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Transformation

The world in 2030, Part 1

25 February 2025

Key takeaways

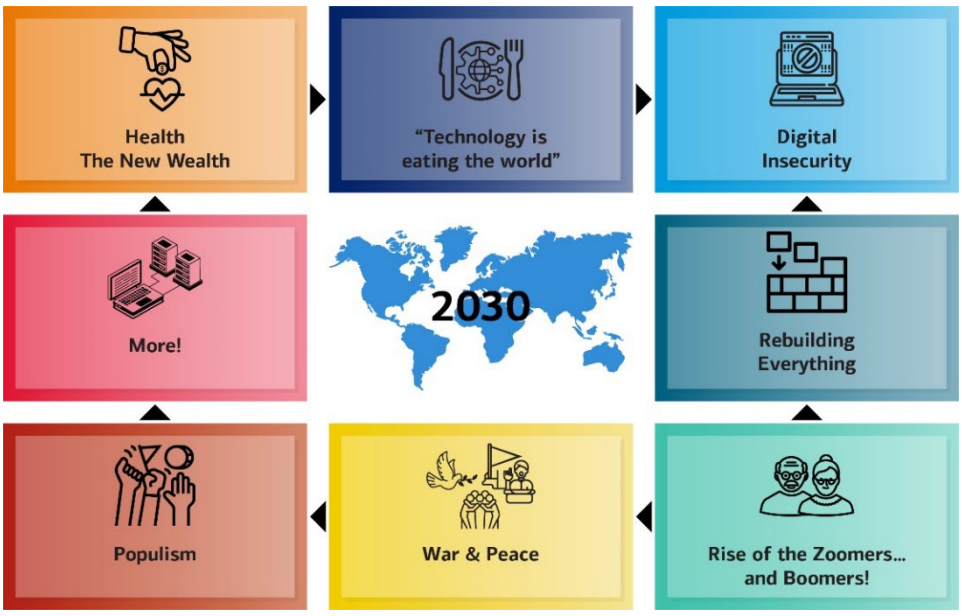
- As we head toward 2030, the next five years will be like no other. In fact, according to BofA Global Research, these are the years that will rip up the old rule book and rewrite the framework of the economic, strategic and thematic megatrends that will impact society.
- While the first half of this decade can best be described as a macro world of quantitative easing, GDP booms and inflation shocks - all on the heels of global pandemic - the next five years will see a shift toward more micro themes.
- From the AI revolution to digital insecurity, and the need for more resources (e.g., water, energy and bandwidth) to modernized infrastructure, part one of this two-part series shares the first four of eight themes that will shape our world in the years leading up to 2030.

From a very macro world to the era of *micro*

The first half of the 2020s started with a global pandemic, a $30 trillion policy response from governments and central banks, including quantitative easing (QE), and an inflation and rates shock alongside war and the emergence of AI.

But as we look ahead, the next five years will see micro developments take center stage as the pace of technological disruption accelerates amid widespread adoption of AI in business and society. Meanwhile, powering AI and ensuring productive implementation will require more of everything, including resources and infrastructure. From AI to geopolitics, and from demographic trends to populism, in this two-part series, we'll discuss eight themes that will shape our world over the next five years (Exhibit 1). Here, we start with four: technology, digital insecurity, "more of everything," and rebuilding.

Exhibit 1: From AI to geopolitics and generational shifts to resource bottlenecks, BofA Global Research identified eight themes that will shape our world leading up to 2030.
Illustration of eight themes for the next five years.



Source: BofA Global Research

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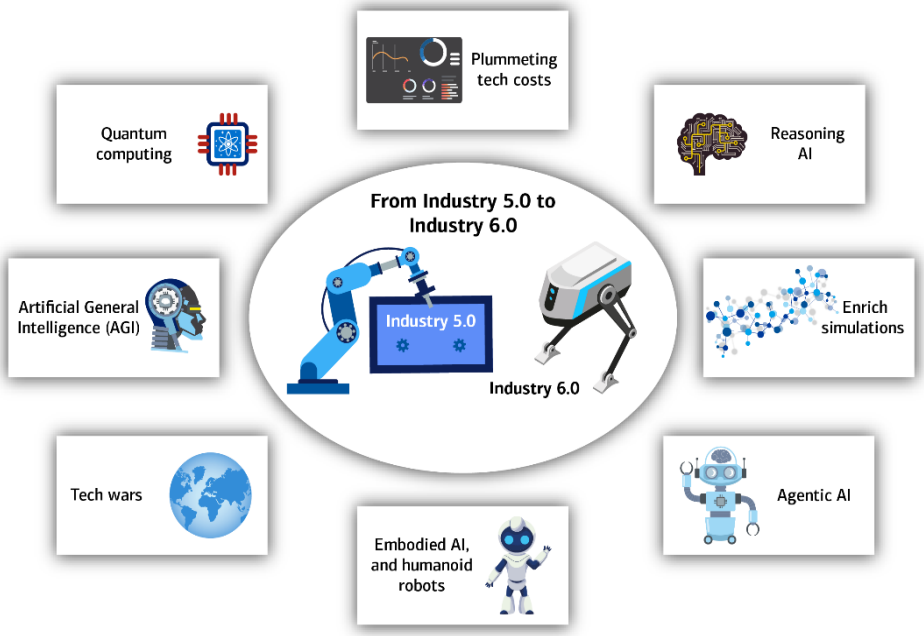
1. “Technology is eating the world”

Technology is moving us to a new phase in the next five years. Powered by the AI revolution, BofA Global Research believes that we will watch technology prices plummet and see AI’s integration in all aspects of our lives, while witnessing its game-changing role in leap-frogging innovation (see: AI: From evolution to revolution? and our Next Gen Tech series for more on this topic). Agentic AI will influence the job market, and rich AI simulations will develop new products in healthcare, industrials and financial services. Furthermore, AI will interact with the physical environment, enabling the next generation of automation. At the same time, we are likely to see a tech war “arms race” between the superpowers, complicated by accelerated deglobalization and tech protectionism, as well as privacy and demographic concerns (Exhibit 2).

Exhibit 2: As the world moves from Industry 5.0 to 6.0, trends include falling tech costs, reasoning AI, enriching simulations, agentic AI, embodied AI, tech wars, artificial general intelligence (AGI) and quantum computing

Illustration of tech trends over the next five years



Source: BofA Global Research

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Welcome to Industry 6.0 – minimizing human intervention

The AI large language model (LLM) revolution has accelerated the adoption of Industry 5.0, which emphasized collaboration between humans and advanced technologies, such as AI-driven robots, to optimize workplace processes. We are now seeing AI integrated in every aspect of our lives, and “humanizing” automated processes. This is moving society from the humanization era (Industry 5.0) to Industry 6.0, which aims to minimize human intervention by creating fully integrated, intelligent manufacturing systems based on the next generation of technologies. How?

- **Tech-onomy: Technologies powering themselves toward lower prices**
  Investments in automation, AI and tech are reducing prices across the board and increasing returns. For example, while drive capacity has risen by more than 20,000 times in the past 20 years, the price per gigabyte has fallen by >99%. More technology gets deployed to satisfy demand, which leads to falling prices. Then, these technologies become cost-effective in new applications, feeding increased demand again.

- **“Reasoning AI”: Adding the human element**
  AI model capabilities are expanding to include tasks that require reasoning. Thus far, AI LLMs have used algorithms for tasks that can be solved with rapid thinking, with increasingly sophisticated versions owing to their emergent properties. However, the new versions of models can now break down complicated problems into separate tasks and hypotheses, using “reasoning” to get to a solution – much like human thinking.

- **Agentic AI: A world of 100 billion AI agents working alongside us**
  What is Agentic AI? Put simply, it’s a type of AI that can act autonomously to make decisions and take actions to achieve a goal without explicit instructions. Think: a proactive, AI-powered agent. It represents a new generation of increasingly

powerful foundation models that act as operating systems for autonomous, action-taking, digital agents capable of enhanced reasoning and decision-making, as well as increasingly disruptive chatbots and copilots. As we wrote in The new wave: Agentic AI, over the next decade, these fully autonomous agent and robot fleets may ultimately alter verticals heavily reliant on human capital and spark a corporate efficiency revolution that transforms the global economy.

- **AI-enriched simulations are changing industries**
  AI simulation combines techniques from quantum physics and deep learning to enable sampling a vast dataset quickly and efficiently. AI-enriched simulations are being leveraged for other innovations such as drug discovery and material breakthroughs including chips, chemicals, and materials. For example, AI has helped to discover 45 times more crystals than previously known to man. And using AI in drug discovery facilitated the finding of a novel drug candidate for liver cancer in just 30 days.

- **Embodied AI, physical intelligence and humanoid robots**
  AI is enabling rapid progress in robots, given the ability to program and interact with them via language models. The term "embodied AI" was first used to describe the branch of AI that focuses on how computers, systems and technology can interact with the physical world. It typically includes AI for sensorimotor skills, navigation, and real-world interactions. But with the rise of generative AI, embodied AI is also being used to give this technology a physical form, typically a robot, including autonomous vehicles and drones. The next half a decade will be breakthrough years for robotics thanks to AI.

- **Quantum advantage as soon as 2025?**
  We are currently in the early prototype phase of quantum. Scaling up a quantum computer's qubit number, a basic unit of information, involves solving for many problems such as error correction, cost, speed, and energy efficiency. Current quantum computing companies will need to solve these problems, but will reach a limit on the qubit number they can achieve because of the complex architecture that they employ, including physical systems like cabling and racks. Like an orchestra, which has all kinds of requirements to run smoothly, for a quantum computer to scale, they must solve problems such as readout control (measuring the quantum state of qubits), real time error correction, cost, energy efficiency, high speed/low latency, multiplexing (dividing a communication channel into a number of 'logical' channels) and GPU (graphics processing unit) integration.

- **Artificial general intelligence (AGI)**
  AGI refers to the hypothetical intelligence of a machine that possesses the ability to understand or learn any intellectual task that a human being can. Since the first discussions about general AI and technological singularity by mathematician Von Neumann in the mid-20th century, scientists and technologists have repeatedly predicted the coming of human-level intelligent machines in the near term. AGI is a winner takes all scenario and whoever gets there first has great power: it could give military advantage, accelerate research and development, make businesses more competitive, and much more.

2. Digital insecurity

Can you imagine ending the decade with the "death" of privacy, job market disruption, 10 deepfakes for every person on the planet, and cybercrime as the third largest GDP in the world? It's no wonder that many of us feel more anxious than ever before about technology risks given everything - cybersecurity hacks, AI agents displacing human workers, the rise of fake news and the spread of mis/disinformation, and social media addiction leading to loneliness.

The global cost of cybercrime is expected to surge to $15.63 trillion by 2029-30.[1] At the same time, an attempted deepfake attack occurs every five minutes,[2] with the number of deepfake videos doubling every six months since 2018.[3] And deepfake damage costs are projected to reach $40 billion by 2027.[4]

Cybersecurity: The digital black swan for 2030?

Cybersecurity is the top risk in a transforming world because of how reliant we are on technology, in BofA Global Research's view. Most of the world managed to get through COVID lockdowns and physically social distance, but would this have been possible without access to the digital world? The rise of generative AI now creates a new 'threatscape' (Exhibit 3). For example, using the compute power of 10,000+ A100 Nvidia GPUs to train ChatGPT, it would take just one second to crack a password today.[5] Hacks now take an average of 277 days or about nine months to identify and contain.[6] And cybersecurity is increasingly becoming a matter of national security, with critical infrastructure more vulnerable to attacks. The costs associated with cybercrime are set to hit $10.5 trillion around 2025, making it the world's third largest 'economy' behind only the US and China.

[1] Statista
[2] Onfido, Entrust
[3] Sensity AI, Information Matters
[4] Deloitte
[5] NetSec, Hive Systems
[6] IBM

Exhibit 3: From supply chain compromise of software dependencies to AI abuse and skill shortages, these are the top 10 emerging cybersecurity threats for 2030
Illustration of the top 10 emerging cybersecurity threats

Source: ENISA (European Union Agency for Cybersecurity) Foresight exercise 2022; BofA Global Research
Note: ICT: Information and communications technology

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Deepfakes: Is this the re(AI) life or is this just fantasy?

Deepfake videos are synthetically altered footage in which the depicted face or body has been digitally modified to appear as someone or something else. Another type of machine learning is added to the mix, known as generative adversarial networks (GANs), which detects and improves any flaws in the deepfake within multiple rounds, making it harder for deepfake detectors to decode them. GANs are also used as a popular method of creating deepfakes, relying on the study of large amounts of data to "learn" how to develop new examples that mimic the real thing, with startlingly accurate results.

Jobs: Will AI replace workers?

The future of work is not zero-sum between humanity and technology. Throughout history, technology has always created entirely new types of jobs as it has transformed the economy. From the first industrial revolution onward, employment has shifted as new technologies have become widespread. However, BofA Global Research does not believe there will be dire job losses from AI in the next five years. Per WEF (World Economic Forum), AI could actually create a net increase of 78 million jobs. In fact, four and a half times more jobs could be positively "influenced" by generative AI compared to those replaced by 2030[7].

However, compared to previous revolutions, the worry of today is the unprecedented speed of disruption from AI agents, humanoid robots, etc., where more jobs might be displaced at a faster rate. We need to reskill one billion people by 2030, which is one-third of all jobs worldwide, because of technology disruption.[8] And the more bearish estimates suggest that two billion jobs could disappear by 2030.[9]

Loneliness… from social media?

Did you know that at an average of 143 minutes per day, per user, the world spends 720 billion minutes per day using social platforms? Over a full year, that adds up to more than 260 trillion minutes, or 500 million years of collective human time.[10] Additionally, we now spend five years and four months across our lifetime on social media. In the same amount of time, we

[7] Forrester
[8] OECD (Organization for Economic Cooperation and Development), WEF (World Economic Forum)
[9] Thomas Frey, futurist
[10] DataReportal

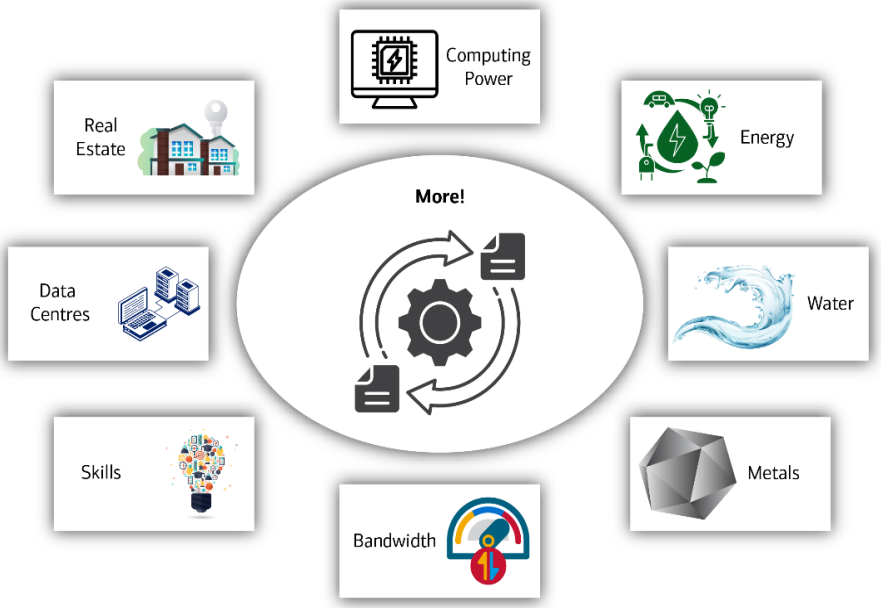
could have flown to the moon and back 32 times, walked the Great Wall of China three and a half times, climbed Mount Everest 32 times, run more than 10,000 marathons and even walked our dogs 93,000 times.[11]

Between 2003 and 2019, the aggregate time spent alone, according to the American Time Use survey, went from 43.5% to 48.7% – pre-pandemic. Then, between 2019 and 2021, the percentage of time spent alone went up to 50.5%. The internet was supposed to make the world more open and connected, yet with nearly 5.5 billion people now online, or 67% of the world's population,[12] it paradoxically feels like we've never been more isolated.

3. More of... everything!

A transforming world has transforming needs. Exponential growth of technology will require significantly more resources and infrastructure, adding to the already growing requirements from population growth. The rise of AI is accelerating demand for data, computing power, bandwidth and expanded infrastructure such as energy, water, commodities and data centers. Several bottlenecks are already emerging in these areas, as well as gaps in the skills and human capital required to deliver them. New technologies and solutions are needed to avoid structural deficits between 2025 and 2030 (Exhibit 4).

Exhibit 4: Expansion of AI requires more of everything: compute, energy, water, metals, bandwidth, skills, data centers and real estate
Illustrating the resource and infrastructure needs required by AI and future tech



Source: BofA Global Research

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Exponential technology requires a lot more of...everything!

Simply put, deepening technology adoption alongside population growth means we need significantly more resources to enable the productivity gains and economic growth potential from AI and future technologies. The key growth areas in the next five years include:

- **Compute**: Semiconductors are crucial enablers of future technologies, with demand broadening as their capabilities expand. Demand for graphic processing units (GPUs) that can handle tasks simultaneously (known as parallelism) is accelerating, predominantly to train AI models. On top of that, demand for specialized chips for AI inference is set to grow as the usage of AI models grows. It's not just AI, though: manufacturing capacity and supply chains are expanding due in part to increasing demand from electronics, autos, industrial and communications networks in addition to data/compute requirements for AI.
- **Energy**: We're going to need a lot more energy capacity to accommodate increasing demands from technology, in addition to decarbonization and energy security goals. This has broader macro implications, gradually shifting the provision of energy from that of an extracted commodity in finite quantities with volatile prices, to a generated technology with widespread availability, decreasing cost as the scale of production increases. Whilst clean energy assets dominate new

[11] Short Stack, MediaKix
[12] DataReportal

capacity additions, multiple sources of energy generation will be needed to meet these increasing demands for power, varying by region.

- **Water**: Growing agricultural, residential and industrial uses are increasing the risk of water scarcity. Some two-thirds of the world's population face shortages as soon as 2025[13] and accelerating AI is set to compound this. See our publication, Ocean Tech: Transformers, for more on this topic. Why? Data centers require water for cooling purposes, to avoid equipment overheating and inefficiency. In fact, they consumed 309 million gallons of water a day on average in 2023 (enough to supply 3.3 million people) and are projected to increase to 468 million per day by 2030[14] as more AI data centers are established.

- **Metals**: Several mined materials are becoming increasingly critical for multiple overlapping technologies, particularly in the energy, transport and aerospace sectors. This poses not only a scarcity risk, but also a geopolitical one because the concentration of minerals in a few geographical areas risks a race to control the resources required.

- **Bandwidth**: Rising AI/tech adoption will stress internet infrastructure, requiring more fiber and advanced networks such as 5G, and beyond. Today, the digital universe has reached the level of the yottabyte, with 90% of the world's data having been created in the past two years.[15] According to IDC (International Data Corporation), the amount of data created is projected to double every two to three years. Significant capacity additions to the network and bandwidth are needed to enable this growth to continue.

- **Skills**: As previously mentioned, per OECD (the Organization for Economic Co-operation and Development), up to one-third of the global workforce will need to be reskilled by 2030 owing to a combination of disruptive technologies. And an even higher 40% of the workforce may need to be reskilled as a result of implementing AI and automation by 2028.[16]

- **Real Estate:** Where will all the data centers be built? Well, more land will be needed to accommodate growing technology requirements. In 2024 there were a total of 11,000 operational data centers, but as much as 24,000 are expected to be required by 2030.

4. Rebuilding everything!

Global infrastructure needs to be expanded and modernized to accommodate converging demographic, sustainability and innovation trends. But there's a funding gap – $94 trillion is required globally by 2040,[17] and an estimated $500 billion is needed each year by 2030 *on top* of available public funds.[18] This spans several structural trends – including decarbonization, electrification, disruptive technologies, reshoring, shifting demographics and aging of existing assets – all requiring a significant increase in infrastructure investment.

The relationship between technology, economic growth and infrastructure is closely tied to both expansion *and* modernization requirements. For the former, expanding infrastructure is needed to support digital technologies and several structural trends, including data centers, high-speed data networks, and energy installations to power them. On the other side, however, older infrastructure such as power grids, water systems and transport networks require replacement and modernization to integrate new technologies such as AI monitoring, sensors and intervention.

Energy transition: Towards a decarbonized, decentralized, digital energy system

The global energy system is transitioning towards more diversified sources of power generation and storage, which requires significant infrastructure and technology. Global investment trends are beginning to reflect this, with close to $2 trillion invested in a range of clean energy assets in 2023 (double that of 2020). However, much more is needed.

The power we're supplying…it's electrifying! Grid reinforcements are needed

Simultaneous electrification of transport, buildings and industry creates several difficulties in balancing the production, transmission, storage and demand for energy. The electricity grid needs to add considerable new capacity to accommodate this, in addition to upgrading and replacing existing assets. Investment in supporting supply chains is necessary as well, such as cable manufacturing and metals. Copper required for electricity networks could double in 2020-40 for example, per the IEA (International Energy Agency), outpacing the volume required in electric vehicles.

This work requires a combination of investment and technologies. However, smart grid infrastructure, virtual power plants, regional and subsea interconnectors, and reconductoring (advanced conductors that can double capacity on existing lines), are examples of key technology investments that could help mitigate asset replacements.

[13] WWF (World Wildlife Fund)
[14] Bluefield Research
[15] IBM
[16] WEF
[17] Oxford Economics
[18] Brookfield

Disruptive tech needs more data centers and related infrastructure

Data centers are key to enabling AI and several related technologies, with capacity set to increase rapidly. McKinsey projects that by 2030 scaling data center infrastructure will require more than $1 trillion, $250 billion of which would be in installation of mechanical and electrical systems. To put the pace of demand growth in context: to avoid a supply deficit, at least twice the data center capacity built between 2000 and 2024 would need to be built in less than a quarter of the time.

Grids get digital and automated

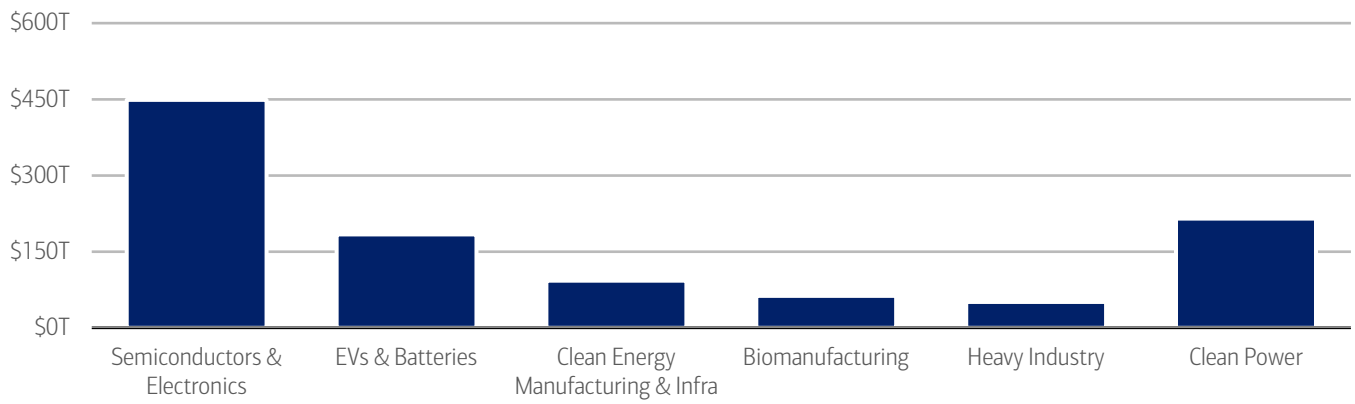
Changing energy generation/consumption patterns will require better monitoring, optimization and control of the electricity grid, all of which can be enabled through digitalization and automation. Annual grid spend on digital technologies is set to more than triple between 2022 and 2030, per BNEF (Bloomberg New Energy Outlook), to over $100 billion, tripling again by 2050, shifting from the largely monitoring spend today, to technologies required to enable more distributed energy resources. Automation and control would make up the majority of these investments. This not only enables the reliable provision of energy, but also identifies bottlenecks more quickly, brings more energy resources online when required, and achieves peak load shifting through pricing incentives – all of which is expected to increase in the next five years.

Aging assets meet reshoring and energy security

Aging infrastructure in several developed economies needs to be rebuilt and modernized. In the US, infrastructure such as roads, dams, and water treatment plants have all exceeded their life expectancy on average. Half of US power grid infrastructure assets are more than 20 years old, and 30% of EU (European Union) power lines are over 40 years old, which could reach 90% by 2050.[19]

This has not gone unnoticed. Since 2021, more than $1 trillion in private manufacturing investments have been announced in the US, for example, following incentives such as the US Infrastructure Investment and Jobs Act. Focus has been on reviving manufacturing in several industries (e.g., semiconductors, EV (electric vehicle)/batteries, and renewable energy) with multiple national security and economic objectives including energy security, tech self-sufficiency, reducing price volatility and geopolitical risk (Exhibit 5).

Exhibit 5: Private US manufacturing investments announced since 2021 exceed $1 trillion, half of which is in semiconductors and electronics
Infrastructure investment is reviving US manufacturing ($, trillions)



Source: White House Invest in America as of January 10, 2025; BofA Global Research

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Demographic trends driving infrastructure investment

A combination of urbanization, aging populations and changing consumer/retail preferences are all driving increased infrastructure investment needs. The global urban population exceeded the rural population for the first time in 2007 and the world has continued to urbanize since. By 2030, the UN (United Nations) expects the world to have 43 megacities (vs. 31 in 2018) with a population of over 10 million people. By 2050, it expects some 66% of the global population to be living in cities on average, rising to 87% in developed countries (vs. 70% in 1980). Asia and Africa are set to contribute the majority of this growth (90%).

Such rapid urbanization will require smart solutions in infrastructure – particularly in mobility (e.g., mass transit and eventually autonomous vehicles), clean energy, housing, water, food production (e.g. vertical farming), technology (e.g., telecommunications), and waste management.

[19] Eurelectric

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