Global Counsel

Enabling digital efficiency:

The opportunity for a more competitive and resilient energy transition

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COMMISSIONED BY CISCO

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About this report

Global Counsel (GC) was commissioned by Cisco to develop a policy framework to guide governments in harnessing digitalisation as a tool to enable a more energy-efficient and energy-secure global economy, highlighting tangible ways governments can use digital technologies to cut costs, enhance resilience, and reduce emissions. Through this lens, the report aims to showcase how digital innovation can reshape traditional approaches to sustainability challenges—offering governments new ideas that can drive economic growth and provide energy security.

The insights and recommendations in this report are derived from GC's own independent research, discussions with governments, non-governmental organisations (NGOs), research bodies, and businesses, and Cisco's experience developing and deploying digital technologies.

Cisco's industry-leading portfolio includes innovations in networking, security, and cloud management— which contribute to building a secure and connected future. As a global leader in digital infrastructure, Cisco has a goal to reach net zero greenhouse gas (GHG) emissions across its value chain by 2040. The company strives to help industries and communities reduce their environmental footprint through secure, scalable, and energy-efficient digital solutions.

GC is a strategic advisory firm, helping companies and investors across a wide range of sectors to anticipate the ways in which politics, regulation and public policymaking create both risk and opportunity - and to develop and implement strategies to meet these challenges. The GC team has experience in politics and policymaking in national governments and international institutions backed with deep regional and local knowledge. The GC team behind this paper brings extensive expertise in technology, energy, and climate policy.

Executive summary

Why focus on digital energy efficiency?

In 2024, global energy efficiency was expected to see only a modest improvement of approximately 1%. This is about the same rate as the year before and represents about half the average annual improvements over the decade between 2010 and 2020. While some countries made greater energy efficiency improvements to build resilience in response to the energy crisis between 2021 and 2023, the overall pace of global efficiency gains is declining[1]. Progress is especially slowing in advanced economies while emerging and developing economies have either kept the same pace or only slightly improved. This trend is concerning because energy efficiency is a proven tool for reducing costs, improving energy security, and building resilience. For individuals, businesses, and governments alike, greater efficiency translates into lower energy bills and less exposure to price volatility. Moreover, accelerating energy efficiency improvements is also necessary for delivering over a third of the global CO_2 emissions reductions needed between now and 2030[2].

Digital energy efficiency solutions present policymakers with the opportunity to enhance economic competitiveness, strengthen energy resilience, and support sustainable economic development. Governments around the world have already recognised the importance of energy efficiency by committing to an ambitious target to double energy efficiency globally by 2030 from 2022 levels at the COP28 international climate summit in Dubai, UAE. Successful delivery of this goal could lower energy usage by 10% even if global GDP grows by as much as 25%[3]. Digital efficiency solutions decrease the energy required to provide services like transportation, lighting, heating, and cooling.

By reducing the cost of energy services, we can free up resources for households, businesses, and governments to allocate elsewhere. For businesses, doubling energy efficiency would improve their resilience to energy price volatility while cutting operating costs by as much as 8%[4]. Doubling energy efficiency could also result in the largest emissions reductions of solutions available to policymakers[5]. COP28 was a pivotal moment recognising the wide-ranging benefits of energy efficiency for the economy and society. Now, by focusing on the sectors, enablers, and policy levers that can encourage this change, we can enable accelerated action.

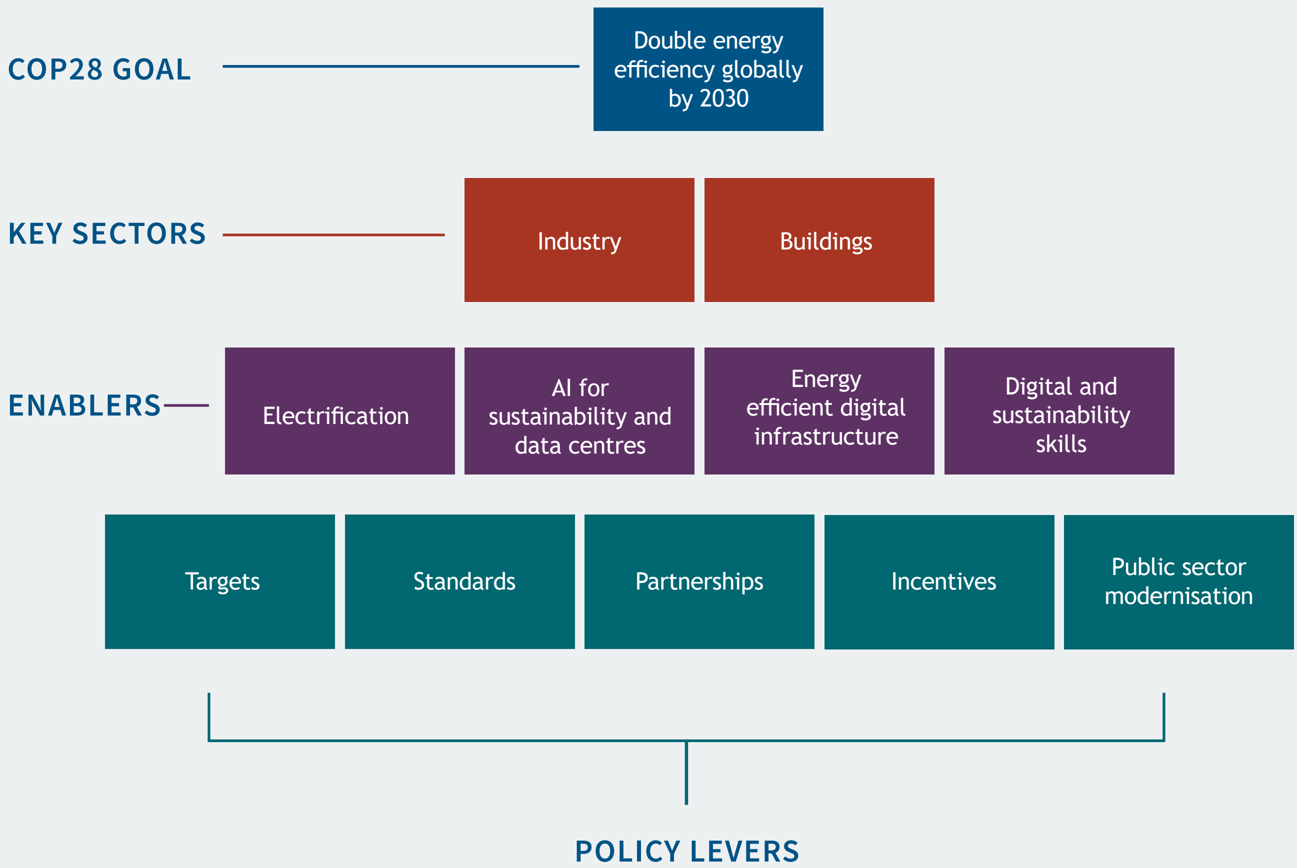
Industry and the built environment are key sectors in which policymakers can have a significant impact on improving energy efficiency using digital solutions. In 2023, industry accounted for more than 170 exajoules (EJ) or 39% of global final energy consumption[6 7]. Meanwhile, in the same year, global energy demand in buildings represented 125 EJ or 28% of global final energy consumption[8]. The energy use of both sectors grew between 2010 and 2023 and is projected to continue growing under current policy scenarios despite the importance of starting to decrease emissions to meet global sustainability goals[9,10]. While new industrial production methods mature, especially in hard-to-abate sectors like steel and cement, existing technological solutions can play a vital role in reducing energy waste. At the same time, sectoral transformation in the built environment is needed focusing on two fundamental strategies: energy efficient retrofitting and embedding energy efficiency requirements in new buildings. Digital technologies to improve energy efficiency in both industry and buildings are proven, economically practical and ready to use given the right enabling environment. Businesses operating in these high energy use sectors could use digital technologies to reduce costs while contributing to overall energy security and resilience.

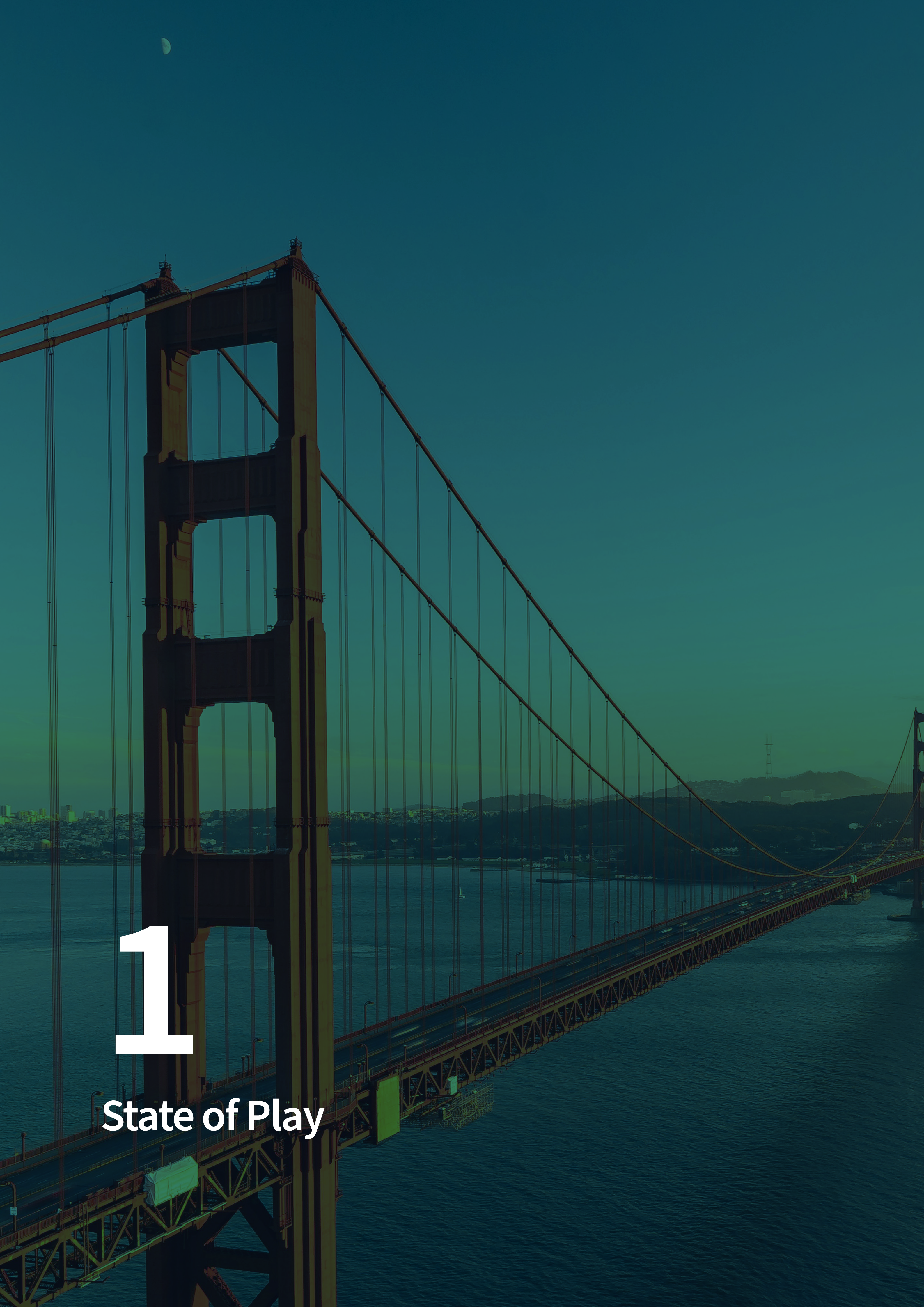
For high energy use sectors to become more energy efficient, four core ‘enablers’ should be considered: electrification, AI and data centres, energy efficient digital infrastructure, and digital and sustainability skills. Electrification is necessary for enabling end-use sectors, such as industry, to be powered by the increasing amounts of clean energy sources supplying the grid. AI for sustainability and data centres can empower users to more effectively identify and reduce energy waste in industry, buildings and other sectors. However, the net efficiency gains from AI and data centres will depend on the development and use of energy efficient hardware and digital infrastructure. Finally, key sectoral transformations and enablers are expected to rely on the upskilling and reskilling of workforces to meet the demands of the new digital economy powered by clean energy.

To bring about systemic change through these enablers, policymakers should focus their efforts, in industry and buildings, on five core policy areas:

- → Encourage economy-wide and sector-specific targets to spur advancements in energy efficiency.
- → Collaborate with partners to develop internationally aligned standards for energy efficiency in industry, buildings, and data centres.
- → Encourage the development and use of fiscal incentives to support the development and use of energy efficient technologies.
- → Partner with industry to invest in the skills needed to power clean innovations and the digital economy.
- → Modernize public sector infrastructure and systems using energy efficient technologies.

Taken together, this paper sets out the overarching framework for the policies, enablers, and key sectors that are needed to double energy efficiency globally — helping national policymakers make their countries cleaner, more resilient, and more economically competitive.





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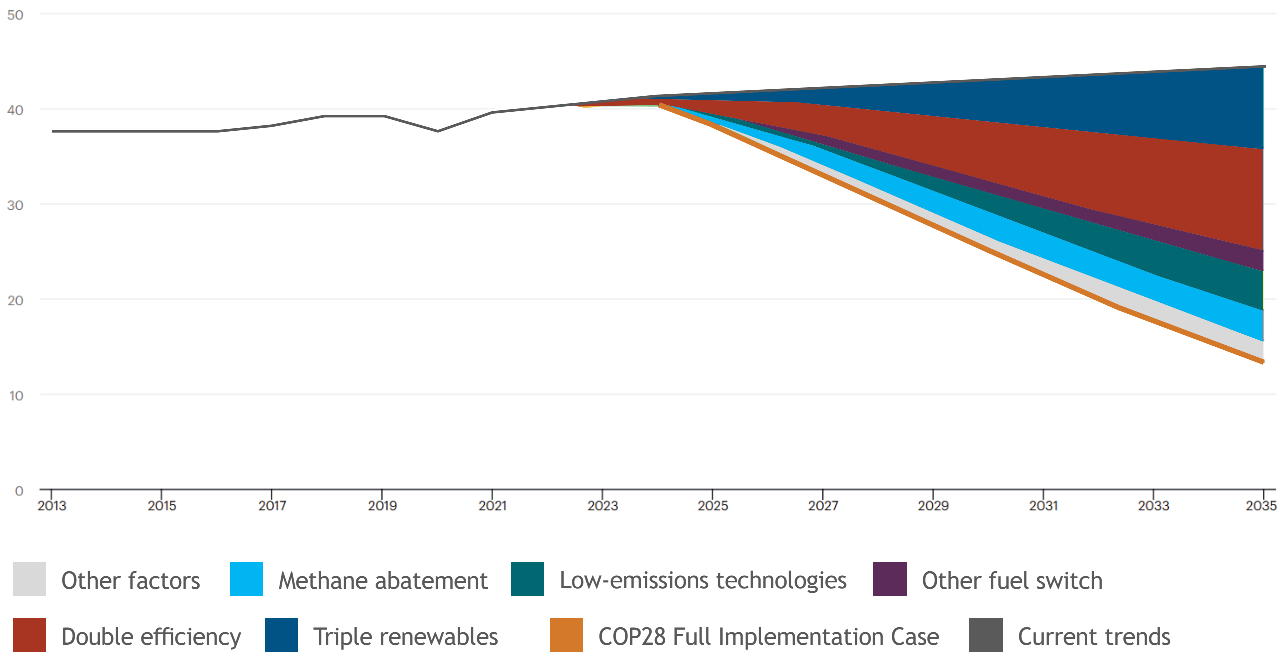
State of Play

State of play

In 2023, nearly 200 world leaders convened at COP28 and signed the 'UAE Consensus,' committing to accelerate "efforts globally toward net zero emissions energy systems well before or by around mid-century." To deliver on this long-term objective, governments agreed on two interim milestones for 2030: tripling the global installed capacity of renewable energy and doubling the rate of energy efficiency. If implemented alongside enabling policies, global energy sector emissions could fall by 30% by 2030 and 60% by 2035, compared to 2022 levels[11]. Successful implementation of these goals could help deliver the promise of a more energy-resilient global economy.

The immediate challenge for policymakers is to turn these global energy objectives into effective national strategies. Over one year after the historic agreement to double global energy efficiency, estimates project that the average rate of global energy efficiency improvements will remain at 2%, well short of the 4% target[13]. Progress is also highly uneven across jurisdictions. While the EU has demonstrated notable ambition, many other countries have not yet identified strategies to bolster the adoption of modern solutions that can enhance energy efficiency while still driving more sustainable economic growth. Without new domestic plans and policy instruments - such as standards and incentives - these countries risk missing critical milestones, potentially jeopardising progress on global targets and missing out on a key economic growth opportunity.



SOURCE | INTERNATIONAL ENERGY AGENCY (2024). FROM TAKING STOCK TO TAKING ACTION[12]

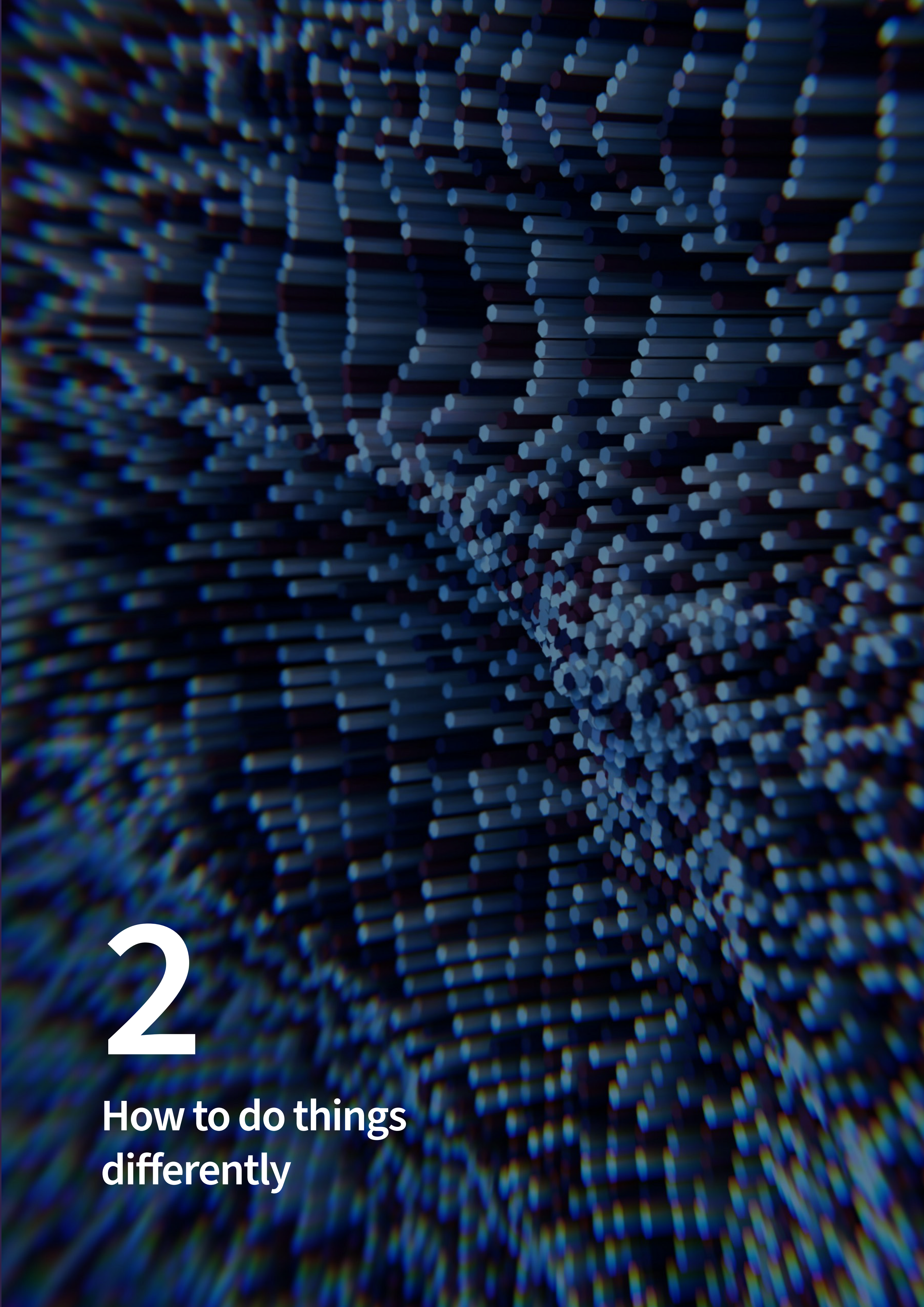
An opportunity to focus on digital energy efficiency

Of the two COP28 2030 energy goals, doubling energy efficiency improvements has the potential for the greatest impact on lowering costs for businesses and improving sustainability. Modelling from the International Energy Agency (IEA) suggests that doubling efficiency improvements would lead to 10% lower global energy demand even if the economy grows by as much as 25% by 2030[14]. In addition, not only is energy waste impacting businesses' sustainability performance, but it is also affecting competitiveness: businesses that minimize energy waste also reduce their energy expenses. Analysis indicates that implementing technologies to reduce energy demand that are available at scale today could result in up to $2 trillion USD in annual savings globally by 2030[15]. Meanwhile, due to the energy crisis between 2021 and 2023, businesses across OECD countries are on average currently facing 40% higher energy prices than in January 2021[16]. This cuts into business profits and prevents greater investment in other critical areas of the economy. Together, these considerations make energy efficiency improvements one of the most significant economic and decarbonisation opportunities available for advanced, emerging and developing countries alike.

Prioritizing digitalisation can help achieve global energy efficiency targets. Deployment of innovative technology, such as the Internet of Things (IoT) and AI, can help industrial, energy, built environment, and agricultural sectors optimise energy consumption to reduce costs and emissions. Estimates suggest that, if done effectively, efficiency gains through digitalisation could abate 10 gigatons of CO_2e by 2030[17]. For example, digital twin solutions are reducing emissions all around the world, with cities like Rotterdam[18] and Abu Dhabi[19] at the forefront of deployment. However, governments have often addressed the digital and energy objectives in siloes, missing opportunities to bolster their combined impact. This is especially important as electrification, increased manufacturing and building construction, and growing use of AI are on track to accelerate energy usage. To ensure that energy efficiency gains outpace growing demand, national governments should break down prevailing siloed approaches to digitalisation and energy efficiency and security.

Digitalisation of high-impact sectors, especially industry and buildings, can yield the greatest efficiency gains and emissions reductions. Together, these two sectors accounted for nearly a third (31.7%) of global CO_2 emissions in 2023, making them key priorities for decarbonisation[20]. With existing policies, emissions from buildings are projected to rise and industrial emissions flatline. Energy savings from digitalisation can help cut certain industrial subsector emissions by anywhere from 15 – 66%[21, 22]. For example, AI can help heavy emitting industries to optimise management of heating and lighting systems through forecasting, clustering and offering recommendations to users. Meanwhile, digitalisation can reduce energy demand in the building sector by up to 10% while increasing demand response capacity tenfold[23]. Policymakers working to bolster energy efficiencies across their economy should focus their efforts on the role that digital technologies can play in enabling the decarbonization of these two sectors.

Following a wave of elections in 2024, newly elected governments have an opportunity to build a more competitive and resilient energy sector, increase energy affordability, and deliver on these global commitments. This report provides a framework to help governments reduce uncertainty for businesses and adopt new approaches that maximise the benefits of digitalisation for energy and sustainability goals.



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How to do things differently

How to do things differently

Accelerating efficiency improvements in industry and buildings

DIGITALISING INDUSTRIES

Digital technologies have long been utilised by industry to enhance safety and productivity but are underutilised for optimizing energy performance and efficiency. Expanding the application of digitalisation could unlock substantial energy savings with short payback periods by optimising process controls both within and beyond industrial plants. Innovations like digital twins, machine learning, and improved connectivity could have an even more transformative impact. Enhanced data collection and analysis have the potential to optimise production processes, improve energy efficiency, and minimise waste across production operations.

While it is difficult to quantify the precise energy savings from digitalisation—given variations in activity type, management practices, organisational culture, and supply chain integration—data from real-world facilities suggests that advanced digital process controls can achieve substantial efficiency gains at little or no net cost[24]. It has been estimated that smart manufacturing solutions alone could reduce GHG emissions by 2.7 gigatons of CO_2e[25]. The potential for energy savings from digitalisation in industry is significant but not being realised under existing policy frameworks in spite of potential competitiveness gains, likely reflecting a relatively low awareness.

The IEA's net zero scenario suggests that industrial emissions need to start falling by 2030 to reach net zero by 2050. While industrial emissions have not grown between 2019 - 2023, they have flatlined during that period—a trend that is expected to continue unless significant changes occur[26]. Decarbonising the industrial sector is particularly challenging: many low-carbon technologies for key processes are still in development or remain prohibitively expensive, while industrial assets have long lifespans and are rarely replaced. However, technological solutions already do exist to reduce the impact of current industrial processes as new production methods mature. In particular, digitalisation can improve industrial energy efficiency resulting in lower energy usage, emissions, and costs for industrial production (see case study 1).

Case Study 1: Splunk's Partnership with Bosch Rexroth

Splunk offers a big data platform that helps users with a range of tasks, including cybersecurity, observability, and network operations. Splunk provides users with granular, unified and real-time visibility across applications and hardware devices. In the manufacturing sector, this capability empowers companies with a unified view of key technical and business metrics across their operations to optimize at scale. Splunk partnered with Bosch Rexroth to help optimize energy efficiency, energy cost and carbon footprint across their production facilities. Through the partnership, Splunk was able to support Bosch's approach to environmental sustainability reporting while also optimising performance with digital solutions

IT and OT observability in our factories is key. We have significantly increased our resilience by using Splunk's energy management solution by tackling energy costs, energy efficiency and carbon footprint."

HARALD LUKOSZ, REFERENT PRODUCT AREA STAGE R&D, BOSCH REXROTH AG

Major economies are increasingly integrating climate and energy security into comprehensive industrial strategies. For example, the EU's Clean Industrial Deal (2024), Japan's Green Transformation programme (2022), the UK's Invest 2035 industrial strategy (2024), and India's Production Linked Incentive scheme (2020). As governments set industrial decarbonisation targets, companies are integrating these into their planning, even where voluntary. They recognize that alignment with national and international decarbonisation targets is a driver of long-term competitiveness as well as important for environmental sustainability. However, many of these examples offer too little detail on the role that digital technologies can play in industrial decarbonisation, let alone outline the policy instruments to support their development and use. So, policymakers should take steps to more clearly define and promote the role of digitalisation within their energy security and industrial decarbonisation policy frameworks, ensuring industry buy-in along the way.

BUILDING SMARTER

Achieving the goal of doubling energy efficiency requires a fundamental shift in approach to the built environment. Policymakers and the private sector should focus on retrofitting the existing building stock while encouraging new buildings to align with energy efficiency performance standards. The solutions and technologies for the built environment already exist, there is now a need to focus on implementation.

Retrofits regularly pay for themselves through energy savings over the medium- to long-term. For example, a retrofit of the Empire State Building completed in 2010 cost about $31 million and has reduced energy consumption by 40%, resulting in savings of at least $4 million annually[27]. They also help business' resilience by reducing their exposure to energy price volatility. For example, during the 2021 – 2023 energy crisis, in a survey of over 200 large UK businesses, 77% said that energy had become one of their biggest business risks, impacting their confidence to invest and ability to support the UK's net zero goals[28]. The cost savings and resilience that comes from retrofitting can play an important role in enabling a more competitive business environment.

Retrofitting can also play a key role decarbonising the existing building stock, especially in advanced economies, where buildings have relatively long lifespans—averaging around 80 years, and over 90% of the buildings that will still be in use by 2030 already constructed[29]. With more than 40% of building floor space in developed countries built before the introduction of energy codes in 1980, retrofitting represents an untapped opportunity for efficiency gains. Under the IEA net zero scenario, emissions from the built environment need to fall 50% by 2030 to reach net zero by 2050. Retrofitting 20% of the existing building stock to a zero-carbon-ready standard by 2030 is a critical step to doubling energy efficiency while cutting costs for businesses[30]. Achieving this target requires sustaining an annual deep renovation rate exceeding 2% from now until 2030 and beyond[31]. However, without policy change, the current 1% rate of retrofits globally is expected to continue.

Around 50 countries, mostly in Europe, have set efficiency requirements for existing buildings, typically applying at the point of significant renovations[32]. However, global investment in this area remains insufficient. Governments can support building energy performance by simplification of regulations, encouraging energy retrofits through incentives, and by supporting innovative methods, such as bulk retrofits using prefabricated construction elements. Governments can also drive progress by promoting grid-interactive buildings, which can offer system flexibility, reduce consumer costs, and help integrate renewable energy into the grid. Technologies like smart meters and building energy management systems allow consumers to monitor and reduce their energy consumption effectively.

To meet the scale of the challenge, over $550 billion in annual investment is needed globally for improving energy efficiency from 2026 to 2030[33]. In 2023, global investment reached just $250 billion—less than half of what is required[34]. As such, governments and the private sector should work together to help address this funding gap. Policymakers can look to Canada as an example, where the country's Deep Retrofit Accelerator Initiative offers funding to organisations to bring together and coordinate retrofit stakeholders in the development of deep retrofit projects for commercial, institutional, and mid- or high-rise multi-residential buildings[35].

Another key strategy for governments is to encourage the use of energy efficiency standards for the development of new buildings. This is especially important in developing and emerging economies where there is a higher rate of new build construction. For example, it has been estimated that 30 – 40% of India's energy use can be reduced by designing and constructing buildings to common energy efficiency codes[36]. Recognizing this potential, India's national government has started to establish building energy standards, and subnational governments are actively working to implement them. Leading these efforts, the southern states of Telangana and Andhra Pradesh are prioritising the Energy Conservation Building Code

(ECBC). Nationwide, numerous cities and states have enacted or are considering laws to accelerate the decarbonisation of new buildings.

Building energy codes can be a powerful policy tool for encouraging energy performance standards but their uptake has been slow and uneven. While progress has been made in places like India, existing policies differ widely between countries in terms of their coverage and ambitions[37]. As of 2023, over 100 countries lacked energy performance codes. Approximately 70 countries updated their building codes in the last five years[38]. Certain jurisdictions, such as the United States, Australia, Singapore, and the United Kingdom, have building codes that require energy management systems for large buildings. However, the role of smart solutions is often not adequately integrated into these codes – a clear, persisting policy gap. While the adoption of energy codes is increasing globally, policy implementation needs to accelerate and embed digital solutions to enhance energy efficiency. Policymakers should also aim to streamline building codes to ensure interoperability across jurisdictions, making it easier for businesses to understand compliance obligations and reduce regulatory barriers to investments in efficiency improvements.

Case Study 2: PENN 1 pushing the frontiers of smart retrofitting[39]

The global pandemic forever altered the dynamics between companies, their workers, and their workspaces. As organizations worldwide reconsider how to best utilize their real estate and support their employees moving forward, Cisco has demonstrated what is possible with its renovated office in PENN 1 Plaza in New York City.

PENN 1, a 42,000-square-foot Midtown Manhattan building, constructed in the 1970s, was never designed to be smart or data driven. However, with Cisco's cutting-edge technology, the PENN 1 office has been transformed into a model of innovation, flexibility, and sustainability.

The renovation features a network infrastructure built on Cisco Catalyst® 9000 switches and access points, and Power over Ethernet (PoE) technology that provides data connectivity and electrical power to the building's subsystems. This foundation enables PENN 1 to integrate a range of smart building technologies, all accessible through a single interface—Cisco Spaces—which helps building managers to monitor and adjust energy use in real-time, for example.

Through automation and PoE, PENN 1 has achieved energy efficiency gains, helping to reduce energy consumption by 36% when comparing an 8-month billing period pre- and post-retrofit. PENN 1 exemplifies how legacy buildings can be transformed to meet modern sustainability standards and adapt to evolving work environments.

3

Putting the enablers in place

Putting the enablers in place

Achieving the necessary transformation in industries and buildings will require fundamental building blocks to be put in place. Rapid electrification, the deployment of AI for sustainability, as well as more energy efficient data centers and digital technologies can underpin policymakers' ability to realize the energy, emissions and cost savings outlined above.

ELECTRIFICATION

Energy sector end uses, including industry and the built environment, are increasingly being electrified. Achieving electrification at pace requires a comprehensive policy approach that leverages digital technologies and facilitates the right enabling environment.

Digital technologies will play an important role in building resilient electricity systems by enhancing grid reliability and facilitating the integration of diverse energy sources. For end-users, digital solutions can boost energy and material efficiency and reduce emissions. Integrating large amounts of variable solar and wind power—whose peak output often does not align with peak demand—needs advanced grid management. Digital technologies, data processing, and analytics offer significant potential to forecast and balance electricity supply and demand—thereby lowering costs, enhancing efficiency and resilience, and reducing emissions. This is especially critical as end uses, including industry and buildings, increasingly depend on electricity for their energy. Estimates suggest that smart grids, analytics solutions, and advanced energy management systems could cut 1.8 gigatons of GHG emissions while generating greater revenue opportunities[40].

Recent advances in digital technologies, falling costs, and widespread connectivity have sped up the pace of electrification. However, there is still progress that needs to be made, especially in developing countries. To strengthen energy resilience and security globally, policymakers should implement supportive industry-backed standards and policies that foster innovation, ensure interoperability, and address cybersecurity and data privacy risks. They should also support investment in broadband infrastructure to enable digitalisation.

AI FOR SUSTAINABILITY AND DATA CENTRES

AI offers various solutions to help governments and businesses mitigate and adapt to extreme weather. For example, in São Paulo, Brazil, a company called Sipremo[41] uses AI to predict the timing, location, and type of extreme weather events. This helps businesses and governments better prepare and mitigate the increasing challenges faced by communities. Meanwhile, an Edinburgh-based company called Space Intelligence uses AI to map the effects of deforestation on the climate in over 30 countries[42]. The company's AI tool allows for quicker and more accurate measurements of metrics, such as deforestation rates and carbon storage in forests. These are just a few examples; the applications of AI to help solve environmental challenges are already numerous and are expected to continue growing as the technology matures.

Alongside electrification, and increased manufacturing, the growing demand for AI has led to growing energy consumption. AI currently accounts for less than one-fifth of total data centre energy demand globally, but this share is expected to grow rapidly in the coming years[43]. However, in the medium to long term, it is possible that AI energy usage and the efficiency gains for digitalisation do not have to be at odds and can instead be complementary.

To facilitate this, policymakers should create an enabling environment for the private sector to innovate new, low-carbon solutions for AI. Research from Google and the University of California, Berkeley, has demonstrated that the carbon footprint of large language models (LLMs) can be reduced by 100 to 1,000 times using optimized algorithms, specialized hardware, and energy-efficient cloud data centres[44]. This can be done without compromising the quality of AI models. Supporting current initiatives and accelerating new approaches in this area can spur economic growth and enhance energy efficiency across the AI value chain. Governments should partner with industry to explore how to bolster R&D in energy efficient AI infrastructure while encouraging the adoption of existing solutions that mitigate the energy demands of high-intensity AI workloads, as exemplified by Splunk's Sustainability Toolkit[45].

Businesses and governments alike need a clear understanding of AI's emissions, energy usage, and efficiency performance to create effective interventions. This is essential for fostering AI innovation by helping developers and users understand the connection between AI and energy consumption, promoting more sustainable practices, and identifying opportunities for energy-saving solutions. Additionally, standardising metrics would simplify reporting for companies operating across international borders—reducing financial and non-financial burdens and encouraging consistent information-sharing practices. The first step in addressing this gap would speed up the adoption of existing energy efficient hardware, while governments put in place further measures to support innovation.

AI can also act as an incentive to accelerate and manage deployment of clean energy. AI is accelerating deployment because it requires us to bring online new low carbon energy like Small Modular Reactors (SMRs), renewables, and batteries at scale[46]. As such, AI acts as a catalyst for innovation, accelerating research and development of next-generation clean energy technologies. It also plays a crucial role in manufacturing, lowering capital requirements and speeding up the scaling of new technologies and markets . This strategy considers not only energy supply but also how AI companies can use their own technology to manage demand, their premises and their use. There is an opportunity to replicate this in other areas. To support such solutions, we need the government to partner with industry on supply of energy while innovating and scaling the lessons we have already learned in terms of demand management and fast-tracking the permits required to build 21st century energy systems.

DIGITAL INFRASTRUCTURE AND ENERGY EFFICIENT HARDWARE

Energy efficiencies can be realized through digital infrastructure and hardware[48]. Hardware is an essential part of AI and broader ICT value chains. It encompasses the physical components necessary for AI computations, including data centres and equipment like processors, storage devices, and networking equipment. The energy consumption of this hardware, as well as the cooling systems needed, contribute to the GHG emissions of digital technologies. Opportunities to reduce its impact can include the physical design of data centres, the modularity of equipment, and efficient inventory and life cycle management (see case study).

Despite these opportunities, there are few commonly accepted Key Performance Indicators (KPIs) or standards to support the use and further advancement of energy efficient infrastructure and hardware within data centres. The European Commission recently adopted the Energy Efficiency Directive requiring data centre operators to disclose certain sustainability KPIs. However, this example is unique to the EU and this challenge will need to be considered at a global scale. To ensure that technology plays a positive role in the energy transition, policymakers should align on voluntary, international standards, invest in research and development (R&D) programmes, and develop fiscal incentives to support the use of energy-efficient hardware.

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For the last decade, the digital infrastructure industry has been able to maintain a rapid pace of introducing new generations of faster and more energy efficient computing hardware every few years. However, in this context data consumption is rising faster than ever and development of new energy efficient digital technologies could be better supported through government-led research and development partnerships. Some models for effective R&D programmes could be emulated, such as Singapore’s Research, Innovation and Enterprise plan (RIE). Singapore's RIE plan outlined the country’s investment strategy to support innovation in technology and sustainability underpinned by cross-cutting areas of research and skills. More programmes like the RIE plan from other governments could help drive efficiency improvements around the world and signal promising areas for capital investment. As such, policymakers should set challenges and provide funding envelopes for existing public research organisations working in collaboration with academia and industry to make new breakthroughs to ensure that technology energy efficiency continues to outpace usage.

DIGITAL AND SUSTAINABILITY SKILLS

Global digital and energy transitions are fundamentally re-shaping the ways we work. As the energy system becomes increasingly digital, the demand for highly skilled individuals will continue to grow. Sustainability tech skills are increasingly sought-after by companies as they try to take advantage of the twin energy and digital transitions. For the increasingly digitalised energy sector, countless new skills will be needed to deliver on the possibilities that technologies offer, particularly when we consider that data analytics and wireless networks like 5G are changing the way that utilities operate. Almost 10 million people already work in energy efficiency related jobs and this demand will continue to grow[50]. Workforces need to have the skills to monitor, diagnose, and fix energy, industrial, and building systems faster and more efficiently.

Energy and digital transitions are driving job growth and productivity around the world, but skills shortages continue to impede individuals, companies, and societies from making the most of these opportunities. The global number of sustainability jobs grew an average of 8% annually over the five years between 2018 and 2023[51]. However, there are not enough candidates to meet the growing demand for sustainability skills in the labour market. For example, the UK needs an estimated 400,000 jobs to build and manage new energy sectors, but there are only 200,000 workers with the relevant skills required for these roles[52]. Meanwhile, the digital skills gap is even greater, acting as a significant constraint on the uptake of new technologies in organisations. This puts businesses at a competitive disadvantage as workers struggle to keep up with emerging technologies. For example, Cisco’s AI Readiness Index shows that only 13% of companies globally are prepared to leverage AI and AI-enabled technology to their full potential[53]. AI and other digital technologies will be unable to deliver productivity and efficiency gains unless we improve the ways that we work, starting with the skills needed to do the job. Addressing the digital and energy skills shortages in a systematic way will require institutional action.

Matching supply with demand in the labour market for digital and sustainability skills will require closer collaboration between industry and governments. The emergence of such talent gaps stem from a range of possible sources, including inadequate training and the slow evolution of institutional education. Public-private partnerships are needed to address these root causes to ensure that digital and sustainability skills can become an enabler for societies to capitalise on the benefits for competition, sustainability, and resilience.

Case Study 3: Interstates data centre modernisation[49]

Interstates, a construction leader based in the United States, has upgraded its data centre, streamlined IT operations, and established a hybrid cloud model using Cisco UCS X-Series servers and Cisco Intersight. The high performance and density of Cisco's modular systems helped Interstates to reduce its server footprint by over 50% across two data centres. The platform's modularity also provides flexibility and a projected lifespan exceeding a decade. Reducing rack space helped Interstates to lower its energy and cooling needs, supporting its sustainability goals.

4

Policy recommendations

Policy recommendations

Alongside industry innovation, policymakers can play a pivotal role in enabling a more energy-secure economy by improving energy efficiency. Whilst the COP28 UAE Consensus outlined the broad contours of governments' commitment to energy efficiency, businesses and investors benefit from clearer signals from policymakers and an enabling legislative environment to ensure widespread adoption of cost-effective, energy efficient practices that boosts competitiveness and supports economic growth.

Drawing on input from businesses, investors, governments, NGOs and research bodies, the following policy proposals may help increase the uptake of energy efficiency technologies, reduce costs for businesses, and accelerate the transition to net zero. Whilst unique local and regional dynamics will impact the exact policy levers employed by governments, there are five core objectives with cross-jurisdictional reach that should be prioritised by policymakers:

1 Encourage economy-wide and sector-specific targets to spur advancements in energy efficiency.

WHY?

Economy-wide energy efficiency targets are a powerful tool that could be integrated into wider energy and digital infrastructure plans. Targets act as an important indicator of a jurisdiction's overarching direction of travel and help to create a clear and predicable framework for business and investors. These economy-wide targets could be complemented by sector-specific ones to provide greater clarity for businesses, allow for clear tracking against ambitions, and indicate the sectors that are ripe for investment.

HOW?

In 2023, the EU revised the EU Energy Efficiency Directive to collectively reduce the bloc's energy consumption by 11.7% by 2030. This target was coupled by clear energy consumption metrics, with a limit of 992.5 million tonnes of oil equivalent (Mtoe) for primary energy and 763

Mtoe for final energy. Under the updated rules, EU Member States were also required to meet clear annual energy savings targets of 0.8% of final energy consumption in 2021-2023, at least 1.3% in 2024-2025, 1.5% in 2026-2027 and 1.9% in 2028-2030. These economy-wide targets gave a clear signal to businesses operating across the EU, making clear that every Member State would actively pursue energy saving measures over the next decade.

Governments could couple economy-wide targets with sector-specific ones to provide greater clarity for businesses and indicate priority sectors, such as manufacturing and commercial buildings, where there are promising investment opportunities. For example, the EU Energy Performance of Buildings Directive sets a target to reduce GHG emissions in the building sector by at least 60% by 2030 compared to 2015 levels and to achieve a fully decarbonised, zero-emission building stock by 2050[54]. This EU ambition has also been echoed by buildings targets from other major global economies, including the United States, China, Japan, and the United Kingdom. These statements of intent from governments provide a valuable foundation for investment planning for businesses across the economy.

2 Collaborate with partners to develop internationally aligned standards for energy efficiency in industry, buildings and data centres.

WHY?

Energy efficiency standards for industry, buildings and data centres vary substantially across international markets, despite public investment and policy development to date. For businesses, this has generated additional costs and an uneven playing field while policymakers have lacked a common reference point for national policy development. Internationally aligned and industry-backed standards are powerful tools in resolving these challenges and have already proven successful in driving widespread adoption of new technologies, developing global markets and harmonizing regulation across a range of sectors.

At the EU level alone, there is fragmentation between Member States' approach to the energy efficiency of buildings. Despite a broad commitment to reduce the average primary energy use of residential buildings by 16% by 2030 and 20-22% by 2035 (outlined in the Energy Performance of Buildings Directive), each country can adopt its own standards to meet this ambition. For international businesses operating across multiple markets, this has generated additional costs, forcing them to invest in compliance functions rather than innovation.

Meanwhile, there are no generally accepted metrics for evaluating the energy efficiency of data centres. This is particularly problematic given the role that energy efficient digital infrastructure and hardware will need to play in mitigating the growing energy consumption of data centres. Policymakers should work with industry and standard setters to create data centre metrics that can work across jurisdictions.

HOW?

The introduction of internationally recognised and industry-supported standards could help to resolve these concerns, streamlining requirements, reducing compliance costs and fostering a level playing field that allows companies to compete against common benchmarks. In the US, the Environmental Protection Agency's ENERGY STAR® label has already helped to harmonize energy efficiency standards for buildings across the country. It issues a 1 – 100 ENERGY STAR score to buildings based on the measured energy use of a building, accounting for differences in property type, operating conditions, and regional weather data. With scores based on a percentile (i.e. buildings with a score of 50 perform better than 50% of their peers, buildings with a score of 75 perform better than 75% of their peers) businesses compete against common benchmarks and do not have to invest in state-specific compliance functions.

The ENERGY STAR label has also improved consumer understanding and confidence in energy efficiency solutions, with over 90% of American households recognising the ENERGY STAR label and 45% of American households surveyed knowingly purchasing an ENERGY STAR certified product in 2023. Federal incentives have also been aligned with the ENERGY STAR label, creating additional clarity for both businesses and consumers.

Policymakers should collaborate with international partners to streamline energy efficiency standards at an international level to support the harmonization of international markets, reduce compliance costs for businesses, and create a level playing field that encourages innovation in energy efficiency.

3 Encourage the development and use of fiscal incentives to support the development and use of energy efficient technologies.

WHY?

From 2022 to 2024, global annual investment in efficiency in the industrial sector remained constant just above 50 billion USD[55] while efficiency investment in the building sector decreased by 7% to about 270 billion USD[56]. Yet, annual investments will need to triple in order to double energy intensity improvements by 2030[57]. Investment in energy efficient solutions can be a significant opportunity to lower energy costs for consumers and businesses, increase business productivity, and create job growth. For example, the IEA assessed that the energy efficiency measures taken by 31 member countries since 2000 cut the bills of households and businesses by USD 680 billion in 2022[58]. Fiscal incentives help to accelerate the maturation of innovative energy efficient digital technologies and drive their uptake by businesses. Policymakers should couple targets with incentives that encourage businesses to adopt energy efficient solutions whilst reducing the financial risk.

HOW?

During the development stage, energy efficient digital technologies require research and investment to scale from inception to commercialization. Public funding via R&D or government-sponsored grants helps to bring in private investment and accelerate innovation. For example, the US Energy Department's Advanced Research Projects Agency-Energy (ARPA-E) provides funding to high-potential, high-reward energy technologies that are too early for private sector investment. ARPA-E supports projects that explore entirely new ways to generate, store, and use energy, with the goals of advancing energy independence, promoting national security, reducing emissions, improving energy efficiency, and strengthening the resilience and reliability of the energy grid.

Even after commercialization, many energy efficient digital technologies, like smart sensors, IoT devices or energy efficient data centers, may carry high initial costs for businesses. Fiscal incentives can help to offset these costs, making the investment more affordable for businesses and removing a significant barrier to uptake. For example, Italy has introduced a 'Transition 5.0' package of measures, which includes tax deductions for capital expenditure in new energy efficiency investments. To access the tax credit, a minimum energy consumption reduction of at least 3% of the entire production structure or 5% of the specific production process is necessary. The tax credit covers a portion of the cost of investment taking the following structure: 35% up to EUR 2.5 million, 15% between EUR 2.5 - 10 million, and 5% between EUR 10 – 50 million.

4 Partner with industry to invest in the skills needed to power a more sustainable digital economy.

WHY?

The transition to a more sustainable, digital economy will create shifts in the labour market, creating new employment opportunities and an increased demand for sustainability and digital skills. As of 2024, the number of people employed in jobs related to energy efficiency across the globe has reached almost ten million[59], yet there remains a severe capacity and skills gap which risks delaying the uptake of energy efficiency technologies. To address the shortage of skilled workers, industry has already begun to implement skills initiatives. However, the scale of the challenge will require greater collaboration between the public and private sector, drawing on the private sector's unique understanding of specific skills gaps and governments' ability to drive long term investment in the education system and workforce.

HOW?

To facilitate this collaboration, policymakers should create formalised government-industry-academic partnerships to address the skills gap. Such partnerships would provide a platform to gather evidence around the short-term skills shortages faced by industry and discuss the longer-term policy interventions that could be employed to bolster the energy and digital skills pipeline. The US Department of Energy's (DOE) Industrial Assessment Centers and Building Training Assessment Centers provide a useful example of how public-private partnerships can address skills shortages while fostering a more sustainable digital economy. The DOE has invested $40.8 million into hands-on training for students and apprentices as well as upskilling opportunities for existing manufacturing workers. Participants exit the programme with the skills required for high-quality, in demand roles that are essential to support the uptake of energy-efficient technologies, such as advanced manufacturing technicians for batteries and solar manufacturing, building energy managers, insulators and heating professionals.

Policymakers should invest in similar local initiatives to support the large-scale upskilling that will be required to support the energy transition, drawing on the combined expertise and capital of industry and policymakers to secure a more sustainable digital skills pipeline.

5 Modernize public sector infrastructure and systems through the use of energy efficient technologies.

WHY?

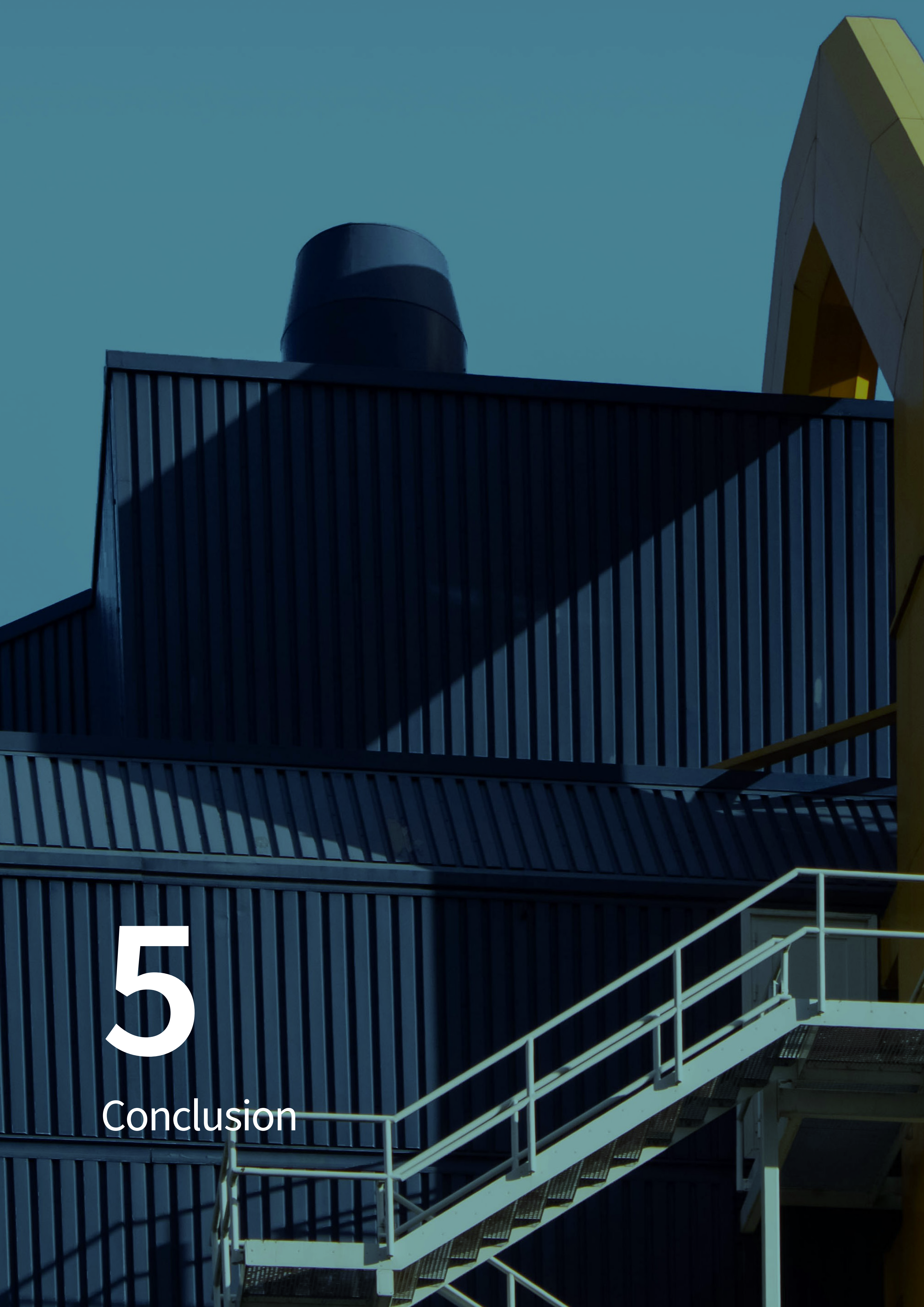
Governments systems are outdated and often rely on inefficient hardware and software[60 61]. For example, in the US, 80% of the federal government's $100 billion in annual IT spending goes towards operating and maintaining existing systems[62]. Identifying outdated, energy-demanding technologies within the public sector that could be replaced with modern, secure, energy-efficient technologies help realize long-term cost savings and support the transition to low- and no-carbon energy sources. By leveraging the purchasing power of the public sector, policymakers can increase the adoption of energy efficient digital technologies, build confidence in these solutions amongst businesses and the wider public, and reap the benefits of lower energy costs. To take advantage of this role, policymakers should integrate energy efficiency into public procurement, policy, and investment decisions in both energy and non-energy sectors.

HOW?

In the first instance, policymakers should examine what government systems and infrastructure would reap the most energy efficiency and cost benefits from modernisation.

Despite growing demands for more sustainable products across the public estate, public procurers often lack the expertise and market knowledge to develop appropriate energy efficiency guidelines in calls for competition. Policymakers could work with government vendors to support the development of guidance and clear frameworks for the inclusion of energy efficiency in public procurement, policy, and investment decisions. This guidance would build on the insights gathered from the government's assessment of what government systems and infrastructure would benefit most from modernization.

Industry-supported energy efficiency guidelines for products and services used across the public estate can also provide much-needed clarity for businesses and drive adoption of energy efficient technologies across the economy. The EU has already introduced a few voluntary, product-specific energy efficiency standards as part of its Green Public Procurement (GPP) approach, including computers, monitors, tablets and smartphones, office building design and construction, data centers and server rooms. Modernisation efforts could aim to replace end-of-life devices with more energy efficient and secure models. Not only can outdated technologies create vulnerabilities for malicious attacks, but replacing old with new equipment brings governments the opportunity to generate cost and energy savings over the long-term.



5

Conclusion

Conclusion

Delivering the goal of strengthening resilience, reducing costs for business, and doubling global energy efficiency by 2030 can help governments foster greater flexibility, stability, and affordability of the energy sector and built environment.

By focusing on efficiency gains in the high impact sectors of industry and the built environment, policymakers can help remove unnecessary waste in the energy system. In doing so, governments have the opportunity not only to help make businesses become more sustainable but also more globally competitive and resilient. To unlock these opportunities, policymakers and business leaders will need to work together to put four enabling conditions in place. These enabling conditions include electrification so that end use sectors like manufacturing can be powered by the increasing quantities of clean energy supplying the grid. They also include AI for sustainability, data centres, and the energy efficient digital infrastructure needed to support more efficient digitalised industries and smart buildings without adding additional strain on national grids.

Delivering on these enabling conditions and sectoral transformations requires governments to put five key policies in place. Firstly, policymakers will need to encourage the development of targets that signal the direction of travel and the key milestones along the way. Secondly, governments will need to collaborate to develop internationally aligned and industry-backed standards for energy efficiency in industry, buildings, and data centres. Thirdly, governments should support the development and use of fiscal incentives to drive investment towards businesses and activities that increase energy efficiency. Fourth, governments and businesses should partner to reskill and upskill the workforce to address the persisting skills gap impeding the digital and energy transitions. Finally, governments can set an example by modernizing existing public infrastructure, accelerating the adoption of energy-efficient technologies needed to double energy efficiency this decade. This paper offers policymakers a strategic roadmap to align sustainability goals with economic priorities, paving the way for a more competitive and resilient energy transition.

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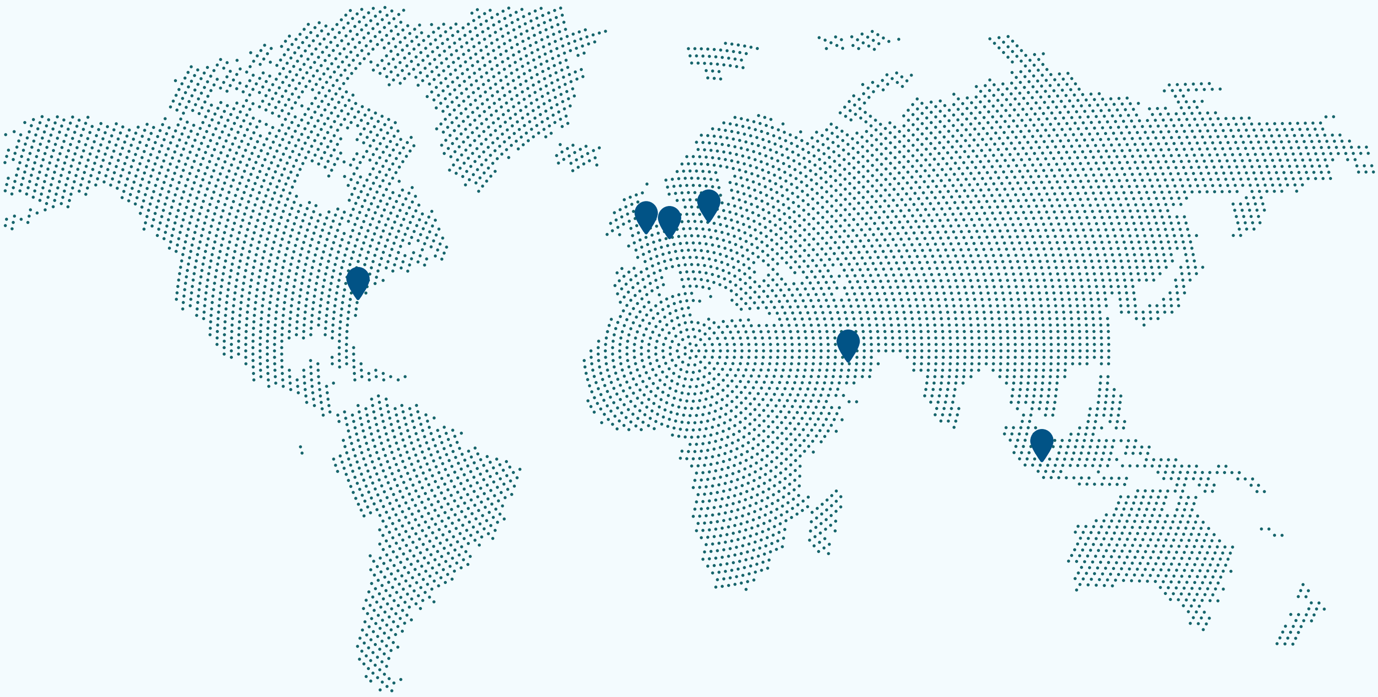

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