities companies. Their smart grids are already a feature of the smart city landscape, with more on the horizon.

The value of data

Fundamental to continued smart city development will be a shift in how cities use technology to manage and analyze data. How do they make good use of it to respond to

identified needs and to push a more sustainable city agenda? In 2030, information about energy, air quality and traffic flow will be collected via various IOT sensors and devices, including citizens’ smartphones. Smart connected digital platforms will enable authorities to manage the data to monitor environmental impacts, keep traffic flowing, manage parking, and improve the quality of life for citizens. In tandem with this is the need for new policies that govern how data is aggregated from a range of sources within new urban ecosystems.

This will impact the way public-private partnerships are settled. The private sector will bring funding, digital know-how and innovation capabilities that complement public sector authority and need for better data management and usage. The data layer will be—and is already becoming—more and more crucial to contributing to the wellbeing of

citizens and visitors.

In some countries, the use of technologies such as AI to analyze data and predict air quality can’t come soon enough. For example, in the latter part of 2019, India’s air pollution hit global news headlines with schools in Delhi ordered to close and the citizens of Kolkata struggling to breathe due to high levels of smog. Europe is also not immune. A recent medical research study³² found that higher air pollution in the UK triggers heart attacks, strokes and acute asthma attacks each year, and contributes to 500,000 premature deaths in Europe annually.

There are already great pioneering smart city examples around the world with a mix of objectives, from happiness in Dubai, to sustainability in Hong Kong. Capgemini has been at the forefront of smart city development, working in partner ecosystems to bring the vision for 2030 and beyond to life.

In Dijon, France, we were part of a consortium developing and rolling out a smart city project known as OnDijon across all 23 Dijon municipalities³³. This is connecting urban equipment to a centrally-managed control center, which monitors public services and equipment, including more than 34,000 LED lighting units. Maintenance can be better coordinated, urban equipment such as traffic lights, street lighting and CCTV is centrally managed, and citizens' transport and travel across the region is more effectively organized and coordinated. The city expects to reduce its carbon emissions by 65% as a result of the transformation.

Incentives, regulation and taxation pave the way for change

Pioneering smart cities recognize the need to drive through new policies for sustainable transport. They take the lead in engaging with transport operators by both regulating their contract requirements and incentivizing change for citizen benefit.

According to recent research, across the ongoing smart city projects globally, 14% primarily focus on energy, 3% on water, 20% on transportation, 5% on buildings, 34% on government and 24% on multi-sector deployments.³⁴ Leading smart cities use cases include the following:

- » **Stockholm:** An EV taxi incentive scheme in Stockholm has successfully stimulated changes in driver habits³⁵. The city has also introduced an EV incentive scheme for taxis at its Arlanda Airport, encouraging take up with a new policy giving drivers with EV taxis priority in customer queues, allowing them to generate better business.
- » **Singapore³⁶:** Among the many initiatives that place Singapore at the forefront of smart city development is its Virtual Singapore platform. This is a 3D model of the city that enables city authorities to observe multi-system effects, such as how a new building affects the flow of traffic, or how parking regions develop.

» **Madrid:** Consumer power saw thousands of citizens protesting in the streets of Madrid to keep a diesel ban on Madrid's city center in force after an incoming mayor tried to reverse the law³⁷. Madrid is among many towns and cities in Spain granting municipal road tax discounts of between 50% and 75% for EVs³⁸.

» **Copenhagen:** With a goal of being the first carbon-neutral capital by 2025³⁹, Copenhagen is on the frontline of adopting sustainable solutions. For example, its diesel buses are being switched to electric in the city center, which is also easily accessible from the local airport by public transport.

» **Paris:** The authorities have implemented a color-coded car emissions sticker scheme to indicate a vehicle's emissions level, with the most polluting vehicles given tightly restricted access to the city center at certain times.

» **Los Angeles:** To reduce traffic and keep children safe, the city is limiting navigation apps by banning cut-through routes in residential streets, aiming to stop sending drivers down narrow side streets.

Government intervention

Investment at national level will also play a part in managing the emissions challenge of greater urbanization through to 2030 and beyond. During 2019, for example, Singapore has been investing in research and development and test-bedding to enhance the efficiency of solar PV systems and develop innovative technologies to implement solar energy systems into the urban environment⁴⁰. Further, with the UN expecting India's urban population to reach 404 million by 2050, the Indian Government made a commitment to invest in 100 smart cities over five years⁴¹.

Continued government intervention—both local and national—will be critical in the development of cleaner, more environmentally friendly cities in the coming decade.

Expect to see more policies and partnerships designed to create sustainable transport models by 2030, along with new housing regulations forcing developers to invest in better energy consumption in the homes they build, and incentives encouraging citizens to leave their cars at home in favor of public transport.





CASE STUDY

CITY OF DÜSSELDORF

We are helping one of Germany's biggest cities to shape and deliver its vision for sustainable mobility. City authorities in Düsseldorf aim to reduce levels of motorized transportation and to establish an independent marketplace for mobility. By developing an innovative digital platform, the city will offer connected and bundled mobility services to its residents, commuters and visitors.

To deliver and scale these innovative solutions, a new urban mobility unit has been set up, bringing together Düsseldorf's administration with an ecosystem of strong mobility and infrastructure partners. Our Caggemini Invent business developed a concept for the new mobility unit and its initial service portfolio, including physical mobility hubs, smart parking solutions and the digital platform app.

8. Next steps, right now

With irrefutable evidence of the escalating global environmental crisis, the challenge for organizations is how to maintain business performance, while pivoting to address the existential threat of climate change. How can they hit the 2030 carbon reduction target prescribed by the IPCC?

This is now an urgent strategic priority. We have a decade to get it right—or even less. The consequences of getting it wrong are unthinkable. Simply improving how businesses operate will not be enough to meet the IPCC's 2030 emissions reduction target. Nor will it meet increasingly stringent regulatory requirements.

Business survival beyond 2030 demands transformative and innovative solutions. Paying lip service to the challenge will not satisfy the growing clamor from consumers for greener, more sustainable products, services, and lifestyle solutions.

10 recommendations for sustainable business

To this end, we have defined a set of 'next steps' for today's business leaders:

1. Pivot your business model to deliver a collaborative response to the climate challenge, forming open ecosystems with other businesses, industries, public bodies, NGOs and consumers to bring about long-term sustainable outcomes.
2. Embed technology within your sustainability strategy and targets, ensuring every technology investment is considered through a sustainability lens.



3. Set up a transformation program to reach ambitious carbon reduction targets. This is a company-wide topic, extending beyond the sole responsibility of the CSR officer.
4. Ask what new business models, products or services your company should be exploring, and redesign your products and services with a planet focus.
5. Measure the environmental impact throughout your supply chain: sharing data and installing reporting platforms and supplier collaboration or coordination systems. And consider how to influence suppliers' sustainability actions, as well as those of your customers and employees.
6. Look into instituting an internal carbon price, which can help to steer more sustainable business and investment decisions—in 2016 more than 1,200 companies worldwide reported that they were either pursuing internal carbon pricing or preparing to do so⁴².
7. Capture data and deploy the necessary architecture systems to help you engage and influence consumers.
8. Understand the environmental impact of your wider operations, using smart or IOT devices, available data and reporting infrastructure.
9. Put pressure on authorities to set higher sustainability targets and protect against environmental dumping.
10. If you're going to go to zero, go to zero now—do not delay. Ambitious targets drive innovation and change.

Disruption demands radical reinvention

The climate crisis is causing massive disruption. To survive, organizations must reinvent their business models and radically transform ways of working. Sustainability thinking is no longer optional, but the speed at which you embrace the opportunity to change—and how far you go—will make a substantial difference, both to your competitiveness and to the planet.

Of course, operating more

sustainably and managing resources more efficiently can make an immediate impact on your costs, productivity and carbon footprint. What's more, newly developed Return on Sustainability Investment (ROSI) methodology indicates that sustainability can be monetized, leading to competitive advantage and shared value for multiple stakeholders. As a driver of financial performance, sustainability contributes to innovation, employee engagement and retention, increased productivity, improved consumer sales and marketing, better supplier risk, and operational efficiencies.

However, the disruptive force of the climate crisis means that this is about so much more than the bottom line. Further, no one company alone can tackle the massive global transformation needed to address climate change. The biggest impact will come when we all look outside our own operations, engaging with partners, suppliers and customers to take an ecosystem view. Sustainability happens within the entire supply chain of value creation, whatever the industry.

There is no time to wait. Pivot your organization to a new, greener ecosystem model and radically change your business model before it is too late—for our planet and for your business.

CASE STUDY

CAPGEMINI

At Capgemini we continue to evolve and reinvent our own approach to sustainability. Having reached our 2020 carbon reduction target two years early, we are now focused on delivering our 2030 Science Based Target as soon as possible. To achieve this, we are taking a holistic approach to energy management in our offices and data centers, enabled by smart technologies. We're facilitating virtual collaboration and promoting smart, safe and sustainable business travel as we reduce emissions and provide alternatives to getting on planes or in cars.

We've installed solar panels and building management systems, along with LED lighting and smart buildings controls that have reduced

energy consumption. At all times we're looking for ways in which we can use new technologies that give us access to cleaner, renewable energy sources. The result? By 2018 we had achieved a 24% reduction in our energy emissions since 2015 and made an 11% cut in travel emissions per head.

As well as these strong commitments and successes internally, we've set an ambitious target to help clients save 10 million tonnes of carbon by 2030. This is important to us—we believe that we can save 10 times as much carbon by helping our clients transform than by making savings purely in our own business.

Our Capgemini Invent business has already embraced the client challenge and is helping organizations design, build and deliver their low carbon strategies. Through these engagements, we are enabling clients to achieve radical transformation by re-inventing almost every aspect of their operations with a sustainability focus.

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A global leader in consulting, technology services and digital transformation, Capgemini is at the forefront of innovation to address the entire breadth of clients' opportunities in the evolving world of cloud, digital and platforms. Building on its strong 50-year heritage and deep industry-specific expertise, Capgemini enables organizations to realize their business ambitions through an array of services from strategy to operations. Capgemini is driven by the conviction that the business value of technology comes from and through people. It is a multicultural company of over 200,000 team members in more than 40 countries. The Group reported 2018 global revenues of EUR 13.2 billion.

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