
Growth
Zero
Reframing net zero as
a driver of growth
oxera

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Contents

Foreword

Climate change is transforming the world we live in. The race to reduce emissions and limit global warming demands rapid, economy-wide transformation and innovation, with governments and businesses playing a crucial role. Time is short, and the task ahead is monumental: to reach net zero by 2050 and limit global warming to 1.5°C above pre-industrial levels.[1]

Based on our current trajectory, most forecasts suggest that we will fail to meet this target by the 2050 deadline, despite the significant improvements that are already underway. If we intend on succeeding, governments and businesses will need to take bolder action.

Economics is fundamental to the interventions that could secure a successful transition to net zero, from innovative policy frameworks by governments, to businesses overhauling their operations for decarbonisation. Economics is also at the heart of achieving a 'just' transition; so that the financial burden does not fall on those who are least able to pay, and capital for transition is directed to where it is needed the most.

Reframing net zero as a driver of growth

Growth Zero is a thought experiment that explores four hypothetical levers that each represent a possible economic pathway to achieving net zero by 2050. By combining key outputs from a macroeconomic model with microeconomic insights, it reframes net zero as a driver of growth. It demonstrates that amplifying key policy interventions and market mechanisms could achieve net zero faster *and* drive economic development. By comparing each of the levers—regulation, private sector innovation, carbon pricing and fiscal policy—we consider the most effective ways of decarbonising and aim to shift the transformation conversation to also focus on the growth opportunities that net zero could bring.

[1] United Nations, 'For a livable climate: Net-zero commitments must be backed by credible action', accessed 26 June 2024.

Net zero: a multitrillion-euro growth opportunity

The findings from Growth Zero suggest that net zero can unlock a growth opportunity across Europe worth trillions. It shows that, no matter which of the four policy packages are pursued, economy-wide transition can unlock macro growth overall.

This does not mean that achieving net zero will be a positive story for everyone. Businesses in some sectors will need to completely transform their operations to radically reduce their carbon emissions, while others will benefit from a growing market for their products or services. New regulations will need to be implemented, and new markets will emerge, meaning that businesses must remain cognisant of the changes coming their way. The politics may be hard, but there is no escaping this debate, given the commitments that have been made.

At Oxera, our team of experts look to explain the different ways that economics can drive the progress toward net zero, inspire good decisions by businesses and policymakers, and improve outcomes for society. By exploring the ways in which we can respond to the dual challenges of decarbonisation and long-term growth, we hope to help build a greener, fairer and more prosperous future. We know that there will be trade-offs—that is inevitable—but there are also great opportunities that we need to consider.

Dr Luis Correia da Silva,
Chair and Partner

> “Economics can drive progress towards net zero. It shows us ways to respond to the challenges of decarbonisation and long-term growth, aiming to build a greener, fairer, and more prosperous future.”

About Growth Zero
Growth Zero is an economic study investigating the potential impact of four different levers for achieving net zero in Europe.[2] In each lever, a specific set of policy assumptions are applied as 'shocks' to a macroeconomic model to ascertain the impact on the three focus economies (the EU, Germany and the UK).

The four levers of Growth Zero

1. Regulation:
   strict penalties are placed on high-emission sectors and phase-out dates of fossil fuel dependent technologies are brought forward.

2. Private Sector Innovation:
   large-scale deployment of new, green technology-based production capacities accelerates transition due to efficiencies of scale and learning-by-doing.

3. Carbon Pricing:
   carbon prices are increased by around 30% on average year-on-year in the 2020s, by 8.6% in the 2030s and by 4–6% in the 2040s.

4. Fiscal Policy:
   subsidies for established low-carbon technologies are supercharged whilst taxes are increased on carbon-intensive industries.

Defining the four levers of Growth Zero
The assumptions that define the levers are designed to be bold but realistic. The underlying mechanisms are based on policies or measures that are already in place—or are planned for implementation—in the UK and the EU, but they are dialled up or brought forward in the relevant lever. All of the mechanisms have been applied to some degree across all of the levers. However, the levers are differentiated by intensifying different mechanisms. This kind of amplification is what is realistically needed if countries are to achieve their net-zero goals. See Appendix 1 for a detailed outline of the assumptions used in each of the levers.

Baseline scenario
The results are reported in terms of the difference from a baseline scenario. The baseline represents a business-as-usual trajectory in which current decarbonisation policies that have already been announced are implemented as planned, but no additional policies are introduced. The baseline has been calibrated to historical data and future growth rates implied by external projections.

[2] The modelling refers to emissions in terms of both domestic production (e.g. emissions from domestic power generation and steel production) and consumption activities (e.g. emissions from domestic internal combustion engine (ICE) vehicle use). The emissions impact of imported goods is accounted for in the country of production.

Executive Summary

Our study shows that each of our four growth levers—ramped-up regulation, increased private section innovation, a higher carbon price, or intensified fiscal policies—could unlock a growth opportunity worth trillions of euros and pounds across Europe against the baseline business as usual (BAU) scenario. Under Growth Zero we are better off collectively, both in terms of economic growth and emissions reduction, as the policies implemented are shown to improve economic outcomes by incentivising investment and boosting consumer spending.

Regulation lever
Strict penalties are placed on high-emission sectors and phase-out dates are brought forward.

EU

Date net zero is reached:

2046

GDP boost between now and net zero:

€6.1tn

Representing **1.4%** additional average annual growth 2024–2046

Supporting an average of

1.4m

jobs per year

UK

Date net zero is reached:

2044

GDP boost between now and net zero:

£765bn

Representing **1.2%** additional average annual growth 2024–2044

Supporting an average of

309,000

jobs per year

Private sector innovation lever
Large-scale deployment of new, green technology-based production capacities accelerates transition.

EU

Date net zero is reached:

2047

GDP boost between now and net zero:

€5tn

Representing **1.1%** additional average annual growth 2024–2047

Supporting an average of

1.2m

jobs per year

UK

Date net zero is reached:

2044

GDP boost between now and net zero:

£635bn

Representing **1%** additional average annual growth 2024–2044

Supporting an average of

278,000

jobs per year

Carbon pricing lever
Carbon prices are increased by around 30% on average year-on-year in the 2020s, by 8.6% in the 2030s and by 4–6% in the 2040s.

EU

Date net zero is reached:

2048

GDP boost between now and net zero:

€5.3tn

Representing **1.1%** additional average annual growth 2024–2048

Supporting an average of

1.3m

jobs per year

UK

Date net zero is reached:

2046

GDP boost between now and net zero:

£555bn

Representing **0.8%** additional average annual growth 2024–2046

Supporting an average of

213,000

jobs per year

Fiscal policy lever
Subsidies for established low-carbon technologies are supercharged whilst taxes are increased on carbon-intensive industries.

EU

Date net zero is reached:

2047

GDP boost between now and net zero:

€5tn

Representing **1%** additional average annual growth 2024–2047

Supporting an average of

1.2m

jobs per year

UK

Date net zero is reached:

2045

GDP boost between now and net zero:

£627bn

Representing **0.9%** additional average annual growth 2024–2045

Supporting an average of

267,000

jobs per year

The drivers of growth in Growth Zero

Growth Zero shows that interventions to accelerate net zero can have a significant, positive impact on European economies. But how does achieving net zero drive growth?

The macroeconomic model at the heart of Growth Zero is E3ME; a circular model developed and maintained by Cambridge Econometrics that represents a demand-led economy, and incorporates the 'Keynesian multiplier effect', which assumes that the economy flourishes as the government increases spending, incentivising private sector investment and boosting consumer spending. Compared to the baseline, the ratio of debt to GDP, averages out over the period until 2050. In the earlier years of the model, there is government saving as a percentage of GDP (compared to the baseline) and government borrowing starts to increase against the baseline in all regions and scenarios from 2035 onwards.

Under all of our Growth Zero levers, investment increases demand and creates jobs, raising consumption and driving economic growth. This mechanism is common to all the levers in the study—and is explained in more detail in the full methodology—but there are also key growth drivers specific to each lever which are described in their respective sections.

Net zero can create a growth opportunity worth trillions for European governments and businesses. With the right policy package in place, transitioning to a low-carbon economy can lead to overall macro growth.

Not everyone will benefit equally from decarbonisation. Some industries will need to transform operations, while others will thrive in the expanding market for sustainable products and services. However, by balancing our resources, markets and production, we can drive the macro outcomes in the right direction. Doing so within the framework of competition policy ensuring that corporations who are taking up the challenge to achieve green growth do so competitively and on a level playing-field.

Dr Nicole Rosenboom, Partner, Competition and Climate Economics

The Regulation Lever:
Fast phase out
Strict penalties are placed on high-emission sectors and phase-out dates are brought forward.

Tighter regulation on carbon-intensive activities will be a fundamental part of the path to net zero. Governments can push businesses and consumers down decarbonisation pathways by banning, phasing out and capping major sources of emissions such as internal combustion engine (ICE) vehicles or fossil fuel-derived power generation.

The Growth Zero regulation lever imagines governments doing exactly that: doubling down on regulation to rapidly phase out fossil fuels from the economy. We see swift changes to citizens' everyday lives in this scenario, where we have dialled up or brought forward the net zero regulation currently planned for implementation in the UK and the EU. We model that new petrol and diesel vehicles are phased out from 2027 and new fossil fuel boilers are phased out from the residential heating market by 2025 in the UK and in 2028 across the EU.

We also imagine that EU and UK governments intensify investment into afforestation, and in technology to increase energy efficiency and reduce energy dependency.

The power of increased regulation

Pulling this lever has a powerful impact. Our study finds that—if governments intensified net zero regulation in this way—the UK could potentially reach net zero by 2044, and the EU could achieve net zero by 2046. Our modelling also suggests that this supercharged net zero regulation could result in the most significant GDP boost of all the levers considered in the study: €6.1tn in the EU and £765bn in the UK by the time net zero is reached.

Growth drivers in the Regulation Lever

What are the key drivers of growth under this scenario?

- **Corporate investment in transition technologies:** biofuel blending mandates and earlier phase-out dates for carbon-intensive technologies force households and companies to invest in cleaner, more efficient alternatives.
- **Onshoring of energy generation:** an enforced switch to renewables reduces imports of fossil fuels, saving money and driving investment in local industries while increasing employment.
- **Government investment:** capital directed towards afforestation and energy efficiency creates more jobs, pushing up demand and increasing consumption.

The Regulation Growth Lever in the EU

Total GDP growth
€6.1tn

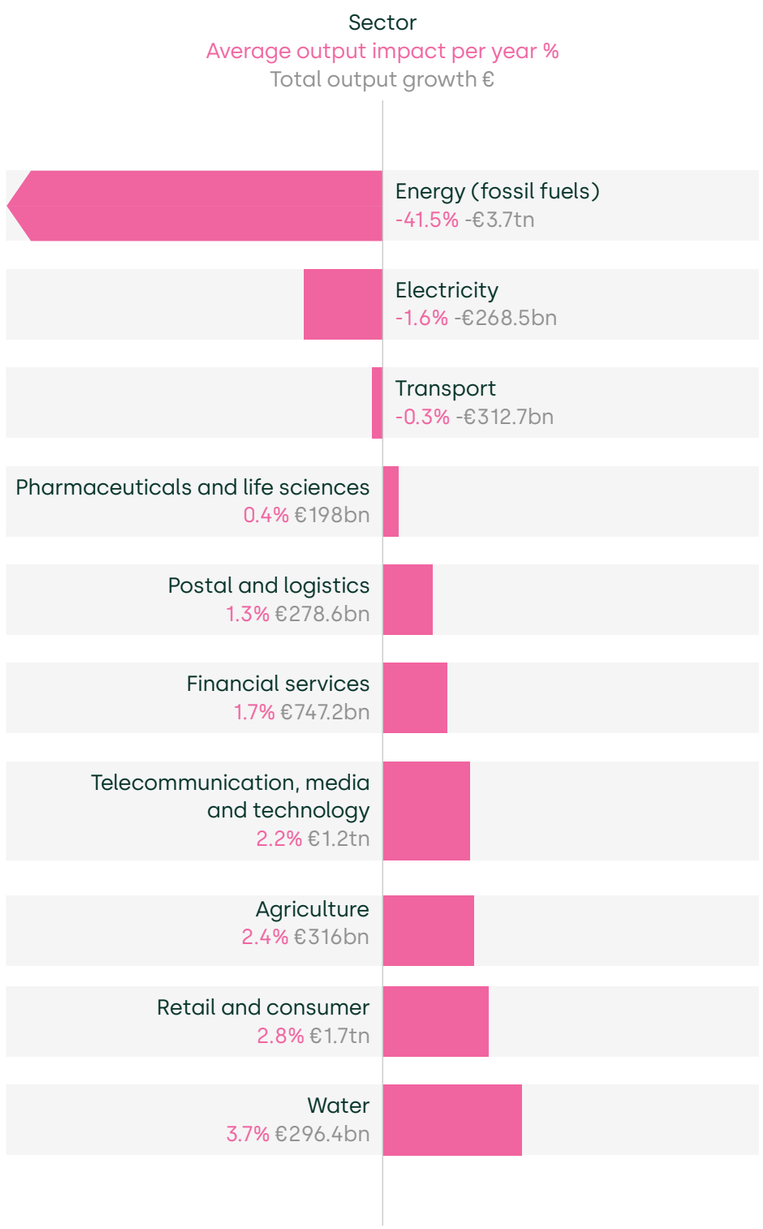
Average GDP growth per year
1.4%

Year Net Zero reached
2046

Average jobs supported per year
1.4m

Average reduction in unemployment rate per year (percentage point difference from baseline)
0.3pp

Average increase in output per worker per year
€1,042



Spotlight:
The Regulation Growth Lever in Germany

As well as investigating the impact of net zero levers on the whole EU economy, Growth Zero also homed in on Germany, the EU's largest economy, with our model producing results to show the impact of each lever on German GDP and jobs.

The Regulation Growth Lever in the UK

Total GDP growth
£765bn

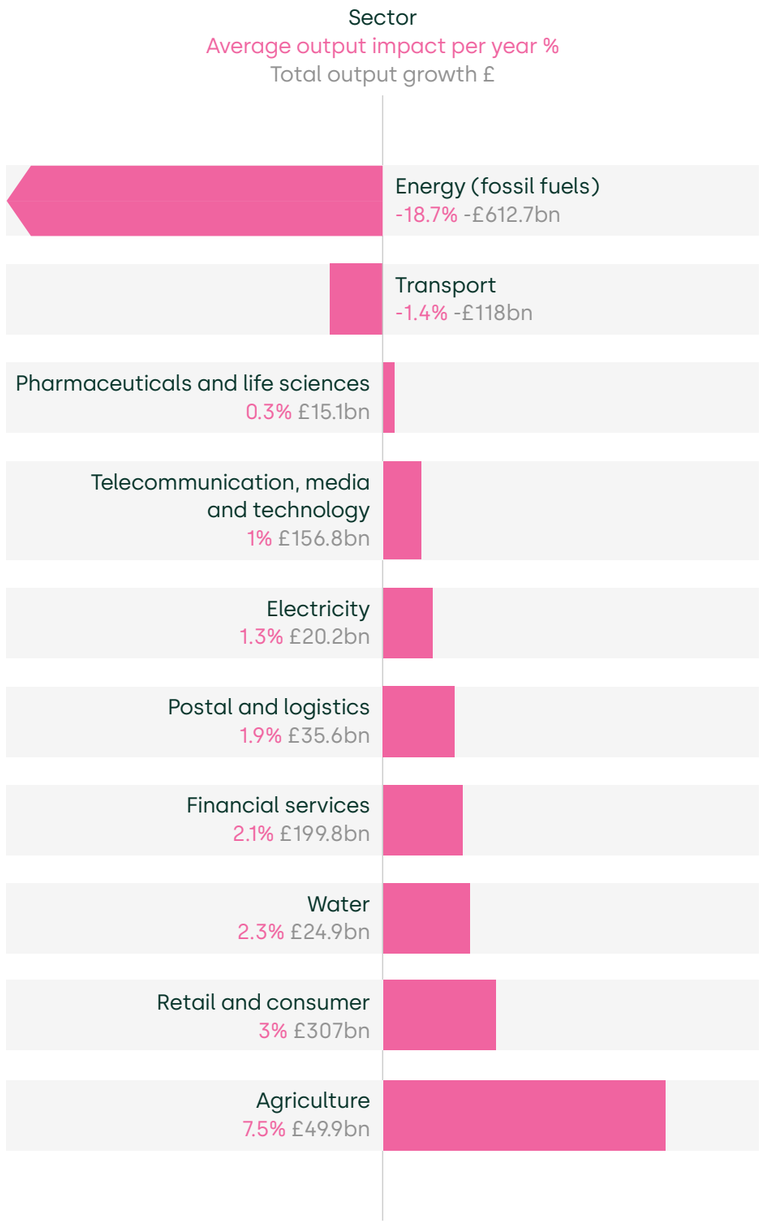
Average GDP growth per year
1.2%

Year Net Zero reached
2044

Average jobs supported per year
309,000

Average reduction in unemployment rate per year (percentage point difference from baseline)
0.5pp

Average increase in output per worker per year
£401



From macro to micro: cooperation versus competition

The more green regulation that is introduced, the more we will see pressure on companies to work together to achieve standards collaboratively, increasing efficiencies in a more sustainable way. This raises a complex debate: to what extent should companies be allowed to cooperate to comply with regulations, reduce emissions and achieve shared net-zero goals? Does this create loopholes for anti-competitive agreements to get through?

Competition should be one of the main drivers to achieve net-zero targets in a cost-efficient way, so any necessary cooperation needs to be carefully balanced.

Dr Giulio Federico, Partner, Competition Economics

From macro to micro: the electrification revolution

Every scenario that we examine requires a huge increase in electrification to get to net zero before 2050. In this regulation lever a proliferation of electric vehicles means significant changes to transmission and distribution. Currently, electricity networks are set up to focus on supplying cities—big power plants and big transmission lines that keep the lights on in urban areas. As we explore routes to net zero, the grid infrastructure needs to change to cater to the 'electrification of everything.'

The bigger the electricity sector, the more important it is to get the market design right, and to ensure that electricity is being priced as efficiently as possible. This study highlights the importance of understanding implications like these as we chart a path to net zero—how do we create an efficient electrified economy, and reap the benefits of the transition?

Dr Helen Jenkins, Partner, Competition Economics

The Private Sector Innovation Lever: Jumpstarting Green Tech

Large-scale deployment of new, green technology-based production capacities accelerates transition.

Private sector-led innovation has the potential to accelerate progress towards net zero while boosting GDP. Businesses reduce their environmental impact and deliver proactive sustainability solutions, while new start-ups develop innovative new technology and emission reduction methods.

Under the Growth Zero private sector innovation lever we witness an era of tech-enabled sustainable progress. We travel in electric vehicles (EVs) and on zero-emission rail networks, whilst warming our homes using heat pumps and electric boilers.

When we pull this lever, we scale up green technology, with deployment and new capacity installations in sectors including power and transport increased by 20%. We also gradually phase out fossil fuels and assume increased electrification in agriculture and other sectors. We project that efficiencies are gained due to scale and learning-by-doing, which drives cost reductions and accelerates transition. While the regulation lever mandated changes, here the private sector responds to the incentives to speed the take up of new technologies.

The power of private sector innovation

Our study shows that pulling this lever could see the UK and the EU achieve net zero well within the 2050 timescale: the UK could reach net zero in 2044, while ramped-up private sector innovation in the EU could see the bloc reach net zero in 2047, according to our projections. This could bring GDP growth of €5tn to the EU between now and net zero, and an additional £635bn of GDP growth to the UK.

Private Sector Innovation Lever

What are the key drivers of growth under this scenario?

- **Investment in clean technologies:** investment into green technologies—both by the private sector and the government—is accelerated, which further stimulates growth through increased employment and consumption.
- **Jumpstart of green technologies:** as the adoption of green technologies in transport, heating and steel increases, prices come down as efficiencies multiply through 'learning-by-doing' and the technology matures and stabilises.

The Private Sector Innovation Lever in the EU

Total GDP growth
€5tn

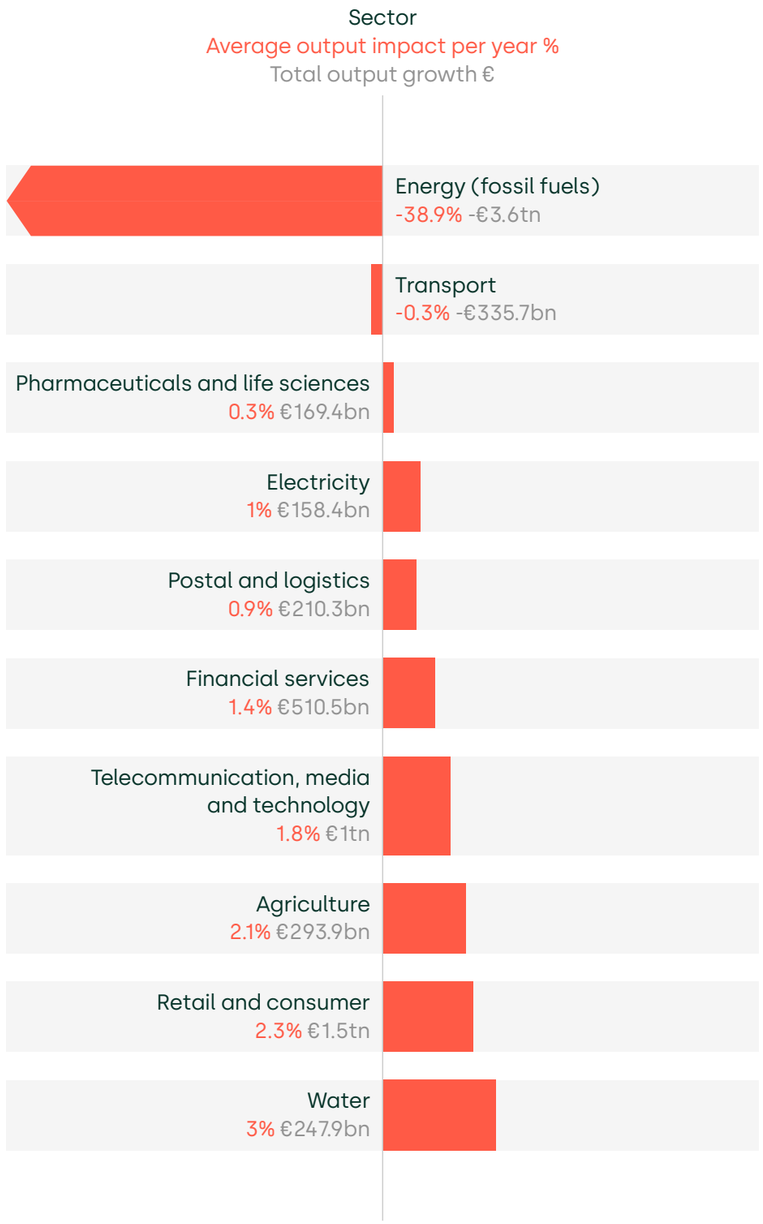
Average GDP growth per year
1.1%

Year Net Zero reached
2047

Average jobs supported per year
1.2m

Average reduction in unemployment rate per year (percentage point difference from baseline)
0.3pp

Average increase in output per worker per year
€817



Spotlight:
The Private Sector Innovation Lever in Germany

The Private Sector Innovation Lever in the UK

Total GDP growth
£635bn

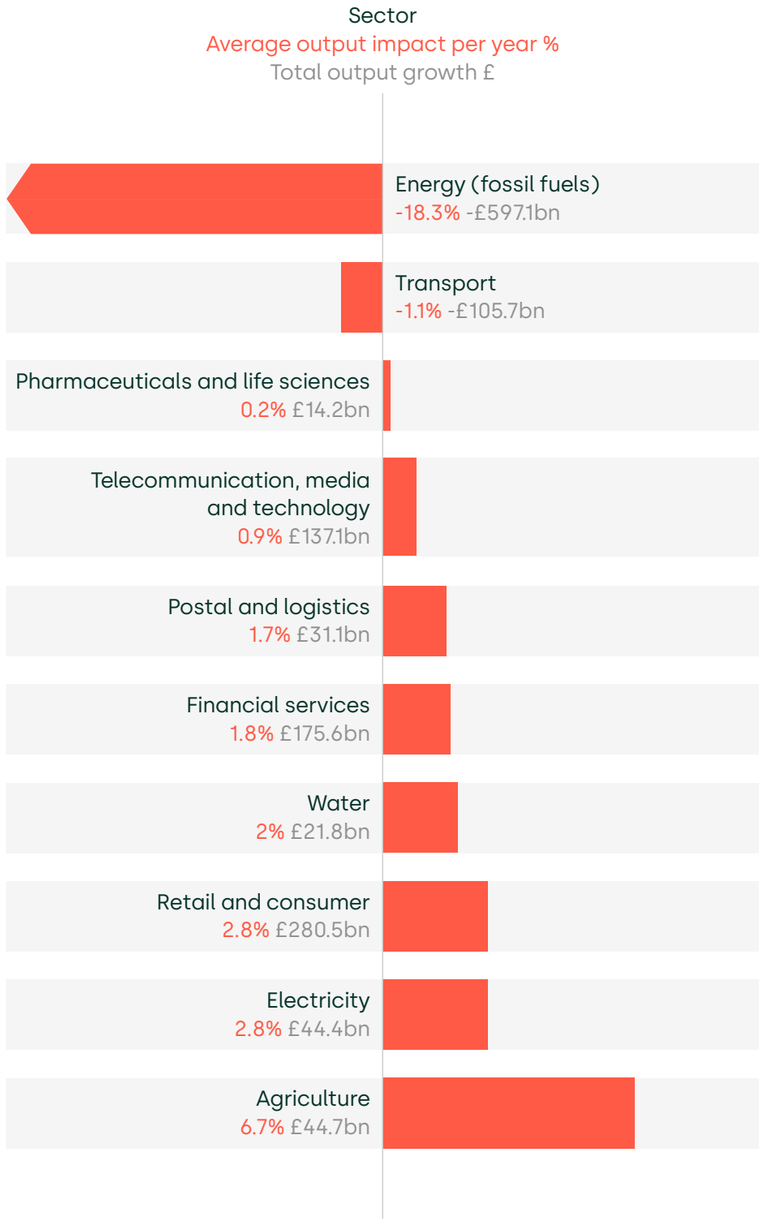
Average GDP growth per year
1%

Year Net Zero reached
2044

Average jobs supported per year
278,000

Average reduction in unemployment rate per year (percentage point difference from baseline)
0.5pp

Average increase in output per worker per year
£212



From macro to micro: implications for negative emissions technologies

We need the private sector to play a driving role in financing and innovation for both emissions reduction at-source and in developing negative-emission technologies. Boardrooms can find it difficult to commit to significant investments in a world of uncertain outcomes, as regards transition pathways and technologies for decarbonisation.

This is particularly complicated for initiatives that are capital-intensive, will only need to be built once and are likely to become part of the backbone of a net zero economy—for example, carbon capture transport and storage networks or hydrogen networks. If investors anticipate that they will be regulated in the future, they will factor this in to their decisions now. The uncertainty over whether their investment (if successful) will be fairly valued by a regulator can hold up initiatives today.

Regulators need to work with the private sector to create viable conditions for innovation and investment, while also ensuring that society is not held captive once the infrastructure or technology is built and is successful. Options could include subsidising the project, specifying a set period of time before regulating returns, or offering insurance against asset stranding.

Sahar Shamsi, Partner, Energy and Climate Economics

Growth Zero and the automotive sector

The electrification of personal domestic transport is an integral part of any net zero transition pathway. All the levers considered in this study include the phasing out of ICE vehicles, and subsidies for EVs.

Imports of cheap, high-quality Chinese-made EVs in practice are creating competition challenges for carmakers and policymakers alike. There are also concerns about the historic level of state aid that has fuelled the EV manufacturing boom in China, with calls emerging for similar initiatives in Europe and the imposition of tariffs on Chinese imports.

The new charging infrastructure that will be required also poses questions about the wider ecosystem needed to facilitate the EV adoption. If the roll-out is too rapid, there is a risk of short-term inefficiencies, but in the long term, the concern is the potential creation of market power as the maturing sector consolidates.

As with all fast-changing markets this creates winners and losers, and businesses must ensure that they understand the microeconomic implications of decarbonisation policies—even if the impact is positive overall.

From macro to micro: planning ahead for EV demand

Many automotive manufacturers are actively building their portfolio of EV models while continuing to manufacture ICE vehicles. By implementing policies that drive demand for EVs, governments could accelerate the pivot away from petrol and diesel models.

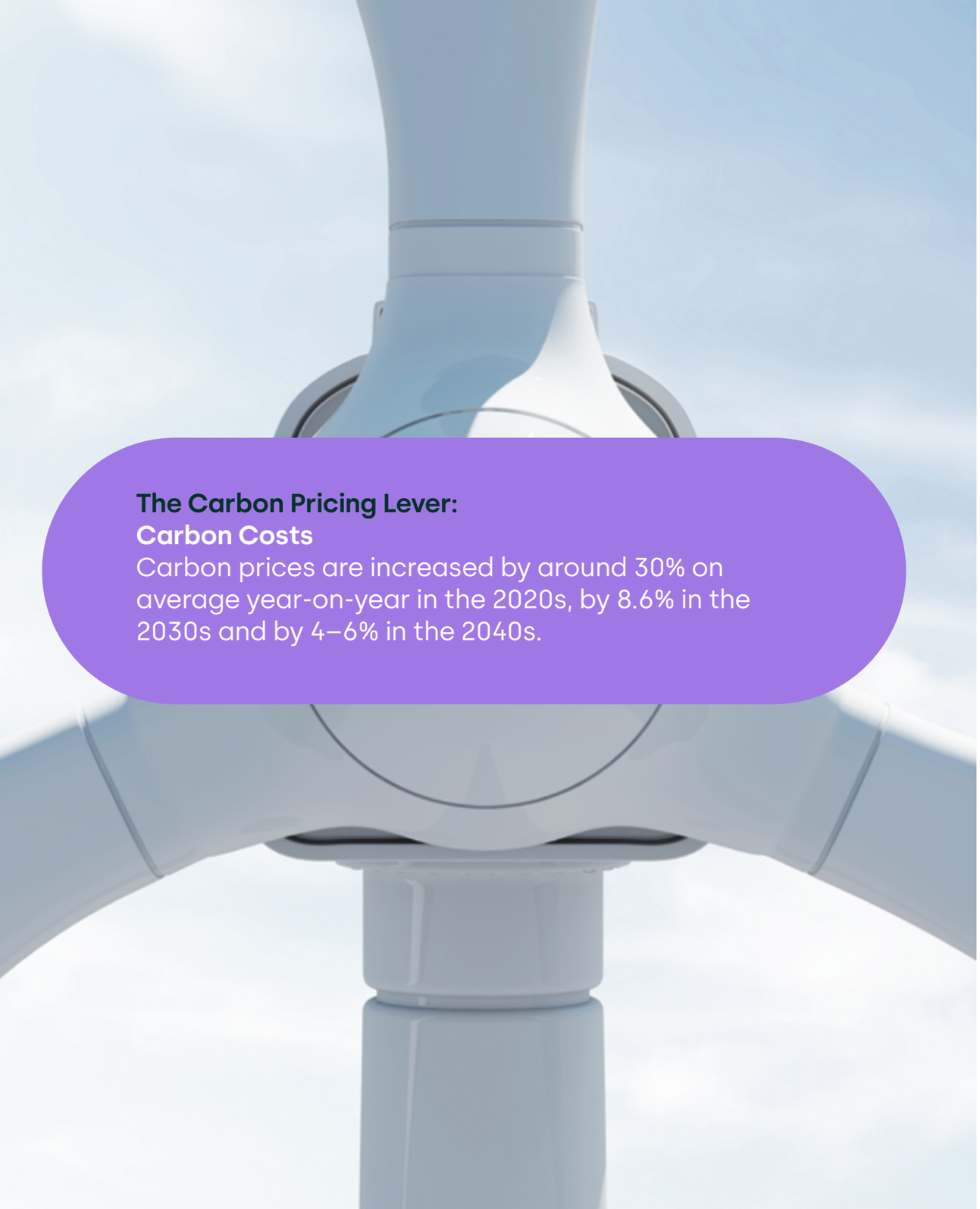
However, there aren't necessarily enough raw materials in the market to accommodate a rapid uptick in copper and lithium requirements. Customers are already sensitive to the price of EV batteries, so investing more into technology—specifically improving battery lifespan or re-energising old batteries—could be an essential alternative.

Michele Granatstein, Partner, Transport Economics

From macro to micro: the ripple effect of ICE and EV price parity

If taxation and subsidies, respectively, create cost parity between ICE vehicles and EVs the economy could see increasing reliance on second-hand ICE vehicles by those priced out of new vehicles, as well as different methods of transportation altogether. If policies make both EVs and ICE vehicles prohibitively expensive for significant parts of the population, governments have to invest in both the decarbonisation of their public transport networks, and also their ongoing, subsidised operation to protect connectivity. And, if buses and trains aren't yet running on renewable energy, are they at least more CO2 positive than the number of cars they're replacing?

Andrew Meaney, Partner, Transport Economics



The Carbon Pricing Lever:
Carbon Costs
Carbon prices are increased by around 30% on average year-on-year in the 2020s, by 8.6% in the 2030s and by 4–6% in the 2040s.

Carbon pricing is one of the most powerful policy instruments available to tackle the climate crisis. It shifts the burden of paying for carbon onto the producers of greenhouse gas emissions and incentivises corporates to invest in cleaner technology and consumers to choose greener options.

The Growth Zero carbon pricing lever imagines a world where the price of carbon is raised faster and higher, and an energy tax is immediately imposed in the road transport sector. Under this lever the carbon price is triple the baseline price,[3] compared to double in the other levers. In this hypothetical scenario, the carbon price increases by around 30% on average year-on-year in the 2020s, by around 9% in the 2030s and by 4–6% in the 2040s. A carbon border tax is not included in the lever, but the global carbon price is consistent with the existence of a carbon border adjustment mechanism.

This hypothetical scenario enables us to project what could happen if these ambitious carbon pricing levels were implemented across regions. Pulling this lever would offer emitters a stark choice between reducing their carbon output or paying a high price for it. We explore the possible effects of escalating carbon costs and the strong financial case for corporates to shift their investments towards cleaner technology. But if governments put a financial price on organisations' 'right to pollute', would the cost of the climate crisis ultimately still pass through to end consumers?

The power of carbon pricing

Under these modelling conditions, the UK could hypothetically achieve net zero by 2046, followed by the EU in 2048—still within the 2050 timescale, but slower than the other levers in the study. Our modelling suggests that increasing the price of carbon to the levels assumed within this lever could boost GDP in the UK by £554bn and €5.3tn across the EU, representing an additional 0.8% and 1.1% average annual growth between now and net zero, respectively.

Growth drivers in the Carbon Pricing Lever

What are the key drivers of growth under this scenario?

- **Corporate investment in mitigation technologies:** with carbon-intensive sources of energy generation being the more expensive option, businesses invest in cleaner energy generation technologies.
- **Onshoring of energy generation:** an enforced switch to renewables reduces imports of fossil fuels, thereby saving money and driving investment in local industries while increasing employment.
- **Revenue recycling:** increased carbon tax revenues are used to help industries decarbonise, which drives investment and demand.

[3] The baseline carbon prices are derived from IEA World Energy Outlook. Carbon prices in this lever rise to 331.5 Euros per tonne in the EU and Germany, and 90.6 Euros per tonne in the UK in 2030.

The Carbon Pricing Lever in the EU

Total GDP growth
€5.3tn

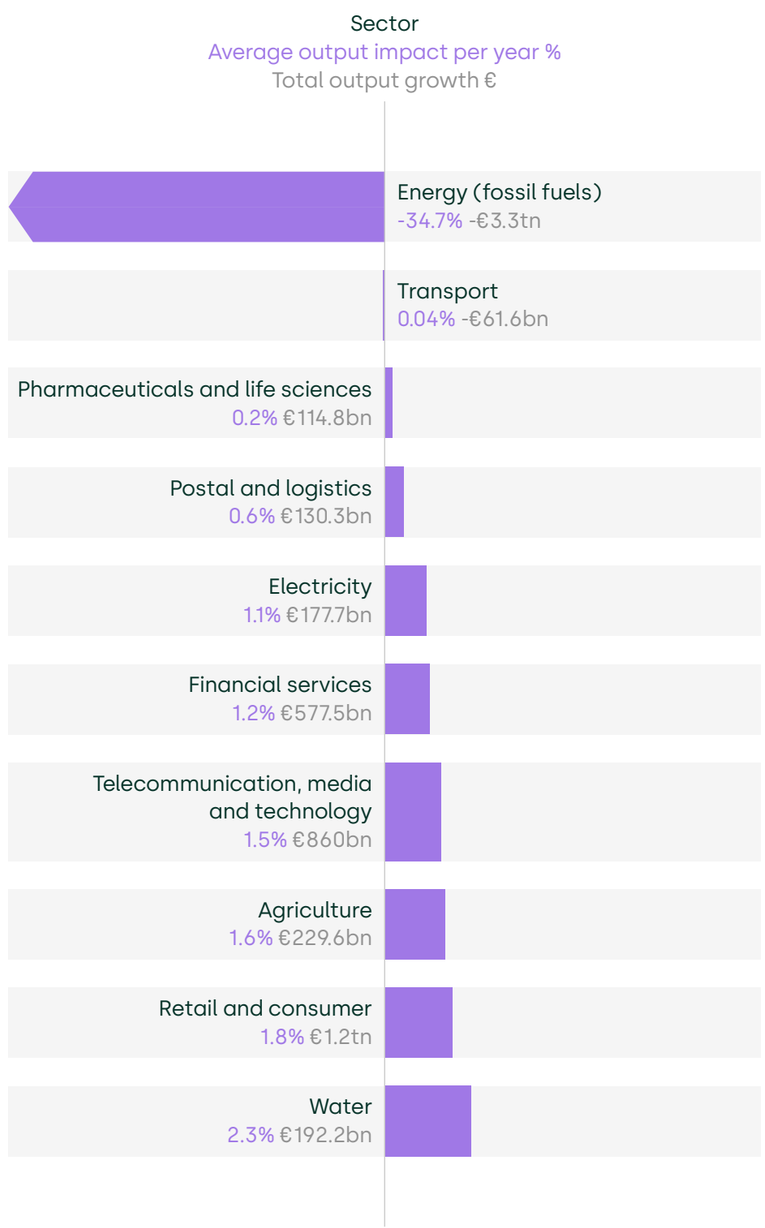
Average GDP growth per year
1.1%

Year Net Zero reached
2048

Average jobs supported per year
1.3m

Average reduction in unemployment rate per year (percentage point difference from baseline)
0.3pp

Average increase in output per worker per year
€571



Spotlight:
The Carbon Pricing Lever in Germany

The Carbon Pricing Lever in the UK

Total GDP growth
£555bn

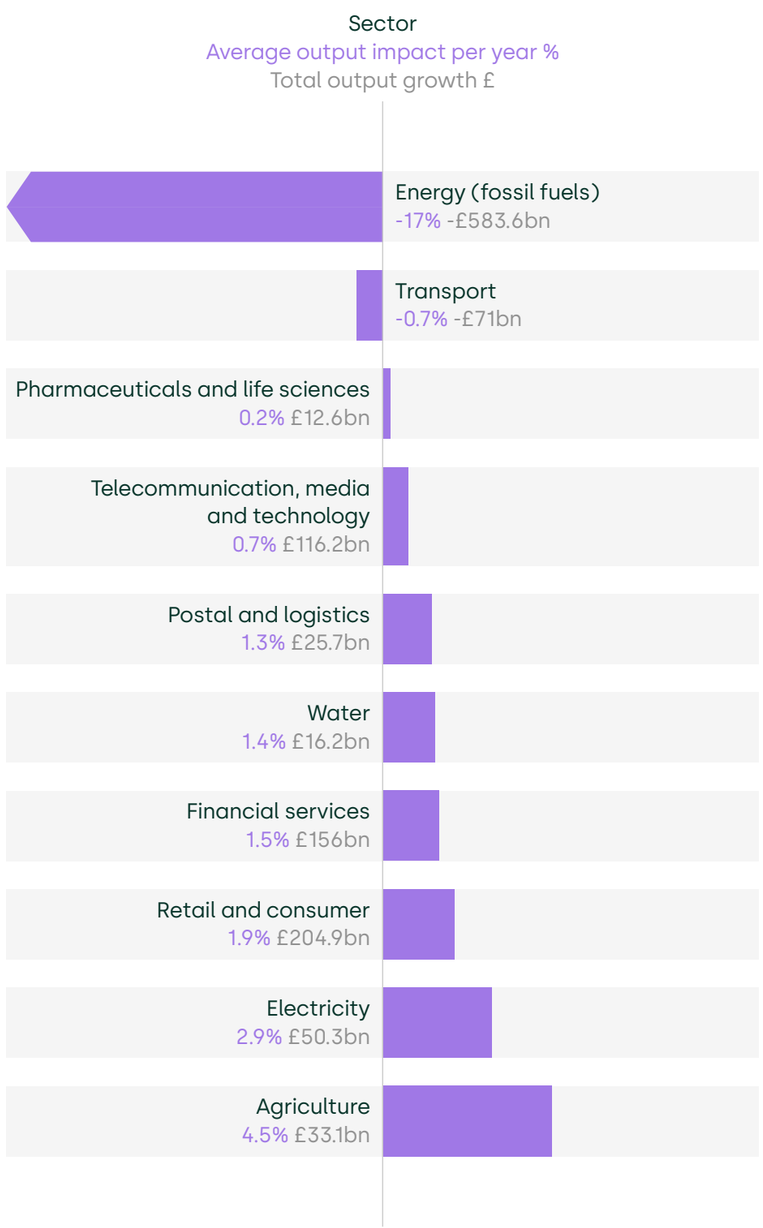
Average GDP growth per year
0.8%

Year Net Zero reached
2046

Average jobs supported per year
213,000

Average reduction in unemployment rate per year (percentage point difference from baseline)
0.4pp

Average increase in output per worker per year
£42



From macro to micro: you can put a price on carbon

By setting a price per unit of pollution (i.e. per tonne of CO2 equivalent), emissions allowances are a way of acknowledging that the environment is not a free resource. It's a market-based solution that effectively enables organisations to buy their 'right to pollute'.

For some industries—steel manufacture, other segments of heavy manufacturing, some areas of transport and agriculture, for example—it may not be feasible to reach zero CO2 emissions at source. In this case, to deliver net zero, policymakers and society may rely on engineering-based greenhouse gas removals from direct air capture and Bioenergy with Carbon Capture and Storage (BECCS) technologies. However, in 2024 these technologies have yet to be proven for deployment at scale.

Therefore, governments and treasury officers will need to find alternative ways of pricing this carbon, funding these industries or investing in different technologies for producing the resources.

Accordingly, there is a complex evolving picture of how we inform the question of 'what is the price of carbon?'. Apart from the emissions allowances and the market pricing of different negative emission technologies like direct air capture discussed here, other use-cases such as the price of voluntary carbon credits, carbon offsets and the social cost of carbon based on economy-wide marginal abatement cost curves can inform that answer.

Sahar Shamsi, Partner, Energy and Climate Economics

Macro to micro: innovation in aviation

The aviation sector is exploring various avenues to achieve climate goals. This involves building fuel-efficient airplanes, the increased use of sustainable aviation fuel, and the development of innovative technologies like electric and hydrogen aircraft. Airlines are taking proactive measures to educate passengers about the environmental implications of flying and are devising methods to counteract carbon emissions without compromising their services.

Michele Granatstein, Partner, Transport Economics

The Fiscal Policy Lever:
Governments Incentivise
Subsidies for established low-carbon technologies are supercharged whilst taxes are increased on carbon-intensive industries.

As countries look to accelerate the decarbonisation of their economies, fiscal policy is an immensely effective lever at the disposal of governments. Both the 'stick' of increased taxes and the 'carrot' of enhanced subsidies can dramatically shape the behaviour of individuals and businesses by altering the financial equation and encouraging more sustainable choices.

The Growth Zero fiscal policy lever imagines governments using their fiscal firepower to inspire a change in business and consumer behaviour. We envision leaders placing levies and taxes on high-emission technologies whilst subsidising greener alternatives.

In our model, there is a rise of rates on the use of fossil fuels across the economy. For example, petrol and diesel vehicles are subject to higher taxes, along with boilers that rely on gas and coal—while EVs receive generous subsidies and taxes are reduced on renewable boilers. Geothermal, nuclear and Bioenergy with Carbon Capture and Storage (BECCS) technologies receive subsidies, and electricity and hydrogen use in the iron and steel industries are initially subsidised, before gradually phasing out.

The power of fiscal policy

Deploying this mix of taxes and subsidies has the potential to bring net zero significantly closer; our modelling suggests that the UK could achieve net zero by 2045, and the EU could reach net zero by 2047. In addition, our study hypothesises that pulling this lever could garner a stable boost to GDP—most notably in Germany, with 0.5–1.5% higher GDP in comparison with the baseline between now and reaching net zero in 2043.

Growth drivers in the Fiscal Policy Lever

What are the key drivers of growth under this scenario?

- **Industry subsidies:** power sector subsidies are directed towards bio-based and carbon capture and storage technologies, and the steel sector receives subsidies that incentivise low-carbon technology deployment and electricity use in the sector.
- **Household support:** heavy subsidies for EVs and renewable central heating/cooling systems create demand for these technologies within the market, fuelling demand and boosting growth.
- **R&D/investment subsidies:** businesses are encouraged to invest in clean technologies, fuelling demand and reducing overall costs.
- **Onshoring of energy generation:** a switch to renewables reduces imports of fossil fuels, saving money and driving investment in local industries while increasing employment.
- **Increasing returns to adoption** drives potential long-term price reduction.

The Fiscal Policy Lever in action

The USA's Inflation Reduction Act

Ratified in 2022, the USA's Inflation Reduction Act (IRA) is a landmark federal law that devotes almost $370bn in subsidies to public and private entities to spur climate action under the banner of reducing national inflation. Through grants, loans, rebates and tax credits, the IRA promotes decarbonisation across all sectors by supporting renewable energy, clean-tech products, the EV sector and the production of carbon-neutral electricity and low-emissions fuels, such as hydrogen.

Whereas the European Green Deal focuses on strategic regulation, directives and targets, the IRA uses market-based incentives to change corporate and consumer behaviour.

The IRA has huge implications for the journey to net zero on both sides of the Atlantic, with the potential to:

- Fast-track the development and deployment of green technologies, lowering the global costs of new fuels.
- Increase the global market for green technologies, further driving investment into clean energy solutions and decarbonisation.
- Offer a competitive alternative to Chinese and European automotive manufacturers, shifting the pricing and availability of EVs.
- Strengthen supply chains for numerous materials and goods, from critical materials to efficient electronics.
- Create well-paying jobs and new economic opportunities for workers.

Macro to micro: funding new technology

It is difficult to determine how effective some technologies or networks, like carbon capture, utilisation and storage (CCUS) or hydrogen, can be until these reach deployment stage at scale. If the private sector will not risk investing in a new technology e.g. due to uncertainty in future uptake and use-cases, then it may be up to governments to provide direction or first-mover incentives. In the US, the IRA establishes hydrogen as a clear priority for funding, effectively 'picking a winner' which will tend to accelerate the industry along the cost curve faster than spreading investment across multiple options. The European approach has supported a range of renewable technologies. The resulting deployment of solar and wind has led to declining cost of renewable generation and we've seen these fuels achieve 'grid parity' in some markets relative to conventional sources of energy.

Jostein Kristensen, Partner, Energy and Climate Economics

The Fiscal Policy Lever in the EU

Total GDP growth
€5tn

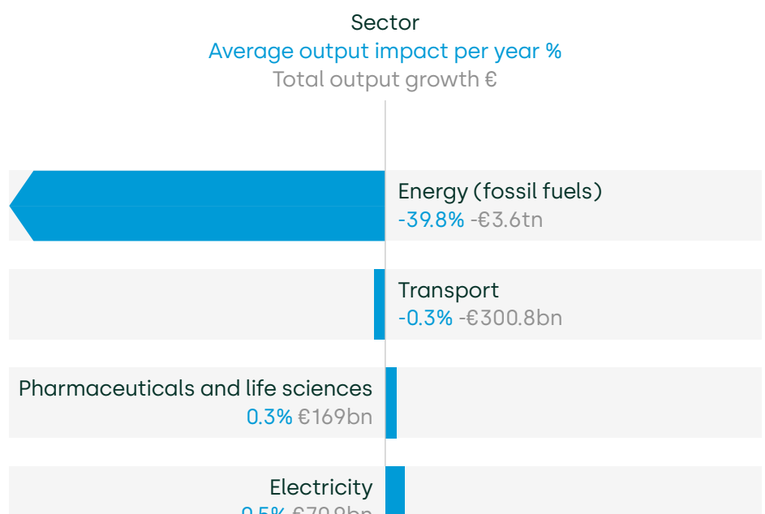
Average GDP growth per year
1%

Year Net Zero reached
2047

Average jobs supported per year
1.2m

Average reduction in unemployment rate per year (percentage point difference from baseline)
0.3pp

Average increase in output per worker per year
€785



Spotlight:
The Fiscal Policy Lever in Germany

The Fiscal Policy Lever in the UK

Total GDP growth
£627bn

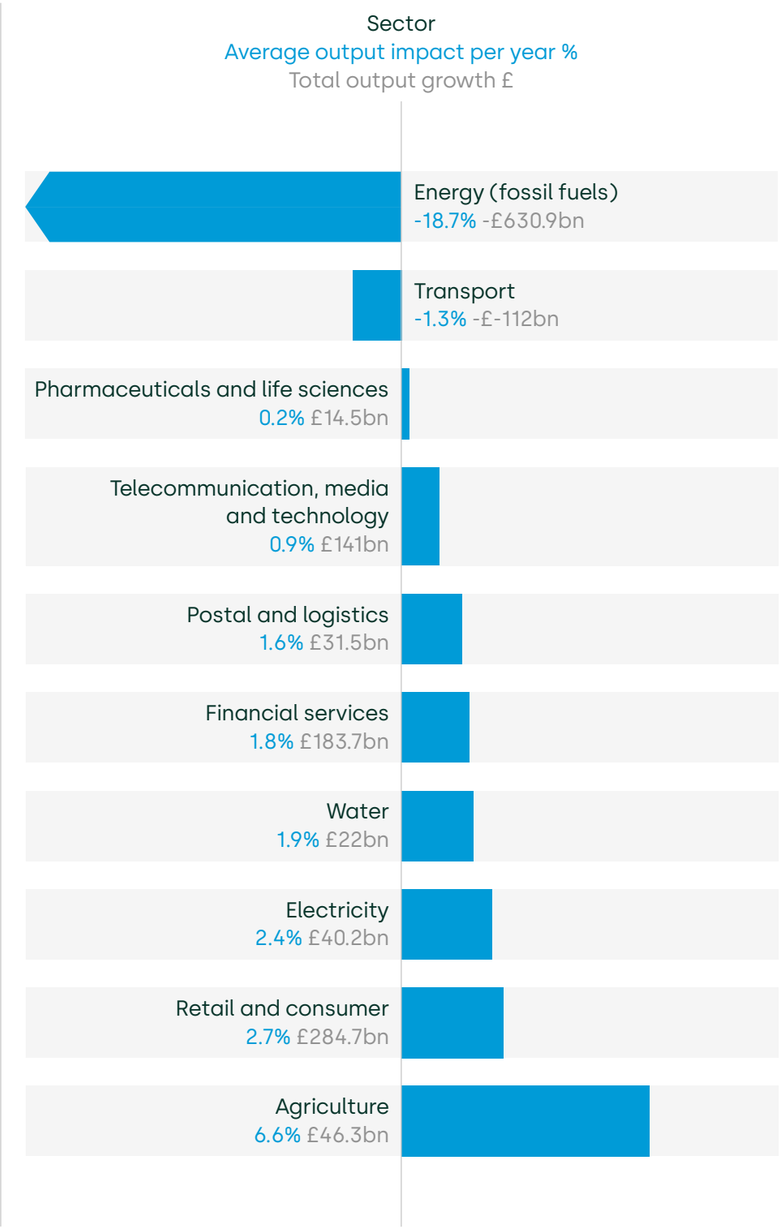
Average GDP growth per year
0.9%

Year Net Zero reached
2045

Average jobs supported per year
267,000

Average reduction in unemployment rate per year (percentage point difference from baseline)
0.5pp

Average increase in output per worker per year
£172



“

From macro to micro: the importance of flexible fiscal policy

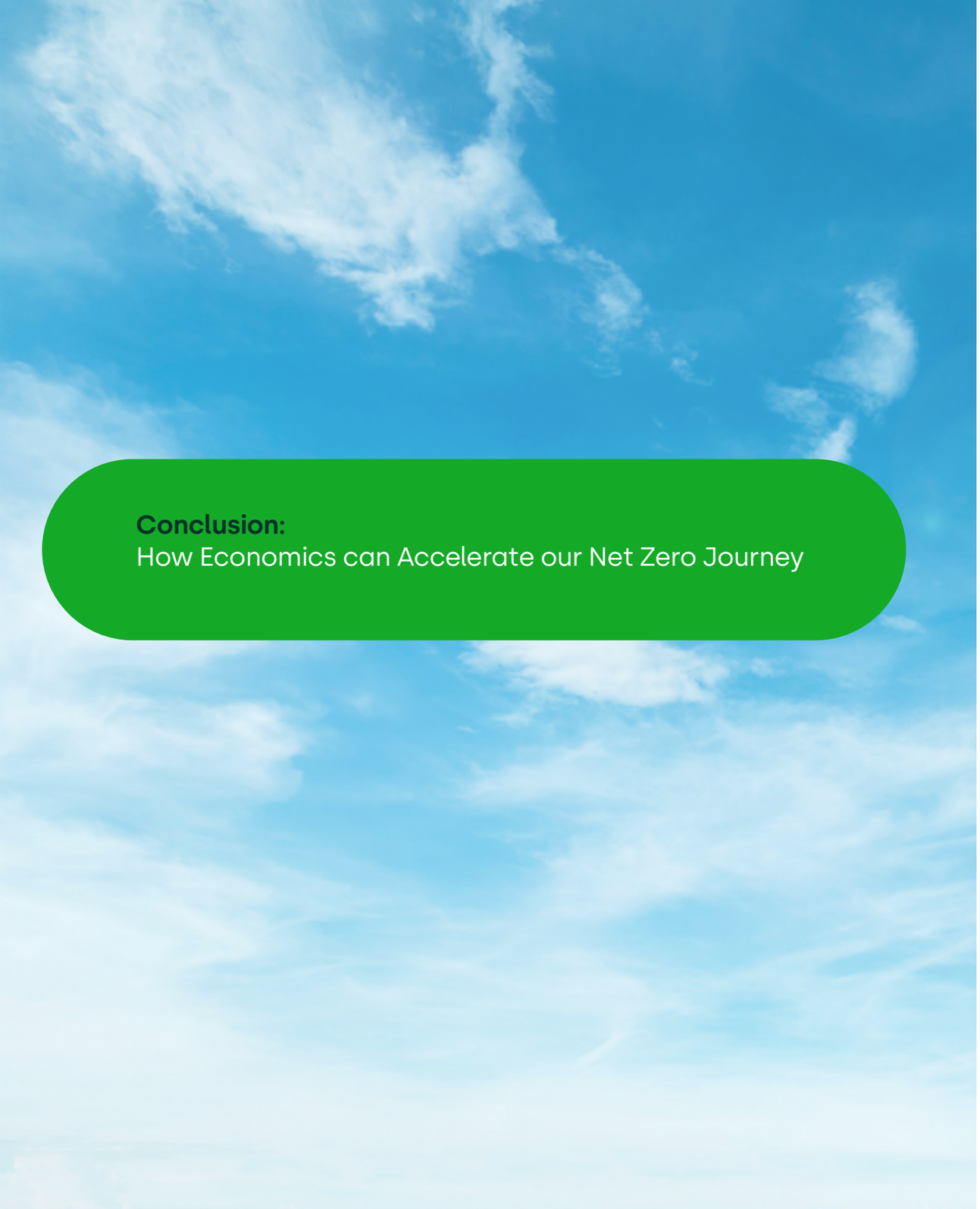
Interventions like this have direct implications on government debts and deficits, and for a supranational body like the EU it can be hard to coordinate a common fiscal response that ensures that a level playing field is preserved across Europe and that competition is not distorted.

Government spending (and related private sector investment) can be directed at green objectives with specific requirements. Under the ongoing Next Generation EU program, energy efficiency measures have to achieve a high bar of emissions reduction to qualify for support, while hybrid and electric vehicles have to demonstrate emissions below a certain level. This means that fiscal support can be targeted effectively.

But even if the money is available, there are absorption and physical infrastructure restraints to consider. Under a scenario where fiscal policies are ramped-up, there would be a question mark over whether the changes could be absorbed at pace. Companies often face administrative bottlenecks, permitting restrictions, delays in accessing the grid, and regulatory challenges. Ironically, other environmental regulations can be a barrier to deployment—but, in the race to net zero, these should not be compromised.

”

Dr Giulio Federico, Partner, Competition Economics



Conclusion:
How Economics can Accelerate our Net Zero Journey

Oxera uses economics to tackle the world's biggest challenges. Today, there are few bigger challenges than climate change, and the need to reduce emissions and transform our economies to protect the planet.

Achieving net zero will require the transformation of businesses, sectors, institutions, and societies. While many countries have committed to achieving the targets outlined in the 2015 Paris Agreement, governments and organisations are still struggling to build credible pathways to reach net zero carbon emissions by 2050.

There is no easy solution, and a blend of approaches driven by incentives, regulation, and taxation—both government-led and private sector-led—will be critical in achieving this milestone. This study demonstrates that, from a macroeconomics perspective, there are many ways of closing the net zero gap, while also supporting prosperity and largely ensuring a stable or increasing disposable income for consumers. It also shows that economic growth and sustainability are not mutually exclusive.

This study highlights the necessity of a consistent microeconomics approach in order to facilitate a successful transition: building a net zero economy involves market and consumer incentives; new financial markets must be created to meet the need for investment in decarbonisation; and necessary collaboration between companies can be encouraged to achieve shared sustainability goals.

Five questions from Growth Zero

The journey to net zero is complex and multi-faceted, touching on areas from market design to sustainable finance. Growth Zero raises five key questions for businesses and policymakers, which economics can help to answer, ensuring that both decarbonisation and economic growth are prioritised.

1. Competition

How is the climate change agenda impacting competition policy, and how are different legislatures dealing with the intersection between collaboration-driven sustainability initiatives and competition? Oxera can advise on balancing positive collaboration with protecting a level playing field.

2. Regulation and market design

What is the market design that is needed to create a growing, decarbonised economy? We can help stakeholders and companies understand the potential effects of policy and regulatory changes and explore the mechanisms that can enable business leaders to meet the challenges of building a more sustainable world.

3. Sustainable finance

What are the impacts of net zero policy and regulatory changes on investors, and to what extent do portfolios need to be rebuilt around greener principles? We can help investors develop their environmental, social and governance (ESG) strategies, and understand the impact of new regulations on the value and risk profile of their investments.

4. Infrastructure development

How can the appropriate value of carbon be reflected in investment appraisals, and how would different approaches to carbon pricing reshape the landscape? As changes to planning regimes and regulation impact the types of infrastructure projects that are developed, we can help organisations consider how projects can be assessed in a changing environment.

5. Climate change litigation

How do lawyers, claimants and defendants deal with the increase in climate-related litigation, which is inevitable as climate legislation develops? We can provide robust economic evidence on the impact of climate change and economic and financial evidence on contractual issues under dispute.

Unlock the Power of data-driven Insights

Our report has unveiled critical insights into today's complex global challenge of reaching net zero. But understanding is just the first step. Our team of experts in economics, finance, and data science is ready to help you navigate the complexities revealed in this report. With 40 years of consulting experience across Europe, we offer data-backed solutions and a multidisciplinary approach to help government and companies prepare for the future. Speak to our experts and discover how we can help you transform data into decisions, and challenges into opportunities.

Dr Luis Correia da Silva
Chair and Partner

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Partner, Competition Economics

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Michele Granatstein
Partner, Transport Economics

Andrew Meaney
Partner, Transport Economics

Jostein Kristensen
Partner, Energy and Climate Economics

Detailed Methodology

Growth Zero is an economic study investigating the potential impact of four different packages of policies—referred to as 'scenarios' or 'levers' in this report—for achieving net zero in Europe (focusing on the EU, the UK and Germany). It compares different mechanisms for reaching net zero, while also looking at the potential impact that these measures could have on the economies in these countries.

Under each scenario, a specific set of assumptions, including public policies and market mechanisms, are applied as 'shocks' to the E3ME model to ascertain the impact of this set of assumptions on the three focus economies.

The four growth levers of Growth Zero

1. Regulation:
   strict penalties are placed on high-emission sectors and phase-out dates are brought forward.
2. Private Sector Innovation:
   large-scale deployment of new, green technology-based production capacities accelerates transition due to efficiencies of scale and learning-by-doing.
3. Carbon Pricing:
   carbon prices are increased by around 30% on average year-on-year in the 2020s, by around 9% in the 2030s and by 4–6% in the 2040s.
4. Fiscal Policy:
   subsidies for established low-carbon technologies are supercharged whilst taxes are increased on carbon-intensive industries.

Defining the growth levers

The policy measures are designed to be ambitious, but technically feasible. They accelerate decarbonisation in our focus markets so that countries reach net zero by 2050. This is the deadline that has legislative commitment in the EU and the UK, consistent with what the UN suggests is necessary to keep global warming to no more than 1.5°C above pre-industrial levels, a key aim of the Paris Agreement.[4] These mechanisms are based on policies or measures that are already in place in the UK or Europe—or that are planned for implementation—but they are dialled up or brought forward for the purposes of the study.

To define each of the growth levers, we conducted a detailed literature review to establish the set of policy measures. Reaching net zero by 2050 will, of course, require a combination of strategies and policies, and all measures feature to some degree in all of the scenarios in the study. However, each of the scenarios are differentiated by intensifying a selection of policies that represent that lever. For instance, one of the policies considered is the phase out of ICEs. Under the regulation lever it is assumed that the phase out of ICE vehicles will commence in 2027, while for the other levers it is assumed that this will begin in 2035. See Appendix 1 for the full list of the policy assumptions assigned to each growth lever.

The baseline scenario

The results of the scenarios are reported in terms of the difference from the baseline scenario. This represents a business-as-usual trajectory in which current decarbonisation policies continue, and policies that have already been announced are implemented as planned, but no additional policy is introduced. The baseline has been calibrated to historical data and future growth rates implied by external projections. Under the baseline with policies as currently set, net zero is only achieved in 2070.

[4] United Nations, 'For a livable climate: Net-zero commitments must be backed by credible action', accessed 26 June 2024.

Reporting the model outputs

The impact of decarbonisation policies on economies and societies will be wide-ranging. For the purposes of this report, we have included several data points for each of the three economies under the four Growth Zero levers, including:

1. The year net zero is achieved
2. Total growth in GDP achieved between 2024 and when net zero is achieved (in currency terms)
3. Average annual GDP growth achieved between 2024 and when net zero is achieved (in percentage terms)
4. Average number of jobs supported per year
5. Impact on overall unemployment figures (percentage point difference from baseline)
6. Potential impact on productivity (using the very simple methodology of dividing output by number of workers)
7. Percentage and currency impact on output for 10 sectors (Agriculture, Electricity, Energy (fossil fuels only), Financial Services, Pharmaceuticals and Life Sciences, Postal and Logistics, Retail and Consumer, Telecommunication, Media and Technology, Transport, and Water). For a full breakdown of the sub-sectors that make up the 10 sectors see Appendix 2

The E3ME model

E3ME is a global model, distinguishing over 71 regions and 70 industry sectors, based on standard international classifications. The model is frequently used for the analysis of socio-economic impacts of climate and energy policy for international bodies including the European Commission and the World Bank.

The E3ME model is founded on post-Keynesian theory and ideas emphasised in complexity economics such as bounded rationality and non-equilibrium economic modelling. The full model manual and detailed description of the model are maintained by Cambridge Econometrics. The full set of equations that comprise the model mechanics can be found in this 2018 publication.

How net-zero investment drives growth in the model

In the macro-econometric framework of E3ME, policies like a carbon tax (with revenue recycling) can stimulate additional investment, which is financed by borrowing. Increasing debt levels contribute to aggregate demand, with unused economic resources increasing overall production levels. Higher rates of current output create an expectation of higher rates of output in the future, and long-term production level increases are used to pay down the initial borrowing, resulting in higher GDP and potentially increased employment.[5]

[5] United Nations, 'For a livable climate: Net-zero commitments must be backed by credible action', accessed 26 June 2024.

When we are looking at replacing current forms of power generation, some technologies require more upfront investment than others, and the amount of lending will depend on the financial attractiveness of the technologies, which impacts the total amount of investment.

Distributional impact

For the EU as a whole and the UK, all levers have an overall positive impact on gross disposable throughout the entire period. The Regulation lever has the highest impact.

For the impact on consumption (total household expenditure on goods and services) a similar pattern is at play, with overall positive impact compared to the baseline and Regulation leading to the highest growth of consumption.

The picture is different for Germany. For all levers, the impact on gross disposable income is negative with Regulation having the lowest negative impact. The years 2024–2040 do show a positive impact for all levers.

For the UK the same data is available by decile group. Here we assume neutral distribution of the carbon price revenues across the decile groups (i.e. there is no targeted redistribution e.g. to lower income households). This shows that for all levers the gross disposable income and consumption for each of the income decile groups is generally higher than the baseline. There are two exceptions to this increase in income and consumption. First, there is a decrease in income for the highest income group in some years for all levers. Second, for the Carbon pricing lever, the income of most (for disposable income) and all (for consumption) decile groups decreases in the final years (2041–2050).

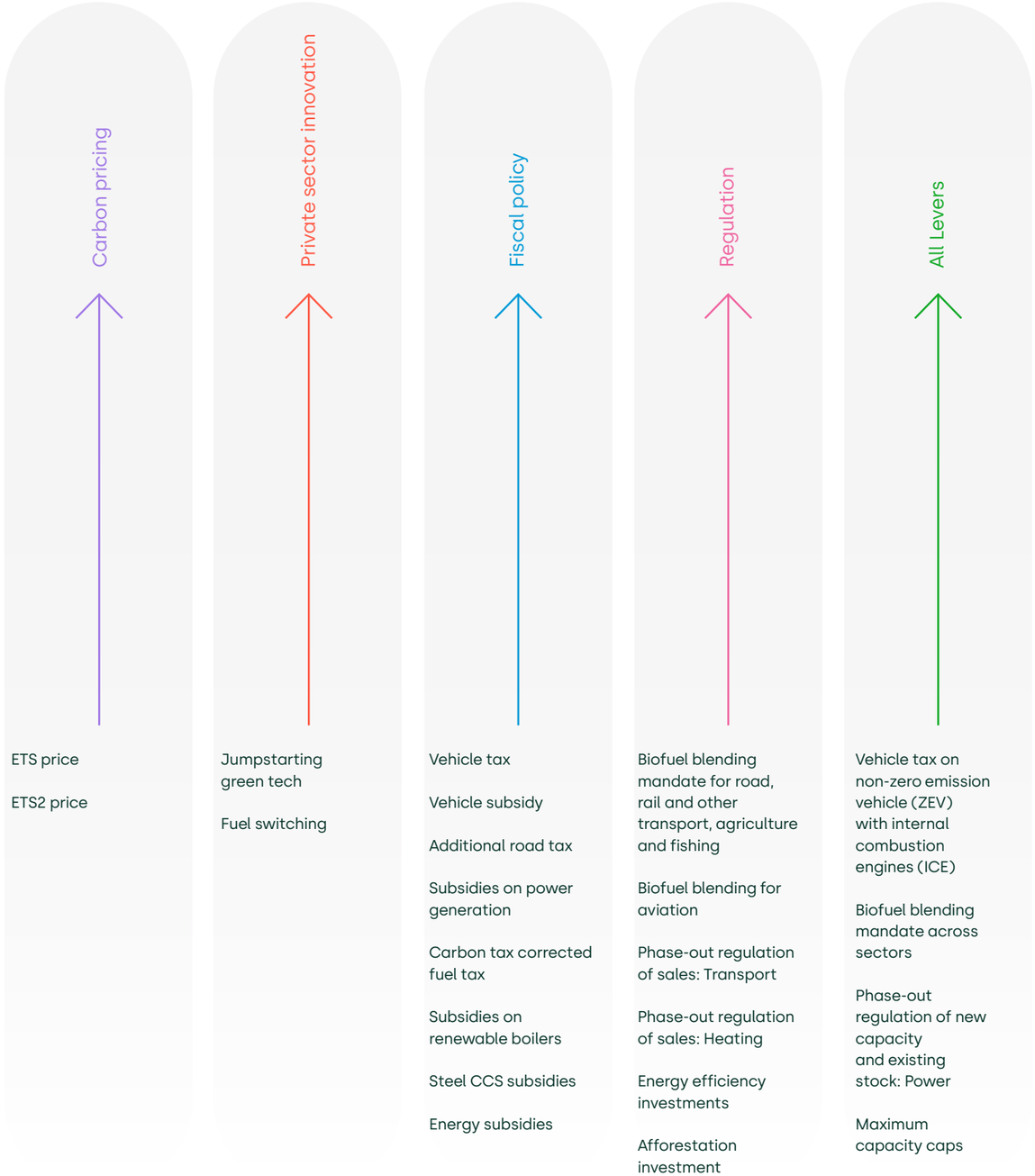
The Future Technology Transformations model: investing in innovation

The Future Technology Transformations model (FTT) is linked to E3ME to provide a micro-level representation of the entrepreneur. It shows that when policies encourage investors to back new technology, this additional investment does not crowd out investment elsewhere (in contrast to a baseline). With this FTT approach in the E3ME model, banks lend money to finance new technology, and this is then repaid as the tech companies earn more money from consumers over the lifetime of the capital. This assumes that the banks are willing to lend to fund the innovations, and it means that the macroeconomic benefits are reaped first, with the costs incurred later (unlike equilibrium approaches, where this is usually the reverse).

Credits

Oxera and Man Bites Dog developed the concept and designed the research for the Growth Zero study. The economic modelling was conducted by Cambridge Econometrics.

Appendix 1: Policy enhancement by lever



Appendix 2: breakdown of sub-sectors

Growth Zero Sector	Sub-sectors
Agriculture	Crops, animals, etc
Electricity	Electricity
Energy (fossil fuels)	Coal, Oil and Gas, Steam, Air Con
Financial services	Financial Services, aux to Financial Services, Insurance
Pharmaceuticals and life sciences	Pharmaceuticals, human health services,
Postal and logistics	Warehousing, postal and courier activities.
Retail and consumer	Retail, travel agency, personal goods, accommodation and food services, other personal services
Telecommunication, media and technology	Publishing, motion pictures, video, television, advertising, market research, telecommunications, computer programming, information services.
Transport	Motor vehicles, other transport equipment, land transport, water transport, air transport.
Water	Water treatment, supply, sewage and waste management.

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