

Supercharging **Net Zero**

The race to a faster, fairer energy transition



Foreword

Taking action to address climate change is the most important commitment we have made as a company. For quite some time now, we've seen the ways in which the climate crisis is real, as it has impacted people living in the communities we serve, our clients' operations and their assets, and also our business and 28,000 of us who call ourselves Arcadians.

The energy sector holds the key that can unlock the solutions we need to tackle climate change. This is because we need to not only rapidly switch to renewable sources of energy, at the same time, we need to upscale capacity so that the rest of our global economy can transition away from fossil fuels. This is the only way we can hope to mitigate the devastating impacts of climate change, which we are seeing more and more each day.

The recent Intergovernmental Panel on Climate Change (IPCC)'s report (AR6, *Climate Change 2021: The Physical Science Basis*) has vividly demonstrated the urgency with which we must act right now. That report is unequivocal in stating that there is no escape from the climate crisis. It is almost certain that global warming will exceed 1.5°C. Only under the IPCC's very low and low GHG emissions scenarios is an increase of at least 2°C avoided by 2100. As we have seen in recent years, the impacts of existing atmospheric carbon levels and associated floods, fires, and droughts are creating significant challenges for infrastructure and public safety.

To mitigate the worst effects of this crisis, we must undertake an urgent transformation of the global economy and this begins with the global energy sector.

It's critical that the energy sector leads the change by both decarbonizing and rapidly increasing its capacity to impel electrification of the wider economy. Every other sector – including transport and industry – is dependent on a decarbonized energy sector to achieve their own net zero goals.

The energy sector is vast and has shown itself to be extraordinarily innovative and nimble in meeting evolving energy needs. Transitioning quickly enough to prevent full on climate disaster, while also addressing climate impacts on existing critical infrastructure, is the greatest challenge the energy sector has ever faced.

The overwhelming urgency of energy transition

It is with this sense of overwhelming urgency that *Supercharging Net Zero*, a study from Arcadis, assesses the state of the transition in the energy sector. Our starting point is the global imperative to reach net zero carbon emissions by 2050. This is the essential step to creating a 1.5°C future. By working

backwards we find that the global energy sector will need to **halve emissions this decade** – with some countries needing to do so within four years.

These timeframes seem impossible but, as the IPCC report has emphasized, we cannot let that prevent us from decarbonizing as quickly as possible. It only reiterates the pressing need for every country and every economy to take up this effort in earnest. Only with this level of global, socio-economic, and political alignment will we be able to mitigate the devastating impacts of climate change during this century.

With a huge injection of capital, policy frameworks adapted to support the energy transition, and a once-in-a-generation infrastructure drive – a supercharged effort — we can still bring net zero within reach. Furthermore, a decarbonized energy sector would deliver more than just environmental benefits. Our study shows that supercharging the transition could unlock a **multi-trillion-euro investment opportunity** – with the greatest opportunity reserved for investors, businesses, and governments that are **the first to move**.

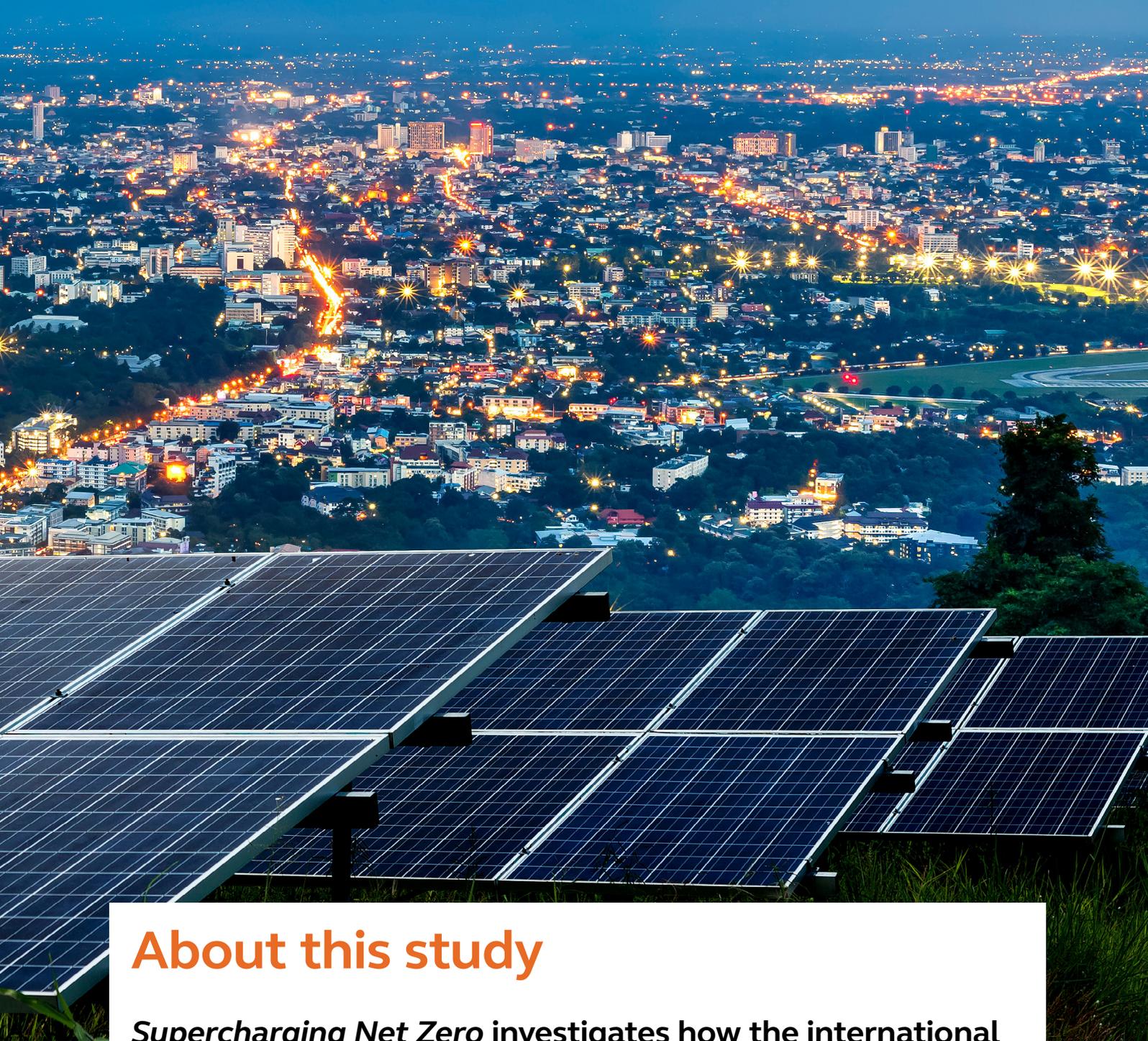
It's time to supercharge net zero

How and when does the international energy sector need to transition to help the wider economy achieve net zero.

As *Supercharging Net Zero* demonstrates, for many markets to achieve these goals in the short-term would require near-unimaginable change. But, as humanity has proven time and again – from the massive effort to electrify rural parts of the world or the push to travel to the moon – where there's a will, there's a way. We are capable of doing big things, even things that seem impossible, when we set our collective mind to it.

What's clear is that now is the time for the energy sector to act in order to unlock a transition that's good for the natural world as well as all of the people who live in it.

Mary Ann Hopkins
Chief Growth Officer



About this study

***Supercharging Net Zero* investigates how the international energy sector – focused on ten key markets – would need to transition in the short-to-medium term to achieve a net zero¹ global economy.**

The study utilizes a dynamic, computer-based, macroeconomic model of the world's economic and energy systems. It draws on data from ten priority markets, providing a representative sample of countries at various stages of the energy transition, (Australia, Belgium, Brazil, China, France, Germany, India, the Netherlands, the UK, and the US) to illustrate how – and when – the global energy sector must transition.

The figures in this report are not a prediction of what will happen; they are the result of a simulation which indicates what the energy sector would need to do to help the wider economy achieve net zero.

For more information, please refer to our methodology on page 25.

¹ Net zero is the point at which greenhouse gas emissions are reduced to zero or for any emissions that are emitted an equivalent amount is removed from the atmosphere.



Executive summary

Supercharging Net Zero examines how the international energy sector would look in a scenario where the global economy reaches net zero emissions in time to limit warming to 1.5°C. We are not currently on track to reach that future, but this analysis shows us a path to get on track, and it should be taken as a template to inspire action and a sense of urgency around accelerating towards a profitable and equitable transition.

Using an energy-environment economic modeling, this report focuses on how ten key markets would need to contribute to a global transition, ultimately drawing out 5 key pathways that can guide investors, businesses, and governments with practical ways to supercharge the transition to renewable energy and decarbonize with urgency.

Carbon Crunch: The world is losing the race to zero

In our supercharged scenario, every market in our study must cut energy sector CO₂ emissions in half by 2029. At the same time, electricity generation capacity must rapidly expand in all markets to meet growing demand of other sectors in the economy – with the steepest increase in capacity required this decade.

Capital Countdown: The imminent investment opportunity in transition

The energy sector would need to invest €6.13 trillion – approximately 7% of global GDP – in renewables this decade to contribute to a global net zero economy, consistent with a 1.5°C scenario. Over the same period, investment in transmission and distribution within global energy grids would need to hit €2.47 trillion. This would require a once-in-a-generation infrastructure effort similar in ambition to the post-World War II Marshall Plan - but on a global scale.

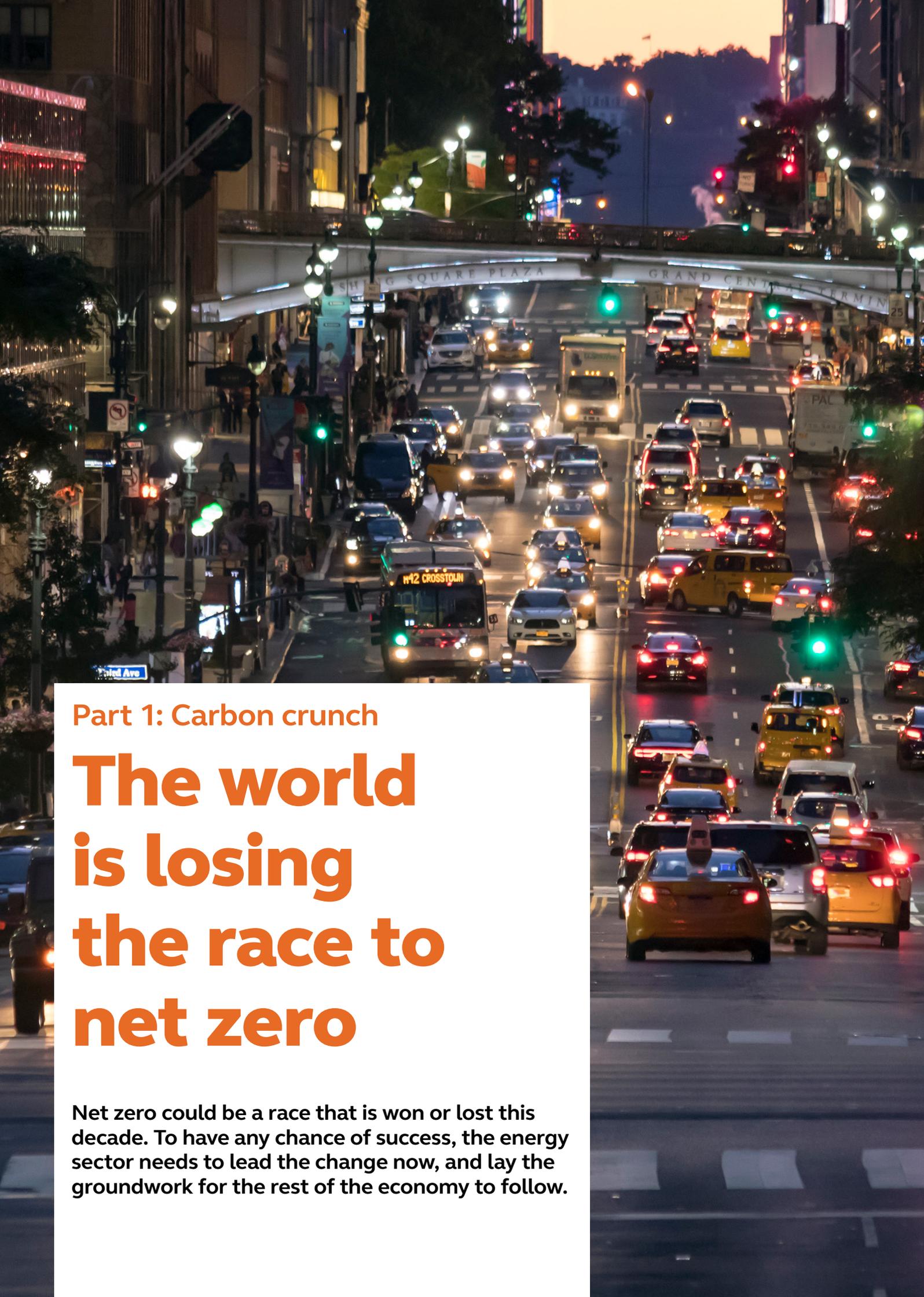
Socio-economic Equity: Transitioning to a fairer future

The most efficient route to transition requires stakeholder buy-in. It would also require a fair balance of benefits. Using consumer energy bills as an example, we examine the social impact of the ideal route to transition, and how it differs between countries.

Energy transition could mean cheaper bills for customers across the globe by 2028 (although there are big differences between countries).

If we want to bend the current global trajectory back towards a 1.5°C path, the only option is to accelerate our reductions in emissions to the extreme that we halve global emissions by 2030. A successful energy transition can bring huge benefits to both the public and private sectors but seeing this transition through will require more than just an acknowledgement of the importance of clean energy.

The time for a supercharged energy transition is now. But for this to succeed, we must: come together to share ideas and technologies, get buy-in from consumers and business, develop blended funding models to ensure resources for energy transition projects, restructure existing pricing models to ensure fairer costs for consumers, and forge strong partnerships between involved parties. We must do all of this together, as a collective, all around the world and at breakneck speed.



Part 1: Carbon crunch

The world is losing the race to net zero

Net zero could be a race that is won or lost this decade. To have any chance of success, the energy sector needs to lead the change now, and lay the groundwork for the rest of the economy to follow.

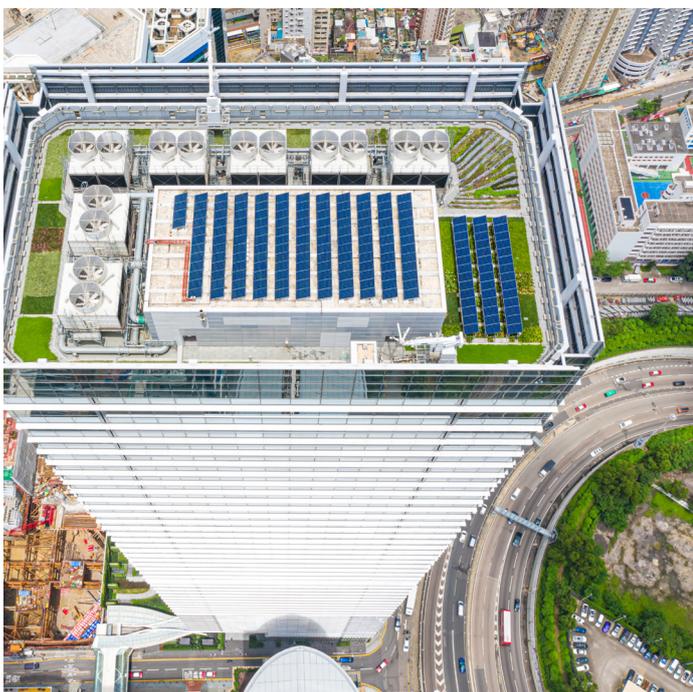
As highlighted by the IPCC's recent report on the overwhelming and alarming physical evidence of the dire state of our climate, it's difficult to overstate the pace of progress required. The energy transition is a significant part of the solution to this crisis and the energy sector must transition to renewables first, in order for the rest of the economy and society to curb greenhouse gas emissions. Using our economic model to forecast energy sector emissions **globally** this research paints a picture of the pressing need for progress that contrasts – sometimes sharply – with the change planned domestically by markets focused mainly on their **individual** journey to net zero.

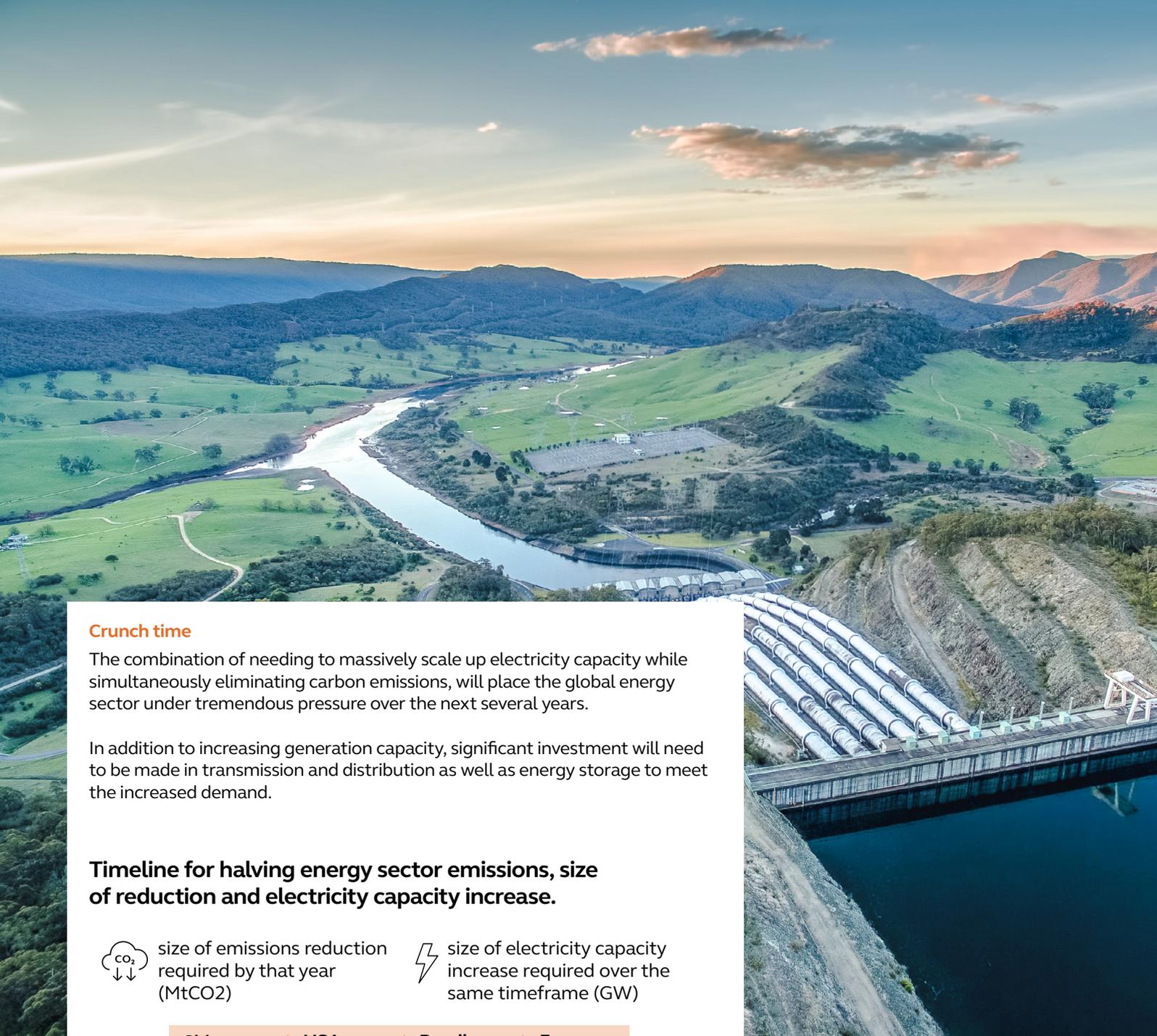
Half the emissions, double the output

If we were to progress to a global net zero economy, consistent with a 1.5°C scenario, all countries in our study would need to cut their energy sector emissions in half by 2029, with most countries having to halve their emissions within the next four years. Although this scenario is not practically achievable, understanding how rapid transition would ideally happen provides a target for us to work towards.

At the same time, the global energy sector would need to dramatically expand electricity generation capacity to meet growing demand from population increases but also to enable the rest of the economy to shift off fossil fuels and onto electricity from renewable sources. In this scenario, demand across this study's focus markets is projected to increase from below 4,000 gigawatts in 2020 to a combined 6,200 gigawatts by 2025 and 8,500 gigawatts by 2030.

This means we must quickly ramp up green energy infrastructure development. China faces the steepest climb, requiring an additional 3,300 gigawatts of electricity capacity by 2025. After 2025, additional electricity capacity requirements slow down for most markets, except for India which would have to more than double capacity in the second half of this decade.





Crunch time

The combination of needing to massively scale up electricity capacity while simultaneously eliminating carbon emissions, will place the global energy sector under tremendous pressure over the next several years.

In addition to increasing generation capacity, significant investment will need to be made in transmission and distribution as well as energy storage to meet the increased demand.

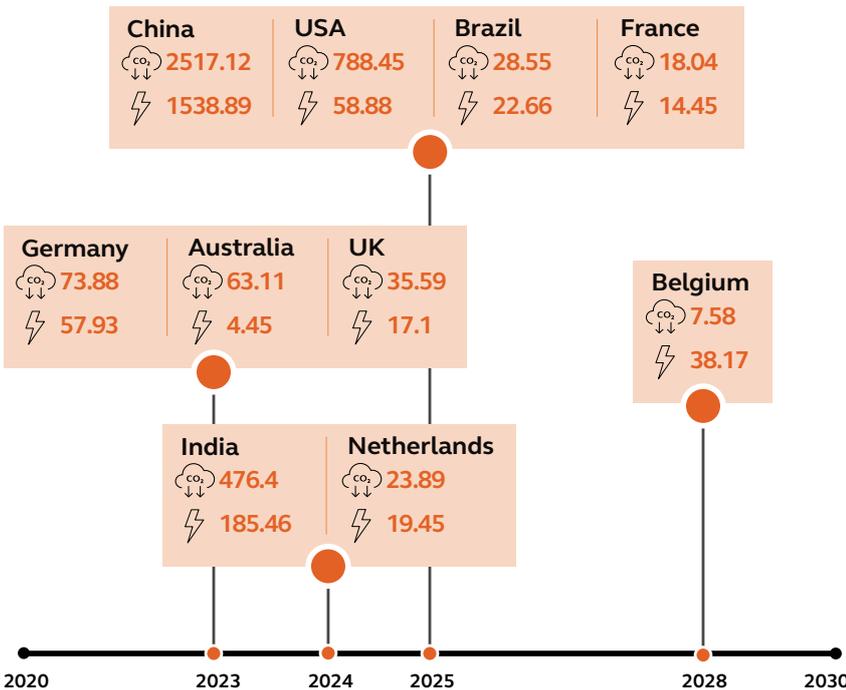
Timeline for halving energy sector emissions, size of reduction and electricity capacity increase.



size of emissions reduction required by that year (MtCO2)



size of electricity capacity increase required over the same timeframe (GW)

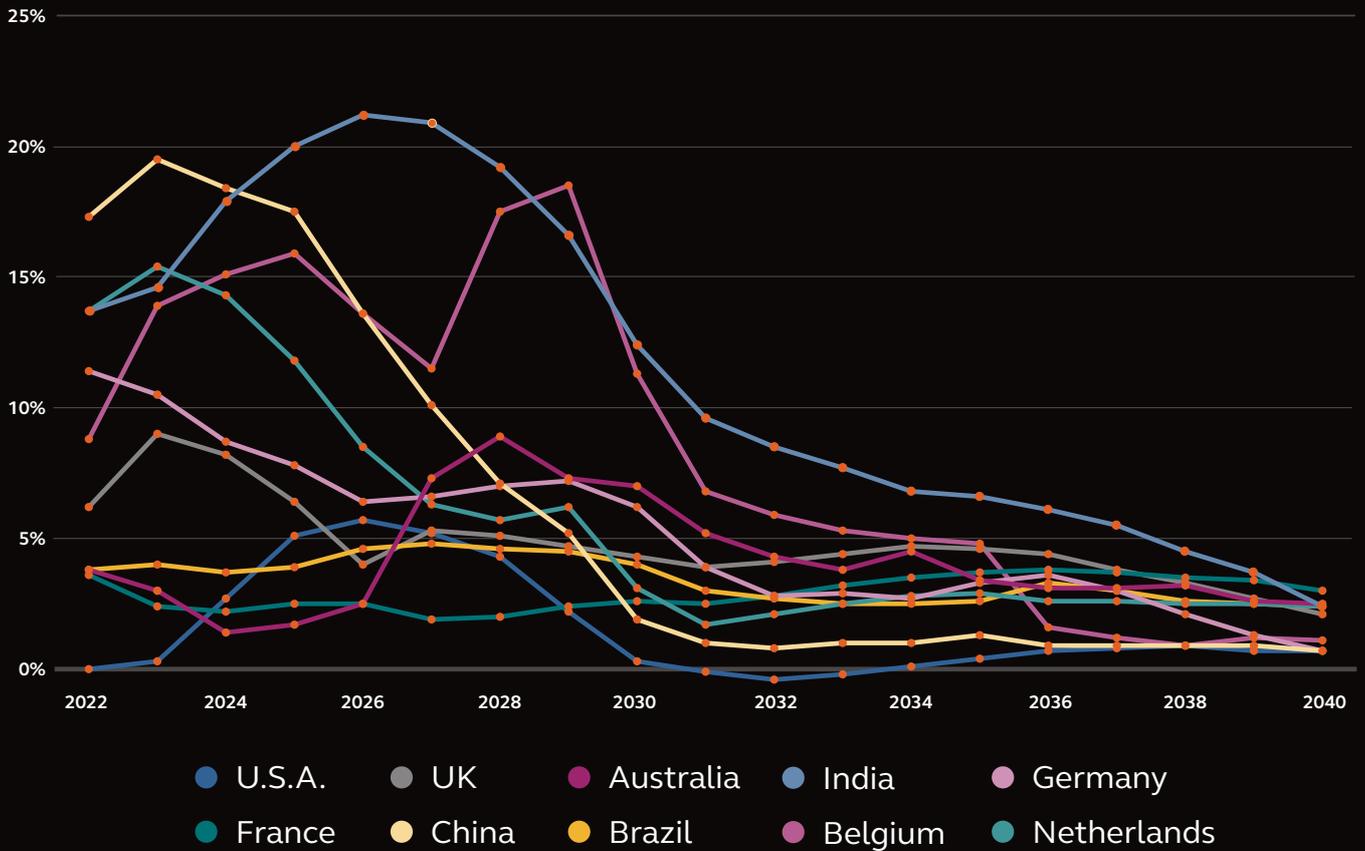


“Supercharging Net Zero shows that, even if we manage to flip the switch from low global political alignment to full unanimous global support, the required energy transition will be tough to achieve. We need to start preparing for the impacts of global warming above 1.5°C now and start building more resilient critical infrastructure and supply chains.”

Luke Keys, Sector Leader - Energy and Resources, Arcadis



Year-on-year electricity capacity change by market



For a net zero global economy to be achieved electricity capacity will need to dramatically increase - with the steepest increase happening this decade



Zeroing in on zero emissions

In our scenario, the energy sector in our study's European markets (Belgium, France, Germany, the Netherlands and the UK) would need to achieve zero emissions by 2036.

Theoretically, Australia, Brazil and the UK are positioned to lead the way by reaching zero emissions this decade (by 2030). To stay on track in this scenario, Brazil would need to halve its emissions within the next four years; for the UK and Australia, they would have to do it within the next two.

Even at a supercharged rate, the energy sectors in the US and China are not projected to reach zero emissions before 2050. Nevertheless, in our simulation both countries will need to deliver outsized reductions in emissions while providing clean and safe electricity for a burgeoning population.

As such, for the world to get to net zero, our research shows other markets will need to not only accelerate their own path but go beyond and continue investing in technology which will help ensure that the entire world is able to go carbon neutral.

KEY CONSIDERATION

The global energy sector is pivotal to the international effort to decarbonize, requiring a radical reduction in carbon emissions this decade combined with a significant increase in capacity. How can industry and governments work together to achieve this transition in such a short space of time?

The need for climate action has never been more pressing. As the IPCC report makes clear, we must prepare for a world in which global warming exceeds 1.5° C. This means adapting our lives and critical infrastructure to the reality of the climate crisis, which, in the short to medium term, will only get worse. We must also take decisive mitigation steps to rapidly reduce greenhouse gas emissions and put the planet on a path towards temperature decreases in the second half of this century. The fact that even the goals set out in the Paris Climate Change Agreement are not sufficient to achieve this aim is no excuse for inaction — we need more urgency in ramping up the development of the green energy infrastructure needed to support 100% renewable electricity grids.

To create real impact, countries must think and act beyond borders – and there is also a pressing need for more robust stakeholder engagement at the national level. Our research demonstrates that it won't be enough for individual countries to achieve net zero; we have to do this collectively. Ultimately, this will mean that we need to start viewing our access to energy, and the infrastructure and networks that underpin it, as similar to our access to the internet. In the same way that internet infrastructure in faraway places facilitates people's access to the web, soon, renewable energy infrastructure in faraway places will need to facilitate many people's access to clean electricity.

Infrastructure like interconnectors allow countries to import and export energy from other countries. This will unlock the true potential of renewable energy production, which is often dependent on particular weather conditions. These exchanges can help countries meet targets for energy transition toward a low-carbon future, lower the cost of electricity and enhance the security of electricity supply for both countries.

An example where this cross-border collaboration will be required is the energy transition in the North Sea. This is a critical global energy hub and it will take the oil & gas, offshore wind developers, transmission owners and operators from all neighboring countries to effectively and efficiently develop the infrastructure required for a greener future. It is vital that the relevant governments and regulators cut through the red tape and put in place the key legislation and assurances business will need to make the collaboration work in the timescales required.

Similarly, the energy transition cannot proceed apace without broad and deep public support. In other words: to supercharge the transition in national markets, the majority of citizens need to understand what the energy transition is and why it's important for the world, their country and their community. Perhaps more importantly, citizens need to understand why the transition is important for them personally and how they will benefit. Only when populations have achieved this depth of understanding will resistance and 'not in my backyard' sentiment evaporate, paving the way for the accelerated transition that's needed to help us avoid the most catastrophic impacts of global warming.

Stakeholder engagement is the means through which energy companies and governments can not only inform citizens of the benefits of the transition, but also can include people in decision-making processes about the changes they will need to embrace.





Case Study: Sustainable offshore wind development around the UK's coastline

Offshore wind energy is one of the solutions that the UK has been developing to meet the energy requirements of millions of homes in a net zero carbon future. There is no shortage of projects that aim to tap into this renewable energy source, but the national government believes that these developments must be done using minimal seabed area and a smaller carbon footprint to protect the health and biodiversity of its seas.

Development leasing rounds for offshore wind projects have been put in place to maintain a sustainable rate of development in waters around the UK. Recent regional leasing rounds have led to the allocation of about 17GW of offshore wind power: 7GW around England and Wales under Round 4 and 10GW under ScotWind Leasing. A significant portion of this new capacity will come from floating offshore technologies around the Scottish Coast.

Arcadis has supported different clients interested in bidding for areas available for lease. We have provided a range of services, such as environmental assessment and business case development, to help clients make informed decisions during the initial assessment phase of the leasing rounds. Offshore construction poses many risks which, when left unchecked, can cause projects to fail and ultimately

slow down the country's net zero ambitions. This is why our team uses geographic information system (GIS) and digital asset management toolkits to offer clients with a least-regrets zonal assessment. These tools also help quantify the risks of bid strategy decisions and provide a focused and efficient assessment of designs and site selection.

Through our holistic service offerings, we have helped clients develop winning bids for 17GW of offshore wind power allocation that the UK has offered. These winning bids will eventually become part of a robust project pipeline that will support the country's goal of accelerating its journey toward net zero without harming another important player in regulating the Earth's climate — the sea.

“This is one example of the type of project we need to see all around the world in which countries collaborate to maximize their collective renewable energy potential.

When developing these assets, it is critical to ensure the new energy system is resilient and constructed in an environmentally sustainable way, taking up less seabed and creating a smaller carbon footprint. These efforts need the experience and shared knowledge of governments, regulators and cross-sector energy companies across borders in order to help accelerate the path to net zero.

Mark Docherty, Sector Leader
Energy & Resources, UK & Ireland

Case Study: Powering a smoother transition

Getting local support for Germany's nationwide energy transition project.

Decentralized renewable energy sources — wind power from the north and solar from the south — mean Germany's nationwide energy transformation, Energiewende, requires different infrastructure to provide reliable electricity. High-voltage, direct current (HVDC) transmission power was seen as the solution, but these electrical superhighways can encroach on private land and negatively affect local ecosystems.

In a joint venture with cooperation partners, Arcadis was tasked with defining a process to secure public support from tens of thousands of stakeholders, for an area that covers about 180,000km. We started by first informing the public about the details and benefits of the project, and then provided them opportunities to actively voice their concerns before any development began.

Our team developed a software solution called mapARC: an external-facing project website linked to a web-based geographic information system (WebGIS). Users can check project data and ask questions that Arcadis can answer directly or refer to the client and project partners and can also see anonymized questions posted by others to help increase awareness and avoid duplication. mapARC allowed us to efficiently manage 20,000 stakeholder comments and requests and integrate 7,000 comments with planning relevance into the development phase.

The consultations revealed key issues that the people care about, such as nature and biodiversity conservation. It became clear there was a need to balance the goals of this nationwide initiative with the needs of those who will be directly affected by the installation of new power lines. The project was then designed to reflect those sentiments, and our work helped secure the necessary planning permissions and allowed the project to proceed as scheduled and within the allotted budget.

The HVDC transmission lines will serve as the backbone for the nationwide, reliable supply of sustainably generated energy that will power households, businesses, and communities. More importantly, Germany will be on track to substantially reduce its reliance on fossil fuels for energy generation, which will help create a carbon-neutral world for its people.



“This project demonstrates how important stakeholder engagement is in driving forward the transition and how, when it’s done right, it helps create better outcomes for everyone.”

Heike Hackemesser, Sector Leader Energy & Resources, Arcadis Europe Central

“The biggest obstacle standing in the way of the energy transition isn’t energy storage or transmission. It’s also not whether we can modernize electricity grids. Stakeholder engagement, or the lack thereof, is the most important challenge we need to overcome. Even in countries where there is broad national support for the transition, when you ask people if they want to have new energy infrastructure built in their neighborhoods, all too often they say, “Not in my backyard”. We have to do a better job of helping people understand how the transition will benefit them personally, so that they will be more accepting of the massive changes we all need make.”

Hendrik-Jan Bakhuizen, Director Energy Transition, Arcadis



Part 2: Capital Countdown

The imminent investment opportunity in transition

Huge investment is needed now to supercharge transition as quickly as possible. The world needs to invest more – and faster – than it is currently.

All parts of the energy sector will require a significant injection of capital to achieve a rapid transition. By blending what we know about technology diffusion curves with the cost of capital for different energy generation and distribution assets, we modelled the demand and potential supply of renewable energy. Then, by forecasting demand, considering efficiencies and other influences on energy price, we calculated the impact that a supercharged transition could have on the value of zero-carbon energy by market and across the world.

Investing in net zero

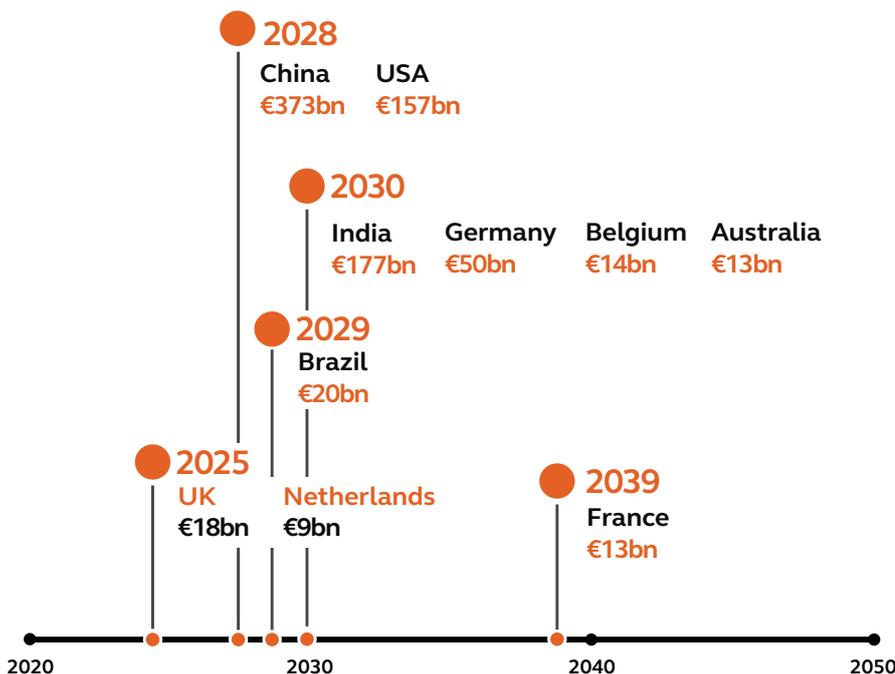
Renewable energy technologies (including solar PV, onshore wind, offshore wind and hydro) and negative emissions technologies (such as carbon capture and storage) will need to see a huge increase in investment for the world to reach net zero by 2050. Across the ten markets in our study, a total investment of €6.13 trillion – approximately equivalent to 7% of global GDP today – would be required this decade, with peak annual funding of €800 billion needed in 2028 – a mere seven years away.

The distribution of this investment would primarily fall on the markets with the largest economies and who are furthest behind in their transition today. When the need for investment would peak in 2028, China would require €373bn, the USA €157 billion and India €154 billion. The remaining seven markets in the study would require a combined €113 billion.

Over the same initial decade, transmission and distribution within global energy grids would need a €2.47 trillion investment, peaking in 2030 when existing levels need to have tripled to €360 billion. After this, investment would gradually reduce, slowing to €335 billion per year by 2050.



When could investment in renewables peak and how big would the opportunity be (figures in 2010 prices)?

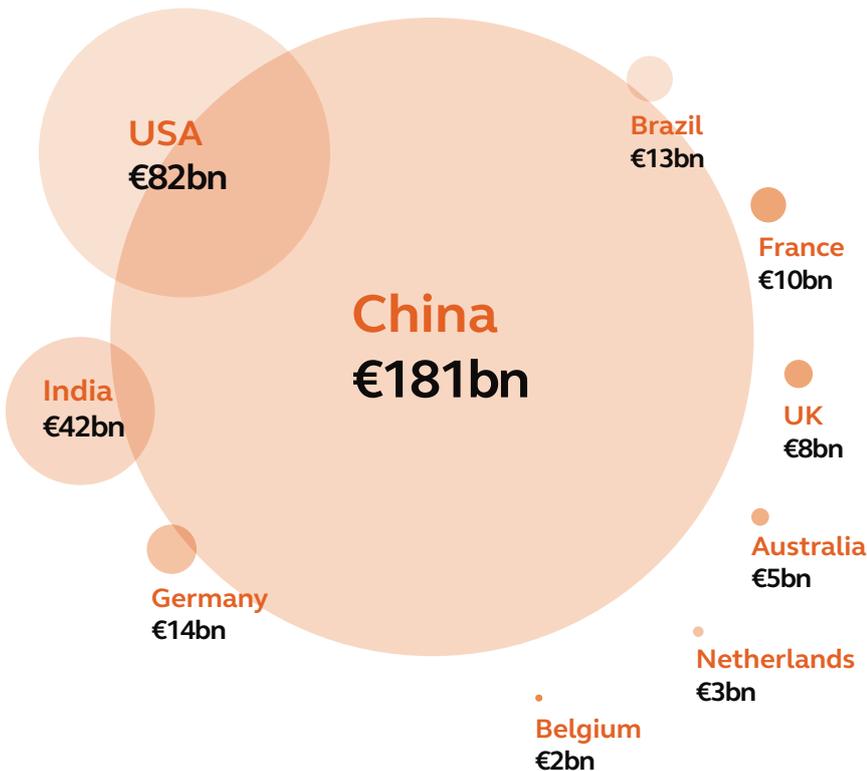


“The energy transition will require funding on a scale that neither corporations nor governments can achieve by themselves; it will need investment from both the private and public sectors. By adopting a blended public and private finance solution, innovative technologies or projects can be de-risked, made bankable and implemented faster.”

Emma Arnold, Head of EHS & ESG Advisory, Arcadis UK



Global investment in transmission and distribution peaks in 2030: how big will the opportunity be then?



Dividends for early movers

With much of the capital requirements peaking this decade, investors who engage in transition early are likely to see the greatest benefits.

Investment to strengthen renewable infrastructure will begin to offer substantial returns as the commercial value of zero-carbon energy rises, from around €851 billion in 2021 to €2.4 trillion by the end of the decade. By 2050, the commercial value of zero-carbon energy sales could be around €4.1 trillion.

“ We now see not only an ever more detailed and urgent scientific consensus guiding policy, but also an increasing public and political will to speed action and investment. Full transition to a net zero power sector, therefore, has become both inevitable and imminent. The only question left is which players will take advantage of this “gold rush“ moment to invest now, using new technologies and new business models to become the renewable energy giants of the future.”

Alexis Haass, Global Sustainability Officer, Arcadis

KEY CONSIDERATIONS:

The investment required for energy transition will peak this decade. With such short timeframes, how can governments, energy companies and investors ensure capital is available and directed to where it is needed most?

Every aspect of society – governments, businesses, and individuals – must be fully committed to rapid energy transition; it can only be achieved with bottom-up solutions to complement top-down efforts.

Blended public and private financing is the key to increasing the resources that will accelerate the transition. Innovative projects are important, but designing and implementing these solutions – (while also ensuring they are sustainable, technically viable, and profitable) will be the difference between success and failure. To encourage this innovation some governments are already using public procurement and planning. Public finance can provide seed funds to ensure innovative projects are bankable and thus encourage private finance to make up the shortfall.

Governments would also do well to begin providing incentives to energy companies that are first movers, to encourage a rapid uptick in investment. Energy companies and investors also need reliability and predictability when it comes to policies and regulations. Currently, in many countries policies are subject to the political winds, with governments

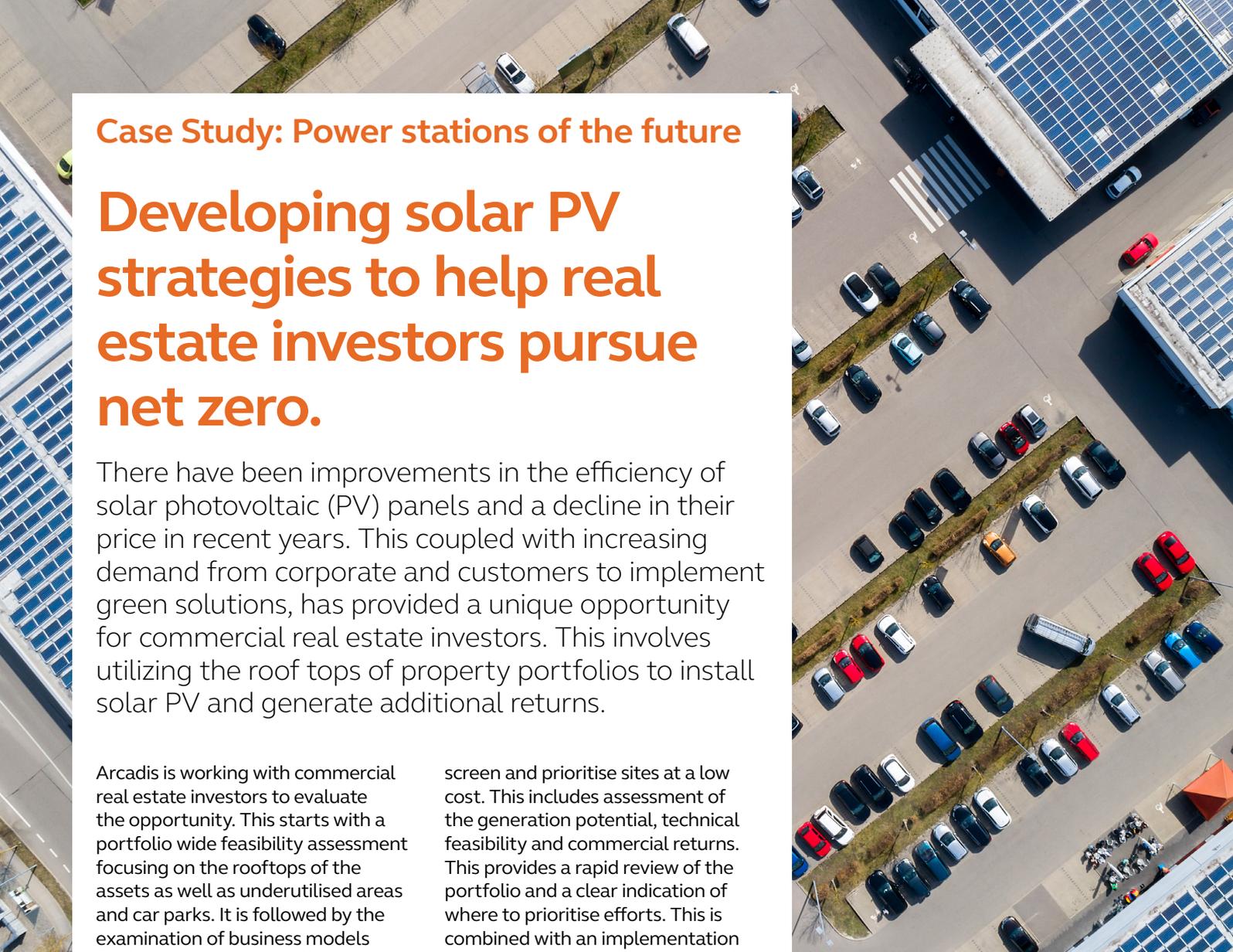
shifting directions with each new administration. Investment could also be accelerated with the support of incentives, using models from other parts of the economy. For example, discounted rates on green bond² financing — typically associated with building updates – could be offered for investment in energy storage.

In those jurisdictions where tax abatement is used as incentive, existing tax credits may need to be renewed or increased. Furthermore, to the extent that there are gaps between the affordability of renewable sources of energy and fossil fuels, price support should be put in place to close said gaps.

The next few years are critical for the effort to swiftly expand renewable energy production. Given that our simulation indicates that most of the capital requirements will peak this decade, investors who engage in the transition early are likely to see the greatest returns. This is because as more and more companies and investors enter the renewable energy space, the increased competition will reduce returns. There are, however, a number of incentives that can make renewable energy investments more attractive. For example, reductions in technology costs, integration of energy storage into modern grids and the use of structured financing. To further bolster profitability and mitigate diminishing returns, project assurance efforts, such as enhancing construction-phase productivity and mitigating potential cost overruns in design phases, can play a critical role.

² Green bonds are fixed-income financial instruments that are used to fund climate and environmental projects, which usually involve assets. Green bonds are often issued with tax incentives designed to make them more attractive for investors.





Case Study: Power stations of the future

Developing solar PV strategies to help real estate investors pursue net zero.

There have been improvements in the efficiency of solar photovoltaic (PV) panels and a decline in their price in recent years. This coupled with increasing demand from corporate and customers to implement green solutions, has provided a unique opportunity for commercial real estate investors. This involves utilizing the roof tops of property portfolios to install solar PV and generate additional returns.

Arcadis is working with commercial real estate investors to evaluate the opportunity. This starts with a portfolio wide feasibility assessment focusing on the rooftops of the assets as well as underutilised areas and car parks. It is followed by the examination of business models to manage a solar portfolio and finally a roll out programme with implementation support. These clients have international presence, operating in more than 10 countries, with over a thousand buildings and Arcadis helps them to decarbonise across the board.

Typically, these clients and funds are new to investment in energy infrastructure assets. To allocate capital, they require help in understanding the technical and commercial risks and opportunities, as well as appropriate methods to measure risk and return. Solar assessments for these large portfolios are typically costly and complex which historically limited the potential to scale this opportunity, however by working closely with clients on these projects, Arcadis has created a unique digital solution to

screen and prioritise sites at a low cost. This includes assessment of the generation potential, technical feasibility and commercial returns. This provides a rapid review of the portfolio and a clear indication of where to prioritise efforts. This is combined with an implementation framework to facilitate execution at a large scale.

Arcadis is helping clients to understand incentives and navigate regulations in different markets, evaluate business models that suit their objectives from roof rental to a more hands on approach and define ways to finance the initiative.

To date Arcadis has assessed solar PV potential for over 5,000 assets for clients. Cumulatively these assets have the capacity to build a power plant that is nearly 4% of the Netherlands total power generation, the potential carbon savings would be ~12 million tonnes CO₂e over the life of the projects.

“These projects demonstrate the potential to deploy a new source of capital for decarbonization as well as investors willingness to consider innovative and scalable solutions. These solutions offer impact, return and also address investors’ concerns about the lack of viable projects in near and medium term”

Mehdi Omrani, Energy Investment Advisory Lead, Arcadis UK



Part 3: Socio-Economic Equity

Transitioning to a fairer future

All this change comes with net benefits to society and the economy. If it is done right, energy transition could bring down the cost of energy and free up billions of euros in disposable income.

For energy transition to be a success, the societal benefits and costs will have to be spread fairly both within and between countries. We modelled the impact the transition could have on total energy bills for consumers (including heating and transport) by calculating the difference between a supercharged transition and a business-as-usual scenario where transition continues at its current pace³. Put simply, these numbers show what happens when consumers no longer have to buy fuels to heat their homes and power their cars, while simultaneously benefiting from large scale efficiencies within electricity generation.

Real savings for consumers

Supercharging the global energy system would ultimately lead to cheaper energy bills for the world's energy customers, in some cases as early as 2025.

By 2028, across these ten markets, annual energy bills could be an average of €21 lower per person across the globe, and by 2030 people could be saving €66 a year, in real terms. In meeting the demands of this supercharged transition by 2050, consumers could be around €200 per year better off, in real terms.

Safeguarding a fair future

However, without intervention to mitigate price increases, all consumers in our study would see their energy bills rise in the short-term to fund decarbonization. A critical issue will be ensuring that the costs of a supercharged transition impact populations fairly.

The transition could also mean consumers in some countries see a reduction in bills long before others. Across Europe, for example, supercharging the transition would result in energy bill savings later in the transition compared to Australia, Brazil, China, India, and USA. By 2045, however, the consumers in all ten markets in this study would have access to both a low-carbon electricity grid and a reduction in overall energy bills (including transport and heating).



“Social equity must be one of the primary principles informing how energy companies and governments make the transition a reality. Over the short and medium term, energy costs will increase in almost all markets. And there are tens of millions of people who cannot afford to pay more for basic necessities like indoor lighting at night or being able to charge a mobile phone. It’s our collective responsibility to ensure that the energy transition is not only fast but also fair.”

Peter Oosterveer, CEO, Arcadis

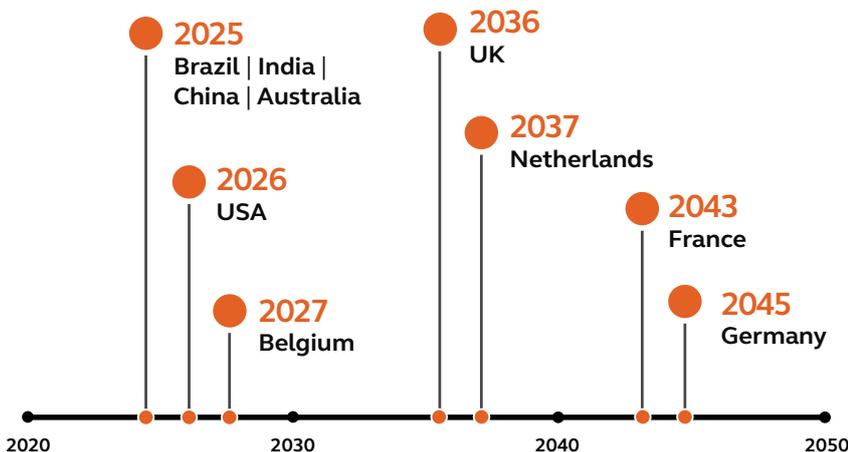


³ Energy bills were calculated by multiplying the demand for energy by the price of energy (including taxes) and dividing by population size (i.e. per capita).



Introducing new pricing models sooner, rather than later, may be an effective way to manage cost fluctuations over the course of transition. In many instances, businesses that use massive amounts of electricity receive discounts for buying energy in bulk, but this creates the wrong incentive structure, and it contributes to inequality because the average individual consumer does not receive this discount.

Fairer transition: When could energy bills be lower than they would be in a business-as-usual scenario?



“Investing in energy transition and in the related infrastructure will bring huge opportunities in the next decade to boost economies and to create green jobs.”

Transitioning to net zero requires innovation both to develop new technologies and to improve existing ones. The impact of building and improving infrastructure assets will also have a ripple effect and lay the ground to boost other growth trends such as digitalization and connecting communities.”

Mehdi Omrani, Energy Investment Advisory Lead, Arcadis UK

KEY CONSIDERATIONS:

The energy transition will likely mean cheaper energy bills in the long term for all energy consumers, but prices could also rise in the short term. How can we ensure short-term increases do not fall on the shoulders of those least able to pay?

Next to the climate challenge, human society is also struggling to cope with unprecedented levels of social inequality. In fact, climate change is exacerbating the equity crisis, in that the poorest people on the planet are all too often the ones most exposed to the negative impacts of global warming. The energy transition also has the potential to disadvantage those of us with the least. To create a fairer transition, governments and energy companies must radically rethink funding and incentive structures, with a focus on social and economic equity.

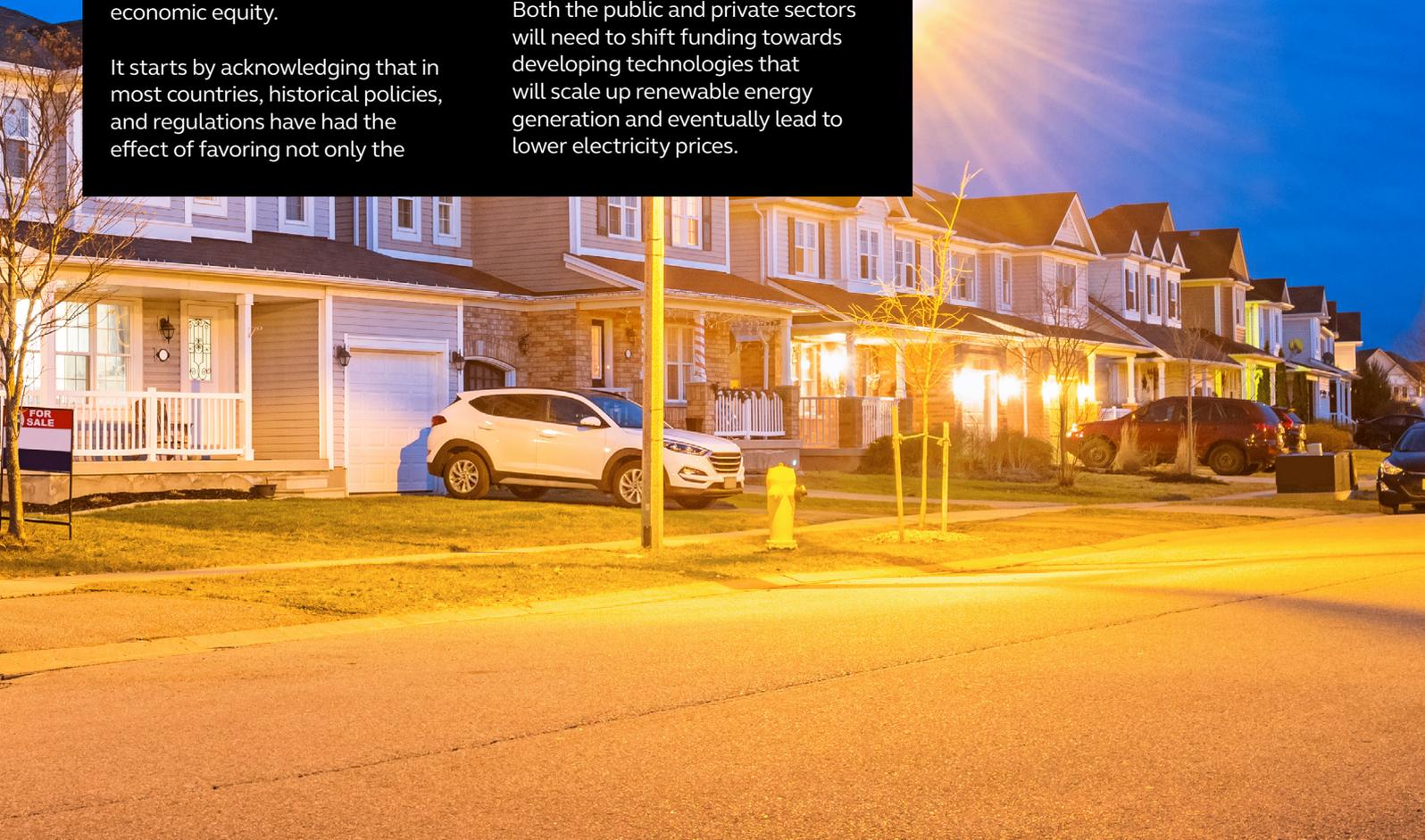
It starts by acknowledging that in most countries, historical policies, and regulations have had the effect of favoring not only the

privileged over the underserved, but also traditional industries at the expense of renewable means of energy production. This must change immediately. Governments will need to incentivize not only energy companies that move rapidly onto renewables but also support consumers who cannot afford to pay higher prices for energy.

The incentive structures around solar panel installations and purchasing electric vehicles also need to be rethought, as these can only benefit people who are already well-off. Instead, greater incentives on investments like better home insulation, high efficiency heating, as well as district-wide or city heating can benefit everyone and do more to drive down energy costs.

Likewise, carbon taxing has a critical role to play in creating a fairer transition, so that people with lower incomes pay a small proportion of the transition costs. It may be time to implement a tax on all goods based on their embedded carbon emissions and then use those funds to invest in renewable energy projects.

Both the public and private sectors will need to shift funding towards developing technologies that will scale up renewable energy generation and eventually lead to lower electricity prices.



Case Study: Supporting a fairer transition

Making our energy supply more sustainable is a top priority, and more and more wind farms will be built in the coming years.

When developing these wind farms, however, local residents are often concerned about shadow flicker, landscapes being tarnished, ecological impacts and, in particular, noise pollution. These concerns cause unrest and reduce support for sustainable energy development.

With this in mind, Arcadis developed an interactive noise forecast app called Geluidsverwachting.nl; Noise forecast. This app provides local residents a hyper-local forecast for wind turbine noise and shadow flicker. The app also shows how loud the wind turbines are expected to be compared to ambient noise and how much electricity is generated by the wind turbines.

Through the app local residents can easily report how they perceive the wind turbine noise at any time of the day. We use this feedback to monitor noise pollution and gain more knowledge on the influence of environmental noise and meteorological conditions on nuisance experienced by the residents. This information is used in optimizing the development and operation of wind farms and for more effective communication.

The app initiates transparent communication, which contributes to greater mutual understanding and trust. A pilot project for a RWE wind farm showed the reported nuisance level was remarkably low due to the fact the wind turbine noise was largely masked by the noise from an existing highway.

In a second project where higher nuisance levels were reported the feedback from residents assisted in determining under what weather and operating conditions nuisance occurred which is crucial information for determining effective mitigating measures. For both projects, residents appreciated the app itself and the fact that they were taken seriously

In November 2019, the noise forecast app was awarded the Dutch 'Award voor de Leefomgeving', an award for innovations that improve the quality of the living environment.

“The forecasts are based on advanced noise and shadow flicker models, taking into account the characteristics specific to the wind turbines and the environment. These calculations are supported by up-to-date and highly accurate weather forecasts from our partner Infoplaza.”

Erik Koppen, Senior Advisor Noise Control and Wind Energy, Arcadis

Summary

The IPCC has made it clear that we must prepare for a world in which global heating exceeds 1.5°C. The need for climate action has never been more urgent, and change must be led by the energy sector to give the rest of the economy the best chance of achieving their net zero goals.

We may not be on track for a 1.5°C future, but we must remain focused on reducing emissions as rapidly as possible. At the same time, green energy infrastructure projects must be supercharged to support decarbonized electricity grids as demand increases.

If countries continue to focus mainly on their individual emissions targets, we simply won't be able to decarbonize quickly enough to avert climate disaster. To unlock the full potential of energy transition, action must transcend borders to create widespread stability of power supply as well as a reduction in prices. This is one reason that global climate change forums such as the annual UNFCCC Conference of Parties (COP) meetings are an essential means of spurring on collective action.

Fast and fair energy transition

A supercharged energy transition would also create significant investment opportunities for the private sector. Blended finance solutions will be the most effective way to produce innovation and resources at the scale that is required, and the potential ROI is substantial for those that can commit early. Although the ideal path to transition will be incentivized by governments, the private sector can – and should – seize the opportunity that's there right now.

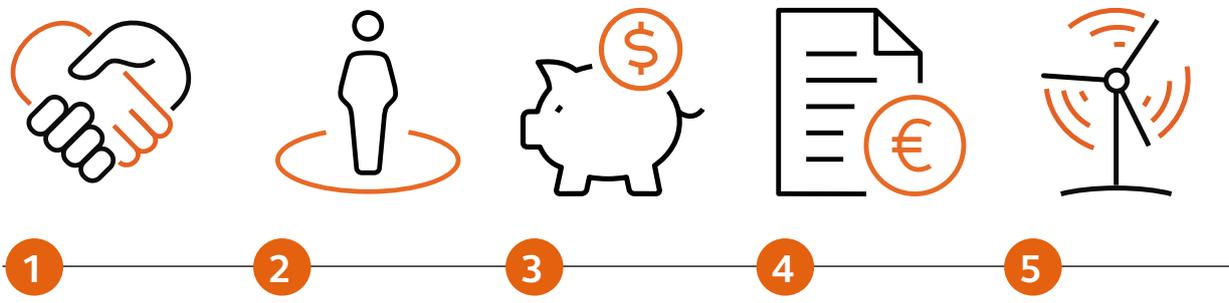
If done right, the environmental and economic benefits of energy transition can support greater social equity – including lower energy bills for all. Governments will also need to help their citizens understand why decarbonization is critical for the world, their country and their community – as well as how they personally stand to benefit. This depth of engagement is essential for overcoming the resistance to building large-scale projects close to populated areas.

Supercharging Net Zero

As our study demonstrates, energy transition is a battle that will be won or lost this decade. For many countries this will require near-unimaginable change in the short-term. However, far from being a sign of defeat, these findings should be seen as a rallying call for the energy sector to heed the advice of the IPCC: that only with immediate, rapid and large-scale reductions in emissions – a supercharged effort – can catastrophic global temperature rises be avoided.



Supercharging Net Zero: 5 Pathways to Net Zero



1
Global success requires global solutions

Working across borders to share platforms, technology and knowledge is critical to rapidly reduce emissions worldwide. This means countries will need to work across borders to unlock the true potential of renewable energy production.

2
Prioritize stakeholder engagement

Buy-in from consumers and businesses will make the transition smoother. The energy sector must engage stakeholders in all stages of project development for a successful energy transition. Deep and broad support from all stakeholders will be essential to transition quickly.

3
Blended financing answers the capital countdown

The energy industry needs funding from both the private and public sector to achieve the scale and innovation needed for rapid energy transition. While the finance structures and level of funding from either public or private sector will vary by country, the scale and speed of change will necessitate funding from both.

4
Restructure pricing for a fairer future

Financial instruments such as incentives and penalties can help manage energy prices fairly for consumers throughout the transition. These tools will also play a role in accelerating the transition by catalyzing necessary change in behaviours.

5
Forge partnerships within the eco-system

Large-scale projects will be most effectively developed when the expertise and capabilities of multiple stakeholders within different fields of the industry is combined. The entire energy eco-system must be actively engaged in creating a greener future.



Supercharging Net Zero: Methodology

Supercharging Net Zero investigates how the international energy sector – focused on ten key markets – would need to transition in the short to medium term to achieve a net zero global economy, in time to keep temperature rises to 1.5°C.

The study utilizes a dynamic, computer-based macroeconomic model of the world's economic and energy systems and the environment, called E3ME. A technical model manual of E3ME is available online at www.e3me.com. Using the goal of a net zero global economy consistent with 1.5°C by 2050, as a baseline, the research analyses countries on their energy system transition in the short to medium term.

We draw on data from ten markets (Australia, Belgium, Brazil, China, France, Germany, India, the Netherlands, the UK and the US) to illustrate how – and when – each market would need to transition.

It assumes governments will do all they can to support a global net zero (e.g. carbon pricing, regulations, energy efficiency investment, as well as sector specific policies such as subsidies, feed-in tariffs, public procurement, fossil fuel ban and taxes).

The figures are not a prediction of what will happen; they outline what the energy sector would need to do in order to help the wider economy achieve net zero in time.

To measure energy transition, the study analyzes a range of metrics:

- speed of decarbonization (year)
- increase in capacity (gigawatts)
- increase in investment in renewables (EUR)
- increase in investment in distribution and transmission (EUR)
- impact of transition on energy bills (EUR)

Data sources

The model database consists of historical data from 1970 to 2019. Various sources were used for different variables and regions. The most commonly used sources for economic variables are Eurostat, OECD, World Bank, the UN, ILO as well as official national statistics. The energy balances and the energy sector variables are derived from IEA data (IEA World Energy Balance released in 2020).

About Arcadis

Arcadis is the leading global natural and built asset design & consultancy firm working in partnership with our clients to deliver exceptional and sustainable outcomes through the application of design, consultancy, engineering, project and management services.

Arcadis differentiates through its talented and passionate people and its unique combination of capabilities covering the whole asset life cycle, its deep market sector insights and its ability to integrate health & safety and sustainability into the design and delivery of solutions across the globe. We are 28,000 people that generate €3 billion in revenues.

We support UN-Habitat with knowledge and expertise to improve the quality of life in rapidly growing cities around the world.

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