OXFORD ECONOMICS

ASSESSING THE MACROECONOMIC IMPACT OF EU CLIMATE POLICY ON FINLAND’S ECONOMY

REPORT FOR AKAVA WORKS

MAY 2024

Akava Works

ABOUT OXFORD ECONOMICS

Oxford Economics was founded in 1981 as a commercial venture with Oxford University's business college to provide economic forecasting and modelling to UK companies and financial institutions expanding abroad. Since then, we have become one of the world's foremost independent global advisory firms, providing reports, forecasts and analytical tools on more than 200 countries, 100 industries, and 8,000 cities and regions. Our best-in-class global economic and industry models and analytical tools give us an unparalleled ability to forecast external market trends and assess their economic, social and business impact.

Headquartered in Oxford, England, with regional centres in New York, London, Frankfurt, and Singapore, Oxford Economics has offices across the globe in Belfast, Boston, Cape Town, Chicago, Dubai, Dublin, Hong Kong, Los Angeles, Mexico City, Milan, Paris, Philadelphia, Stockholm, Sydney, Tokyo, and Toronto. We employ 600 staff, including more than 350 professional economists, industry experts, and business editors—one of the largest teams of macroeconomists and thought leadership specialists. Our global team is highly skilled in a full range of research techniques and thought leadership capabilities from econometric modelling, scenario framing, and economic impact analysis to market surveys, case studies, expert panels, and web analytics.

Oxford Economics is a key adviser to corporate, financial and government decision-makers and thought leaders. Our worldwide client base now comprises over 2,000 international organisations, including leading multinational companies and financial institutions; key government bodies and trade associations; and top universities, consultancies, and think tanks.

May 2024

To discuss the report further please contact:

Felicity Hannon: fhannon@oxfordeconomics.com **Benjamin Trevis**: btrevis@oxfordeconomics.com

Oxford Economics

4 Millbank, London SW1P 3JA, UK

Tel: +44 203 910 8061

TABLE OF CONTENTS

EXECUTIVE SUMMARY

- The **Climate Leader scenario** demonstrates the long-term growth potential for Finland from establishing itself as a leader in climate policy. By achieving net zero emissions by 2035, Finland gains a comparative advantage in the transition and builds investor confidence.
- Increased investment and training also enable Finland to boost innovation and productivity, easing the pressure of capacity constraints and inflation associated with the transition.
- Real GDP grows by an average annual growth rate of 0.94% from 2024-2050, compared to 0.77% in the Baseline, while annual nominal earnings rise to €97,500 by 2050, 13% higher than our Baseline.
- In contrast, if Finland fails to progress quickly to meet its climate goal and invest in structural reforms then the economic gains from the clean energy transition will be limited. This is illustrated by the **Delayed Progress scenario**, where Finland encounters significant setbacks and frictions in its clean energy transition, namely capacity constraints and labour market rigidities.
- This limits Finland's decarbonisation gains, resulting in an average annual growth rate for real GDP of 0.80% between 2024-2050, only slightly above Baseline. By the end of the scenario, annual nominal earnings average €89,100, just 3% higher than Baseline.
- The economy could also experience a shock to businesses and investor confidence if it fails to meet its climate goals. Our **internal risk** analysis shows this could lead to an additional €2.2 billion loss to GDP during 2030-35, over and above the impacts seen in the Delayed Progress scenario.
- In addition, Finland faces a growing number of **external risks** including political instability altering climate policy trajectories, disruptions in global supply chains, and green protectionist measures, such as investment subsidies and state aid. These risk factors are difficult to forecast and could impede the realisation of both scenarios analysed in this report.

1. INTRODUCTION

1.1 CONTEXT AND OBJECTIVES

Establishing itself as a frontrunner in climate policy, Finland introduced one of the world's first carbon taxes in 1990. The country's distinctive cold climate, coupled with the lack of domestic fossil fuels, means it was a natural step to shift towards more sustainable practices to meet its relatively high energy demands.

Finland has now set itself an ambitious target of carbon neutrality by 2035 based on the recommendations of the Finnish Climate Change Panel. The Climate Change Act (2022) [1] states that emissions must fall 60% by 2030, 80% by 2040, and at least 90% (aiming at 95%) by 2050, compared to levels in 1990. These objectives rely not only on lowering emissions in hard-to-abate sectors such as transport and agriculture but also on the absorption of carbon by Finland's abundant forests, which cover almost three-quarters of its landmass.

> We previously estimated around 21 Mt emissions by 2035. But now, we think we will have something more like 17-18 Mt. This has been mostly thanks to good progress in the energy sector.
> – Markku Ollikainen

National targets in Finland are more ambitious than EU-mandated goals. The EU Green Deal[2] is the primary climate strategy for the wider region and sets out the trajectory for the EU to be climate-neutral by 2050. As a milestone to achieve this target, member states are required by law to reduce greenhouse gas emissions by 55% by 2030 compared to 1990, under the Fit for 55 package[3]. At present, both Finland and the EU are on the right trajectory to lower emissions.

> It's a tough nut to crack because the only fast way to improve our sinks would be to limit harvesting wood, but that's not easy in Finland as we have a very strong forest industry.
> – Riku Huttunen.

Russia's invasion of Ukraine has set the direction of travel: there is now a greater focus on energy security. Europe continues to reduce its dependence on Russian fossil fuel exports, boost its clean domestic energy supply and improve energy efficiency.

Nonetheless, questions remain on whether mitigation is occurring quickly enough to reach determined targets. In its most recent review, the Finnish Ministry of the Environment[4] stated that the goal of a 60% fall in emissions by 2030 is still possible, but warned

[1] https://www.treasuryfinland.fi/investor-relations/sustainability-and-finnish-government-bonds/carbon-neutral-finland-2035/#:~:text=The%20emission%20reduction%20targets%20in,to%20the%20levels%20in%201990
[2] https://ec.europa.eu/commission/presscorner/detail/en/ip_19_6691
[3] https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/
[4] https://ym.fi/en/annual-climate-report

neutrality will not be achieved by 2035 unless *additional* measures are implemented to strengthen Finland's carbon sink.

Within this context, our objective with this report is to consider the economic impact of EU and Finnish policies designed to reach these emission targets over the next few decades. The large degree of uncertainty surrounding climate targets and economic outputs means a scenario analysis provides the best means to conduct our impact analysis on the Finnish macroeconomy.

1.2 OUR APPROACH

Our scenario analysis of the impact of climate policy on Finland's economy first requires analysis of the transmission channels through which the EU Green Deal and Finnish climate policies operate. Drawing on interviews conducted by Oxford Economics with Finnish climate energy experts and economists, along with the latest academic literature, we present an informed perspective on the baseline economic outlook for Finland. We then use scenario analysis to understand the economic implications of the opportunities and risks associated with EU and Finnish climate commitments.

Finnish experts interviewed by Oxford Economics

Mr Markku Ollikainen / Chairperson, The Finnish Climate Change Panel.

Mr Riku Huttunen / Director General, Energy Department, Ministry of Economic Affairs and Employment.

Mr Janne Peljo / Chief Policy Adviser, Climate and Environment, EK Confederation of Finnish Industries

Ms Tuuli Kaskinen / CEO, Climate Leadership Coalition

Mr Markku Kulmala / Professor of aerosol and environmental physics at the University of Helsinki

2. LITERATURE REVIEW AND EXPERT INTERVIEWS

To examine the economic impacts of climate policy we adopt a scenario-based analysis given the substantial uncertainty inherent in this context. Our approach first requires that we form scenario narratives based on upside and downside risks identified through our interviews with Finnish experts and a literature review.

2.1 CLIMATE INPUT ASSUMPTIONS

The subsequent section is organised around the assumptions behind our baseline forecast. In each instance, we outline our baseline forecast and discuss key risks that help gauge plausible alternative scenarios. Our parameters of interest are (2.1.1) Carbon pricing and emissions trading, (2.1.2) Green investment, (2.1.3) Research and development, (2.1.4) Electrification, and (2.1.5) Government policy.

2.1.1 Carbon pricing and emissions trading

Carbon pricing and emissions trading systems serve as crucial policy tools in achieving decarbonisation goals. At the regional level, the EU Emissions Trading System (ETS) is the flagship policy aimed at supporting emission goals within the energy and manufacturing sectors. The EU is also laying the groundwork for a more ambitious policy in the carbon adjustment mechanism (CBAM). However, this is presently in the development phase. In Finland, this policy complements national carbon pricing, which has been in place for over three decades.

> From an industry perspective, I would even go as far as to say that EU ETS is all that is needed to support climate objectives.
> – Janne Peljo

Our baseline forecast offers a conservative perspective on the evolution of carbon pricing. We use historical data and the International Energy Agency's (IEA) States Policies Scenario (STEPS)[5] to establish a benchmark for effective prices. This baseline aims to explore how the energy system might evolve with what is already proposed, without a major additional steer from policymakers. Our estimates expect domestic carbon pricing in Finland to rise to €130 in 2030, while the effective price of the EU ETS is expected to reach €112 per tonne of CO_2 in the same year.

With the policy so instrumental to Europe's approach to decarbonisation, there are a range of possible estimates for the future path of carbon pricing in Finland. For example, a working paper from the IMF (2021)[6] recommends that Finland should increase its carbon price to $150 per tonne of CO_2 by 2030

[5] https://iea.blob.core.windows.net/assets/ff3a195d-762d-4284-8bb5-bd062d260cc5/GlobalEnergyandClimateModelDocumentation2023.pdf
[6] https://www.imf.org/-/media/Files/Publications/WP/2021/English/wpiea2021171-print-pdf.ashx

to help achieve its 2035 neutrality target. Additionally, a working paper from the German Ministry of Research[7] summarises perspectives on the evolution of the EU ETS using optimisation models and abatement cost curves. Of the six estimates highlighted, five predict prices between €130 and €160 per tonne of CO2 by 2030. Similar research from GMK Center[8] yields a consensus forecast of €147 per tonne of CO2 by 2030, based on long-term carbon price expectations of nine organisations.

> EU ETS has also allowed politicians to avoid very hard decisions because it has been market-based mechanisms that have been leading the way.
> - Tuuli Kaskinen

All experts in Finland that we interviewed praise carbon pricing and the EU ETS specifically as a very effective means to drive decarbonisation. Research from the IMF (2022)[9] highlights that ETS offers businesses clearer emission paths and reduces political challenges associated with tax hikes.

2.1.2 Green investment

In Europe, realising the ambitions outlined in the EU Green Deal demands significant investment. Our baseline forecast anticipates a restrained role for public investment in Finland, with fiscal consolidation taking precedence. Indeed, there is limited room for increased funding in the short to medium term in Finland, with the new government formed in 2023 committed to reducing public debt. Additionally, with income per capita a key eligibility criterion for access to EU funding, Finland only qualifies for limited support from the EU's Recovery and Resilience plan in favour of poorer nations, with €1.95 billion allocated so far.

For broad private investment, our baseline expects a rebound in the near term amid a broader cyclical upswing driven by monetary policy easing and a better demand outlook. However, in the longer term, we expect an ageing population, the absence of large immigration flows, and weak productivity growth to drag on the long-term economic outlook. This in turn will act as a drag on private investment due to lack of profitable opportunities.

Janne Peljo points us to his organisation's investment tracker that monitors prospective green investment plans in Finland. According to the EK Confederation for Finnish Industries[10], approximately €12 billion in green investment (5.5% of potential investment as of March 2024) has progressed past the planning stage in Finland. This amounts to around 5% of GDP and we have integrated this figure into our baseline forecast. Indeed, investment in Finland is expected to be increasingly focused on green objectives. Tuuli Kaskinen says now that big Nordic banks have their own sector-based emission targets, this acts as a strong tool to support investment into green solutions.

[7] https://ariadneprojekt.de/media/2023/01/Ariadne-Documentation_ETSWorkshopBruessel_December2022.pdf
[8] https://gmk.center/en/news/carbon-price-in-eu-ets-may-achieve-e147-t-in-2030-gmk-center/
[9] https://www.imf.org/en/Publications/staff-climate-notes/Issues/2022/07/14/Carbon-Taxes-or-Emissions-Trading-Systems-Instrument-Choice-and-Design-519101
[10] https://ek.fi/en/green-investments-in-finland/

However, the tracker also indicates that the actual volume of green investment could surpass €200 billion if all plans were realised—an amount nearly equivalent to Finland's GDP in 2022, highlighting the significant potential impact on the economy. Offshore and onshore wind projects make up over half of this potential, while a total of €16.9 billion is planned to support improved capacity infrastructure including the transmission grid, batteries, and energy storage.

> Finland as an investment opportunity is extremely attractive in terms of new electricity generation.
> – Janne Peljo

Large sums are also associated with large uncertainties though, and the difficult macroeconomic environment down to heightened geopolitical tensions and higher interest rates add uncertainties to the outlook for private investment in Finland.

On the upside, there is the potential for increased funding at the EU level to support green investment, something the EK confederation[11] is pushing for, as well as greater national tax incentives for investments. Indeed, the Finnish government has now announced a temporary tax credit[12], providing up to 20% compensation on investments for transitioning to a net zero economy. Enabled by the EU's crisis framework, this initiative offers growth opportunities for investment, especially in electricity production in Finland.

On the downside, the subsidy race among global powers such as the US, China and the EU poses a significant challenge to Finland's ability to attract the investment needed to fulfil its climate goals. If investment decisions are solely influenced by subsidy availability, smaller open economies like Finland will struggle to compete against the financial resources of larger nations. Indeed, Finland has long favoured a market-based approach and so state aid competition could seriously reduce investment potential during the transition.

2.1.3 Research and Development

Research and development (R&D) underpin every element of the EU Green Deal. Finland has historically maintained robust R&D inputs, despite recent volatility in spending, ranking fourth[13] among IEA countries for government budget allocations on energy R&D as a share of GDP in 2020. Our baseline assumes Finland's R&D expenditure will remain at 3% of GDP, maintaining its status as one of Europe's top investors in R&D.

[11] https://www.sttinfo.fi/tiedote/70099999/investointien-houkutteluun-tarvitaan-uusia-keinoja-suomessa-verohuojennus-kayttoon-ja-eussa-selvitettava-investointirahoitusvalinetta?publisherId=69819283&lang=fi

[12] https://valtioneuvosto.fi/documents/10616/199806183/Kasvupaketti%2016.4.2024.pdf/c867e33b-faea-d211-b22a-3b19b2394a89/Kasvupaketti%2016.4.2024.pdf?t=1713272175558

[13] https://iea.blob.core.windows.net/assets/07c88e41-c17b-4ea1-b35d-85dffd665de4/Finland2023-EnergyPolicyReview.pdf

Upside potential remains though, as the new administration has vowed to boost Finland's R&D expenditure to 4% of GDP by 2030, with 1.2% promised from central government and an expected increase in private sector investments to 2.8%.

> There is a wide political consensus that we need to put more money into R&D. We aim at reaching the level of 4% of GDP.
> – Riku Huttunen

The Finnish Government Act on Research and Development Funding (2023)[14] works to address the need for increased funding, with the central government now committed by law to increase expenditure to meet its share of the target. However, the lion's share (over two-thirds) of R&D spending within Finland's target lies with the private sector, and so uncertainty remains. Measures have been put into place to try to spur private R&D investment. Since 2021, several laws and amendments have increased permanent tax incentives for R&D activities in Finland, including an additional 50% deduction on costs during 2021-25[15]. Mechanisms such as this could support Finland in reaching the 4% target, making it one of the biggest spenders on R&D in the EU and bringing strong supply-side benefits to the Finnish economy.

On the flip side, the government's focus on reducing the debt burden means it must finely balance its deficit reduction commitment, and, into the longer term, could reduce its ambition if faced with new economic challenges.

2.1.4 Electrification

A significant portion of the planned investment in Finland will lead to the expansion of clean electricity generation, to serve those sectors that can transition to clean energy as a production input. Relative to other European countries electrification is well underway in Finland, with data from the IEA showing domestic electricity production was 89% fossil-free in 2022. The start of regular operations of the Olkiluoto 3 nuclear reactor in 2023[16] only adds to this and is incorporated into our baseline forecast.

> Finland will be producing much more electricity. The question is how fast and how far will this go, which will be determined by policy and markets.
> – Janne Peljo

While Finland is a leader in clean electricity generation, our baseline shows there is still some way to go to decarbonise the entire economy. We expect coal to be phased out as an energy source by 2029, in line with government legislation.

[14] https://valtioneuvosto.fi/en/-//10616/new-momentum-for-the-finnish-rdi-system-parliamentary-working-group-sets-objectives-for-the-allocation-of-r-d-funding
[15] https://taxsummaries.pwc.com/finland/corporate/tax-credits-and-incentives
[16] https://iea.blob.core.windows.net/assets/07c88e41-c17b-4ea1-b35d-85dffd665de4/Finland2023-EnergyPolicyReview.pdf

Looking at final energy demand in 2022, electricity made up the largest share, at 44%, but remaining shares for oil (40%) coal (8%) and gas (6%) show more progress must be made to meet targets. Finland has already made good progress on household electrification via heat pumps and, consequently, further electrification hinges on reducing fossil-fuel demand in the transport sector. Oil demand is expected to fall in our baseline, albeit at a gradual pace, due to the advancements needed in commercial transport. Coal demand is expected to fall thanks to continued progress in decarbonising the industrial sector in Finland. By 2050, we anticipate that the share of electricity in Finland's total energy mix will surpass 70%, one of the largest shares across our European forecasts.

> The Finnish grid is the best electricity grid in the world. It can take around eight years to create a new grid connection, compared to fifteen years in many other countries.
> – Riku Huttunen

The trajectory of electrification in Finland is exposed to a large degree of uncertainty, however, which motivates our scenario analysis in this report. The potential upside for Finland is huge. Finland's nationalised grid operator, Fingrid[17], estimates that electricity consumption could rise to 120 – 125 TWh by 2035, representing a rise of approximately 40 - 45% compared to 2019. This forecast factors in industry energy roadmaps (+8 TWh), the ongoing transition to electric passenger vehicles (+4 TWh), and a predominant surge in demand from increased green hydrogen production (+40 TWh). Riku Huttunen agrees that reaching around 125 TWh of electricity production by the end of this decade could be a credible scenario. Indeed, he also highlights that Finland has the best electricity grid in the world so new connections take significantly less time to come online than in many other countries.

Even so, capacity constraints on the grid still exist in Finland, and although new connections are relatively fast, they still can take around eight years and so could hold back Finland's rapid decarbonisation plans. Moreover, on a sectoral basis, transportation remains a key challenge in the context of electrification, with the IEA[18] highlighting that the sector remains almost entirely reliant on oil, at 81% of transport's total final consumption in 2021. CEO of the Climate Leadership Coalition, Tuuli Kaskinen, states that for members in her organisation in the field of transportation, emission reductions are a much more difficult question. This is because the market is more local, and costs are quite high in Finland, so it's not that easy to push the carbon-neutral solutions.

[17] https://www.fingrid.fi/globalassets/dokumentit/en/news/fingrid_electricity_system_draft_scenarios.pdf
[18] https://www.iea.org/reports/finland-2023

2.1.5 Government policy

Our baseline incorporates the current Finnish administration's fiscal consolidation focus. However, our research and expert interviews reveal that despite the government's emphasis on market-based approaches, it still plays a vital role in the transition by setting roadmaps and targets.

Sector-based climate roadmaps give power to the industries and bring in smaller companies to align with climate goals.
– Tuuli Kaskinen

Tuuli Kaskinen states that sector-based roadmaps give power and responsibility to industries themselves by providing long-term targets that support planning and confidence in the private sector. These roadmaps mean smaller companies are also included in the conversation.

Conversely, the importance of these roadmaps also means that minor changes to policy or regulation can severely disrupt business planning. If targets change, this could also have a knock-on impact on potential investment and economic confidence. The experts we spoke to, including the chairperson of the Finnish Climate Change Panel, Markku Ollikainen, said that Finland is in a serious problem with its carbon sink and it is a very tough challenge to resolve. This presents a key downside risk for Finland. Failure to achieve targets would likely impact business and investor confidence, with roadmaps needing to be redrawn and Finland's position as a world leader in climate mitigation could be questioned.

I think that we are in a really serious problem with our carbon sink. Harvesting our forests has increased hugely, and the government has been reluctant to accommodate this by reducing soil emissions.
– Markku Ollikainen

We now evaluate the economic benefits and costs of climate policies, making this relevant within the context of Finland. This section is organised according to economic output variables, namely, (2.2.1) Economic growth (2.2.2) Labour market, (2.2.3) Inflation, (2.2.4) Trade and protectionism, and (2.2.5) Innovation.

2.2 ECONOMIC OUTCOMES

2.2.1 Economic growth

Climate policies to achieve mandated targets have implications for aggregate economic activity, though the direction and degree of impacts are dependent on how neighbouring regions or nations also act.

Erbach and Hoflmayr (2022)[19] provide a scenario analysis of the impacts of the European Green Deal when also considering the stringency of climate policy in non-EU countries. Overall, they find limited impacts on aggregate output but a shift in composition from consumption towards investment. If the EU achieves Fit for 55 by 2030 but climate action is fragmented in non-EU countries, they estimate GDP will fall 0.4% below baseline by 2030, as private consumption falls and net exports decrease.

[19] https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)733623

However, if strong international coordination occurs on climate goals with countries outside the EU, and carbon revenues help increase investment and reduce indirect tax, then EU GDP rises 0.5% above baseline. Key to the more positive scenario is the role of investment in adding impetus to the demand side of the economy. The paper also states that increased investment in low-carbon technologies could boost productivity and economic growth in the long term.

In a study aiming to understand the impact of carbon pricing on the European economy from 1999 to 2019, Kanzig and Konradt (2023)[20] find a higher carbon price from EU ETS leads to higher inflation and a decline in real GDP and industrial production. However, splitting out a grouping of European countries that they define as 'revenue recycling', which includes Finland, they find negative effects are much weaker and insignificant. This research argues recycling revenue to lower the tax burden helps cushion the adverse economic impact of climate policies.

Research also points to the important role of the supply side of the economy. Nixon and Hannon (2022)[21] argue that the success of the transition ultimately depends on the productivity impacts from investment and innovation, since aggregate supply must adjust to the investment push to avoid the negative impact of higher inflation.

2.2.2 Labour Market

The decarbonisation goal of the EU carries significant implications for labour markets in developed economies. While the green transition presents promising employment prospects, it also poses a threat to jobs in sectors reliant on fossil fuels as well as causing skilled labour shortages in rapidly expanding industries.

> Our Engineers Association estimated that Finland would need an additional 3000 new engineers per year to be able to match all the requirements that green transition requires.
> – Markku Ollikainen

In the IEA's Net Zero 2050 Roadmap[22], the transition is shown to bring substantial new opportunities for employment, that override the losses in fossil-related industries by more than two to one. In Finland's case, the potential to greatly expand wind power capacity will provide jobs and tax revenue. The Finnish Wind Association (2023)[23] forecasts that if 75% of proposed investments in offshore wind materialise, then this would provide around 150,000 additional employment opportunities in their middle scenario. The huge increase in wind capability is also anticipated to produce around €3.2 billion in tax benefits.

Nonetheless, deep challenges remain in addressing new labour demands in Finland to become a carbon-neutral powerhouse. Markku Ollikaninen emphasises the need to expand education capacity to meet demands for engineers as the shortage of skilled labour is already a concern. Additionally,

[20] https://www.nber.org/papers/w31260
[21] https://spe.org.uk/site/assets/files/10666/3_can_mitigation_boost_growth.pdf
[22] https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf
[23] https://tuulivoimayhdistys.fi/ajankohtaista/tutkimukset-ja-julkaisut/meRikuulivoiman-aluetaloudelliset-vaikutukset

Janne Peljo highlights that skilled labour availability is a top concern among industrial members polled by EK.

A paper from Eurofound[24] (2023) evaluates the impact of the EU Fit for 55 climate package on employment. At the EU level, the impact of FIT55 on net employment is found to be marginally positive at 0.1% compared to the reference scenario. On a sectoral basis, the construction sector sees the strongest positive impact, while the sectors producing low-carbon goods and technology such as wind turbines also benefit from major employment growth.

Employment benefits will be seen for new industries, the key question is will this rise in green sectors supersede the displacement of labour in fossil-fuel-dependent sectors.

> The availability of the highest skilled labour worries CLC members a bit. For example, finding workers who have a really deep understanding of the hydrogen economy.
> – Tuuli Kaskinen

2.2.3 Inflation

Decarbonisation policies, particularly those involving effective carbon pricing significantly impact the economy's inflation dynamics. The crucial question is whether increased energy prices, given the importance of energy as an input across various sectors, lead to sustained inflation or if the effect is temporary.

Effective carbon pricing from mechanisms such as the EU ETS have been shown to lead to a persistent increase in price pressure. A study from Kanzig (2023)[25] shows that a more stringent EU ETS leads to a persistent increase in consumer prices and a fall in economic activity. Poorer households are impacted most, due to the higher share of energy within their consumption basket, leading to lower consumption. In addition, modelling from Paroussos et al. (2018)[26] highlights that the large green investment drive resulting from climate regulation can also trigger higher inflation pressure while worsening public finances. Over time, however, behavioural and structural changes towards cleaner energy and improved energy efficiencies should support lower inflation.

[24] https://www.eurofound.europa.eu/en/publications/2023/fit-55-climate-package-impact-eu-employment-2030
[25] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3786030
[26] https://www.researchgate.net/publication/328192468_A_technical_analysis_on_decarbonisation_scenarios-constraints_economic_implications_and_policies_Technical_Study_on_the_Macroeconomics_of_Energy_and_Climate_Policies

2.2.4 Trade and Protectionism

The decarbonisation goal of the EU also has implications for trade. Developments in the wider region will impact Finland and how its economy performs during the transition. On the one hand, Finland's early adoption of green practices makes it a favourable destination for new technology and investment. On the other, its traditional market-based approach means it finds it hard to compete against other countries using subsidies to play catch up.

> Finland's commitment to a proactive climate policy has helped reassure potential buyers of our technology that our solutions are clean.
> - Markku Ollikainen

Looking from a global perspective, research suggests improved coordination on climate will support more positive macroeconomic impacts. Vrontisi et al. (2020)[27] find that asymmetry between emission targets in the EU and the rest of the world, leads to lower EU exports and a GDP loss of 0.15% by 2030 compared to baseline levels. However, due to the publication date of this research, it does not factor in the newly introduced EU carbon border tariffs which attempt to level the playing field between the EU and the rest of the world. In a more optimistic scenario with global coordination, early adoption of low-carbon solutions is shown to provide a comparative advantage to European economies. This is particularly relevant to Finland, which is already well-positioned to harness export opportunities arising from the EU's decarbonisation goal. Markku Ollikaninen argues that Finland's early and public push towards clean energy has helped reassure potential buyers of Finland's clean technology because the whole country is committed to a proactive climate policy.

On the downside, increased state intervention and protectionism pose a challenge to Finland's market-based approach. Janne Peljo highlights that EU countries such as Germany and France are now compensating for their previous failures by implementing investment subsidies in green steel and hydrogen batteries, and this makes the competitive environment very challenging for Finland. Indeed, in response to the Inflation Reduction Act (2022) in the US, the EU announced the Temporary Crisis and Transition Framework (2023)[28], which relaxed EU rules on state aid.

> It seems that state meddling with markets is here to stay. It makes the competitive environment extremely difficult now for Finland as a market-based country.
> – Janne Peljo

[27] https://link.springer.com/article/10.1007/s10584-019-02440-7

[28] https://competition-policy.ec.europa.eu/state-aid/temporary-crisis-and-transition-framework_en

2.2.5 Innovation

Innovation is also a key outcome of the green transition. Climate policies force new ways of thinking and solutions that help advance processes that can support economic growth. A paper from the IMF[29] (2023) maintains that the green transition will at least match the technological impact of the ICT revolution. This research states that green innovation can progressively raise productivity by increasing energy efficiency and reducing the cost of clean inputs. Evidence of knowledge spillovers and access to new markets are also cited as a positive benefit. In quantifying benefits, innovation is found to have a positive impact on economic activity, with improved trade and investment flows supporting growth and helping to mitigate the potential costs associated with climate policy compliance.

> Large Finnish companies aim to collaborate with top research institutions to ensure access to global networks and be at the forefront of innovation.
> – Tuuli Kaskinen

R&D expenditure drives total factor productivity (TFP). In the context of the Finnish government's ambitious R&D targets, increasing spending in this capacity serves as a crucial pathway for leveraging the green transition to support the economy in the long term. Venturini (2015)[30] studies the role of technology spillovers in productivity growth in OECD countries. This paper finds that R&D expenditure influences TFP over the long run thanks to knowledge spillovers generated by research, modelling that a 1% increase in R&D investment supports a 0.11% rise in TFP. This research distinguishes between business and public R&D, pointing to the former having significant spillover effects in their econometric modelling. Pieri et al. (2018) show that R&D spending has raised the rate of technical change in OECD countries and estimate an even stronger impact on TFP than Venturini (2015) of around 0.15% from a 1% increase in R&D. Extensive research exists on R&D's impact, with OECD (2015)[31] underscoring varying effects across countries and industries on social and private returns. While R&D positively supports long-term growth, its exact magnitude remains uncertain. In our Oxford Economics modelling, we use a conservative coefficient of 0.026% to estimate the increase in TFP from R&D investments, serving as a lower bound compared to the discussed literature.

According to the 2023 Global Innovation Index[32], Finland ranked 6th among the 132 economies featured based on innovation capabilities. The index consists of roughly 80 indicators and points to Finland's main innovation strengths including finance for startups and scaleups and its environmental performance.

[29] https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2023/11/03/Green-Innovation-and-Diffusion-Policies-to-Accelerate-the-Process-and-Expected-Impact-on-540134?cid=bl-com-SDNEA2023008

[30] https://www.sciencedirect.com/science/article/abs/pii/S0048733314001863

[31] OECD (2015). The Impact of R&D Investment on Economic Performance: A Review of the Econometric Evidence. OECD Directorate for Science, Technology and Innovation

[32] https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2023/fi.pdf

3. THE BASELINE AND ALTERNATIVES

3.1 SCENARIO NARRATIVES

Based on our academic research and expert interviews we have formed two scenario narratives that can be compared to our baseline forecast.

Finland is a Climate Leader and achieves its 2035 target.

Finland adopts a stable and leading mitigation framework. The clarity provided by these policies encourages private investment into clean energy capacity which is supported by government investment to support more risky climate investments. R&D funding is accelerated at pace with supportive policies to encourage significant innovation and technological advances across many mitigation technologies. This leads to Finland achieving its emission targets stated in the Climate Change Act (2022) and climate neutrality by 2035.

- Private investment increases as many major new projects, particularly for expanding wind and solar power go ahead[33]. The majority of investment originates from the private sector, with supplementary government investment playing a role in crowding in further investment.
- Carbon prices rise modestly to support climate goals.
- More offshore and onshore wind rapidly increases clean energy production. Finland leans on its efficient and advanced electricity grid to support this new production.
- Electrification continues apace, progressing in areas such as passenger transport and the steel industry. As more electric technology is adopted, energy efficiency improves.
- R&D funding reaches the Finnish government's 4% target and supports innovation. A flexible workforce supports the economy during the transition.

Finland experiences Delayed Progress and misses its neutrality target.

While Finland strives to adopt a leading mitigation framework, setbacks and frictions impede its clean energy transition. Hindered by a lack of technological breakthroughs, capacity constraints, and labour market rigidities, progress on electrification is slow as Finland struggles to unlock its true potential. As a result, the country falls short of its emission targets outlined in the Climate Change Act (2022) and fails to achieve climate neutrality by 2035.

[33] We note that there are ambitious plans for green hydrogen in Finland. Although our GEM does not model green hydrogen explicitly, we can point to this source of clean energy as supporting overall decarbonisation efforts and spurring private green investment in Finland in the Climate Leader scenario.

- Finland implements new policy measures to pursue its ambitious climate goals but misses its targets and 2035 neutrality goal.
- Failure to meet targets disrupts Finnish business planning and the expected influx of private investment, as roadmaps are not met, and targets need to be changed.
- Private investment is also held back by the subsidy race between EU states, the US, and China, which reduces Finland's ability to attract new investment due to its market-based approach.
- Electrification is restrained by a lack of progress in sectors such as transport and heavy industry, as well as capacity constraints on the advanced Finnish electricity grid.
- Carbon prices rise modestly to try to support targets.
- R&D spending does not meet the government's target as investment from businesses falls short of what is needed to reach net zero.
- The Finnish labour market proves rigid, partly due to a failure to upskill the workforce as well as the immobility of the workforce between regions in Finland.
- *Additional sensitivity analysis*: the failure to meet carbon neutrality leads to a hit to business and investor confidence.

3.2 SCENARIO ASSUMPTIONS

Climate channel	Baseline	Climate Leader	Delayed Progress
Green Investment	Green investment is around €12 billion akin to that marked as past the planning stage on EK's tracker in March 2024 (5.5%).	Additional Investment rises above the IEA's Net Zero[34] global estimate of 2.0% of GDP by 2030 to achieve goals. The private sector is assumed to constitute the majority (90%), with the government playing a smaller role (10%). This is akin to 50% of planned green investment on EK's tracker (€90 billion in real terms).	Additional investment is around a third of that in the Climate Leader scenario. Held back by competition from green subsidies in other economies as well as capacity constraints in Finland. This is akin to 15% of planned green investment on EK's tracker (€28 billion in real terms).
Innovation and R&D Expenditure	Our baseline view expects innovation and investment to be limited. Productivity growth has been poor recently and the government is focused on pursuing a policy of fiscal consolidation.	The Finnish government's goal of R&D spending totalling 4% of GDP is achieved by 2030. This investment in new techniques and ideas boosts productivity in the wider economy.	R&D spending is the same as the baseline, as the government prioritises fiscal consolidation and private R&D lags behind targets.
Electrification[35]	Our baseline view assumes electricity output increases over the forecast horizon from 72 TWh in 2022 to 83 TWh by 2035 and 97 TWh by 2050. The rate of electrification is fast in the transport sector, supported by greater EV adoption. For households, previous success of heat pump installation means there is limited scope for additional electrification here.	Total electricity output reaches 120 TWh by 2035 almost in line with Fingrid's Local Power scenario. By sector, strong progress is made in transport and industry thanks to technological breakthroughs and investment.	Total electrification is calibrated to a third below the Climate Leader scenario due to capacity constraints and lower investment. By sector, challenges in heavy industry hold back potential and there is a lack of technological breakthroughs in the transport sector. Total electricity output reaches 91 TWh by 2035.
Energy Intensity	Energy intensity, defined as energy consumption per unit of GDP, continues to fall in line with historical trends.	Thanks to a significant boost in investment and advancements in technology, energy intensity falls to around 75% of what	Energy intensity falls but at a third of the pace seen in the Climate Leader scenario, due to lower green investment and

[34] https://www.iea.org/reports/net-zero-by-2050

[35] Our model does not explicitly capture green hydrogen or biofuels, due to their limited current usage and large uncertainties surrounding their adoption. However, we can implicitly capture that these emerging technologies support the total electrification drive in our scenarios, albeit to a small degree.

		is needed in the IEA's Net Zero scenario. This helps Finland to meet its climate objectives.	issues in hard-to-abate sectors.
Carbon Pricing	EU ETS effective carbon prices rise in line with the IEA's Stated Policies scenario, reaching €112 in 2030. Finland's domestic carbon price growth is anchored to this pathway.	Carbon prices rise modestly in the scenario to support climate objectives. EU ETS rises to €146 in 2030, a consensus figure for what is needed to reach EU goals. Finland's effective carbon price reaches $150 by the end of 2030 in line with a recommendation from a paper from the IMF.	Carbon pricing is the same as the Climate Leader scenario.
Carbon Capture	Carbon capture is minimal in our baseline although not explicitly modelled.	Carbon sink improves to reach the estimated 21 Mt of CO2 needed by 2035, for Finland to reach its neutrality target.	Carbon sink improves but this is a third of the rate in Climate Leader, meaning Finland fails to reach neutrality.
Participation Rate	The participation rate in the labour force rises slightly from 83.7% in 2023 to 84.3% in 2030, as the pressures of an ageing society will mean greater incentives are introduced to prevent early retirement. Participation then remains constant across the forecast.	Labour markets adapt well to the transition thanks to new educational programmes and state support for fossil-heavy sectors. Labour participation therefore stays in line with the Baseline view.	Rigidity in the labour market and a failure to upskill for new green sectors lead to a fall in labour force participation rate from 2030-40. Participation falls by almost half a percentage point by 2040 as older generations opt for early retirement. This recovers towards the Baseline in the final decade of the forecast as educational programmes address issues.
Clean Energy Exports	Finland does not export large amounts of new clean energy.	Finland becomes a net exporter of clean energy. By 2035, 14 TWh is exported, in line with Fingrid's Local Power scenario. Based on electricity price forecasts, this brings an additional €12 billion boost to the economy.	Finland does not export large amounts of new clean energy.

4. RESULTS

In this section, we present the key results of our scenario analysis on the impact of EU and Finnish domestic climate policy on Finland's economy. Using our Global Economic Model (GEM), we explore the economic implications of both scenarios outlined in Section 3, compared against our Baseline outlook.

4.1 BOTH SCENARIOS: CARBON DIOXIDE EMISSIONS

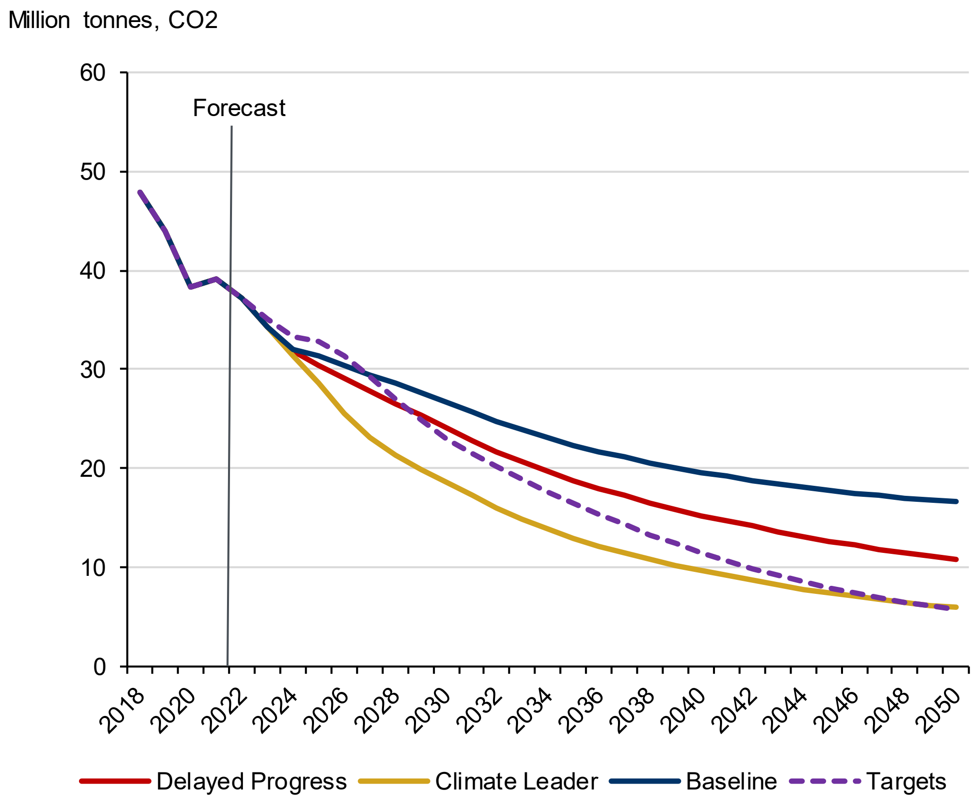
Figure 1 shows the CO2 emission pathways[36] in all three scenarios examined in this report. Importantly, emissions in our GEM are modelled using a bottom-up approach, meaning they are driven by the degree of electrification, the share of renewables in the energy mix and emission intensity. In all three scenarios flow[37] emissions fall, though the rate of change and whether Finland achieves its targets differ based on our scenario assumptions.

In the Climate Leader scenario, Finland meets its emission targets as stated by the Climate Change Act (2022). Relative to 1990 emissions, this means a -60% fall in 2030, at least -80% in 2040, and at least -90% in 2050. The European Commission[38] recommends raising the 2040 target to at least -90% of 1990 emissions, we therefore describe the 2040 and 2050 targets as minimum thresholds. Moreover, aligned with our assumption that Finland is successful in improving its carbon sink to carbon offset around 21 Mt of CO2 by 2035, Finland achieves its carbon neutrality goal in this scenario.

By comparison, the Delayed Progress scenario sees Finland cut CO2 emissions by -58% relative to 1990 by 2030, which falls short of the targets in the Climate Change Act. Emissions fall across this scenario but remain above climate targets.

[36] We take EU targets and apply them to CO2 gross emissions in Finland as a proxy for all GHG emissions.
[37] Measuring flow emissions, while crucial for understanding current trends and immediate impacts on the climate system, may not always provide the most comprehensive perspective on addressing climate change. Flow emissions data often fluctuate due to short-term factors such as economic conditions, technological advancements, or policy changes, which can obscure long-term emission trends. Though not in our report, a broader consideration of cumulative emissions is necessary for developing effective and sustainable strategies to mitigate climate change.
[38] https://commission.europa.eu/news/recommendation-2040-target-reach-climate-neutrality-2050-2024-02-06_en

Fig. 1. Finland's Gross CO2 Emissions



Source: Oxford Economics/Haver Analytics

4.2 CLIMATE LEADER: ECONOMIC OUTCOMES

4.2.1 Labour market

In our Climate Leader scenario, the **labour market** is assumed to be well-equipped to adjust to the transition. Finland has previously implemented educational programs to meet new demands, like those for nuclear and heat pump technology.

This scenario sees the reskilling of domestic labour as well as new high-skilled employment support decarbonisation efforts. 16,500 more people find employment compared to Baseline in 2030, as the unemployment rate falls by 0.6 percentage points. Unemployment then recovers towards a new natural rate of 5.7% compared to 5.9% in the Baseline.

> We can adapt to new needs from the transition. Previously, we tailor-made educational programs to improve the knowledge base of the nuclear energy sector and to meet heat pump demands.
> – Riku Huttunen

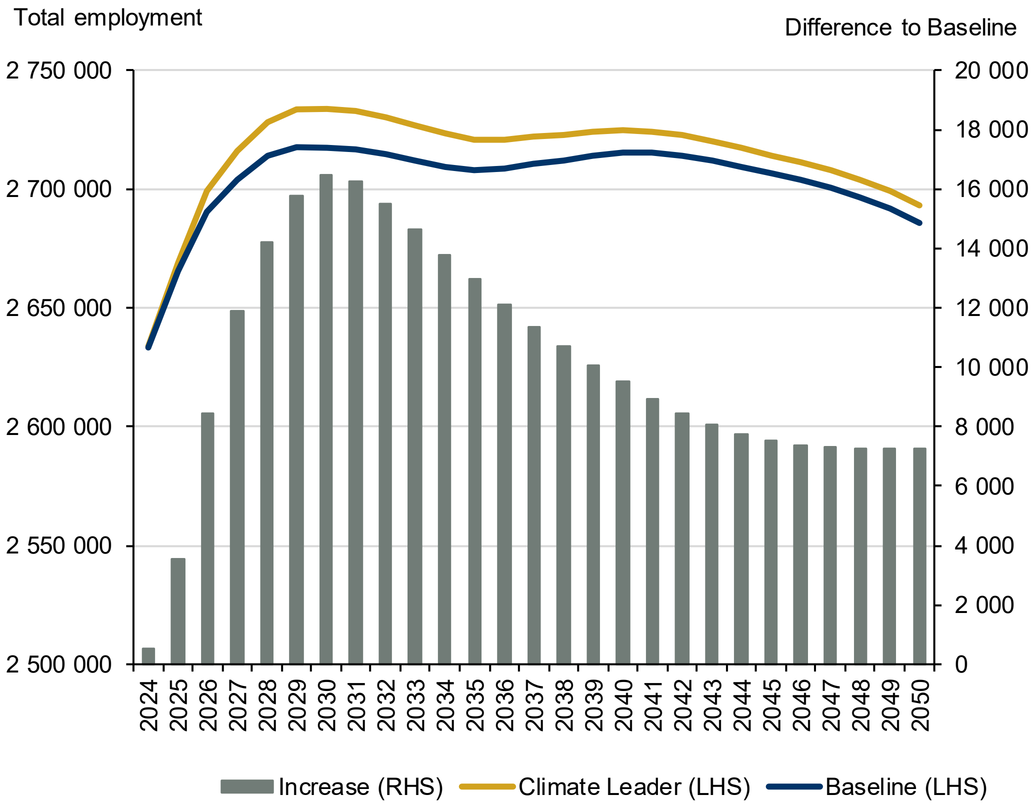
A lower natural rate, or Non-Accelerating Inflation Rate of Unemployment (NAIRU)[39], comes as educational programmes support labour market flexibility,

[39] The NAIRU is defined as the unemployment rate at which inflation remains stable, meaning it's the lowest level of unemployment an economy can sustain without triggering inflation.

enabling smoother transitions between jobs and reducing structural unemployment. Moreover, higher economic growth in the scenario means businesses can expand, and so the demand for labour is higher. Employment differences from Baseline are 7,200 higher in 2050, less than in 2030, as the scenario sees a substitution from labour to capital as productivity rises.

Our findings regarding total employment align with those presented in the Eurofound (2023) paper, as outlined in Section 2 of this report. Specifically, in our Climate Leader scenario, we observe a marginally positive impact on net employment resulting from climate policies. Conversely, our results are smaller than the employment benefits reported by the Finnish Wind Association. This is mostly because we are more conservative about the added electrification and investment potential.

Fig. 2. Finland Employment (LHS: total, RHS: difference in Climate Leader relative to Baseline)



Source: Oxford Economics/Haver Analytics

4.2.2 Real earnings and inflation

Annual **nominal earnings**[40] begin to rise gradually in the Climate Leader scenario, as higher employment improves wage bargaining power and leads to higher wages. Earnings rise to an average of €51,700 by 2030, €1,000 higher than Baseline. The following decade sees a stronger rise in annual earnings, rising to €60,400 by 2035, as potential additions to employment slow, and productivity picks up. This tighter labour market somewhat strengthens the bargaining power of workers, though the

[40] We define nominal earnings as wages and salaries divided by employment, with the latest data from Eurostat showing an average nominal wage in Finland of €41,600 in 2023.

strongest impact on earnings is attributed to strong innovation and productivity gains in the Climate Leader scenario. Indeed, nominal earnings rise to €97,500 by 2050, 13% higher than our Baseline, and this greater compensation is supported by growth in the supply side of the economy owing to increasing spending on R&D and green investment. Across the forecast horizon, nominal earnings grow by a Compound Annual Growth Rate (CAGR)[41] of 3.21% in the Climate Leader scenario, compared to 2.73% in the Baseline.

Stronger nominal earnings more than offset the impact of higher energy costs in the scenario. Between 2030 and 2050, **real earnings** in Finland grow by an average rate of 1.04% each year, compared to 0.72% in our Baseline.

Inflationary pressure is small in the Climate Leader scenario. Consumer Price Inflation (CPI)[42], rises by a maximum of 0.2 percentage points between 2024-28, as the rise in carbon prices only has a small impact on electricity prices due to Finland's already high share of clean energy in the electricity mix, and this creates slightly higher costs for businesses and consumers. Beyond this period, inflation is slightly elevated (average of 0.15 percentage points 2030-50) above Baseline due to sustained levels of higher investment, though the supply side of the economy mitigates any serious inflationary impact from this channel. Resultingly, inflation rises to 2.2% in 2030, compared to 2.0% in our Baseline forecast. Although this is above Finland's target of 2%, the 0.2 ppt rise is assumed to not be enough to warrant policy tightening from the European Central Bank (ECB). This decision is influenced by the relatively small magnitude of the increase and the ECB's need to consider economic activity across its 18 other member countries.

4.2.3 Economic activity

With nominal earnings exceeding the modest impact on inflation from carbon pricing, total consumption in real terms in Finland rises above Baseline. Initial impacts are modest, as supply-side benefits are yet to feed through. **Consumption** grows 1.3% above Baseline by 2030, before rising 2.2% by 2035, as decarbonisation efforts progress and consumers become less exposed to higher carbon prices. In terms of CAGR, consumption grows by an annual average of 0.8% between 2030 and 2050, compared to 0.6% in the Baseline.

Green investment is key to the higher GDP pathway in our Climate Leader scenario compared to Baseline. In the first six years of the scenario, investment into green infrastructure and technology rises by €22 bn, mostly owing to the private sector. By 2030, GDP is 2.9% higher than Baseline, with total fixed investment 9.5% higher.

Beyond 2030, GDP gains are stronger as higher investment from decarbonisation elevates the capital stock and therefore the supply side of the economy, pushing equilibrium investment higher and encouraging greater **innovation**. Indeed, the supply side of the economy is not only supported by rising green investment but also because private companies and the government reach the 4% R&D target by 2030, which leads to the development of new technology and processes that increase

[41] The CAGR measures the average annual growth rate over a specific period, considering the effects of compounding. It indicates the long-term impacts of each scenario on relevant macroeconomic variables.

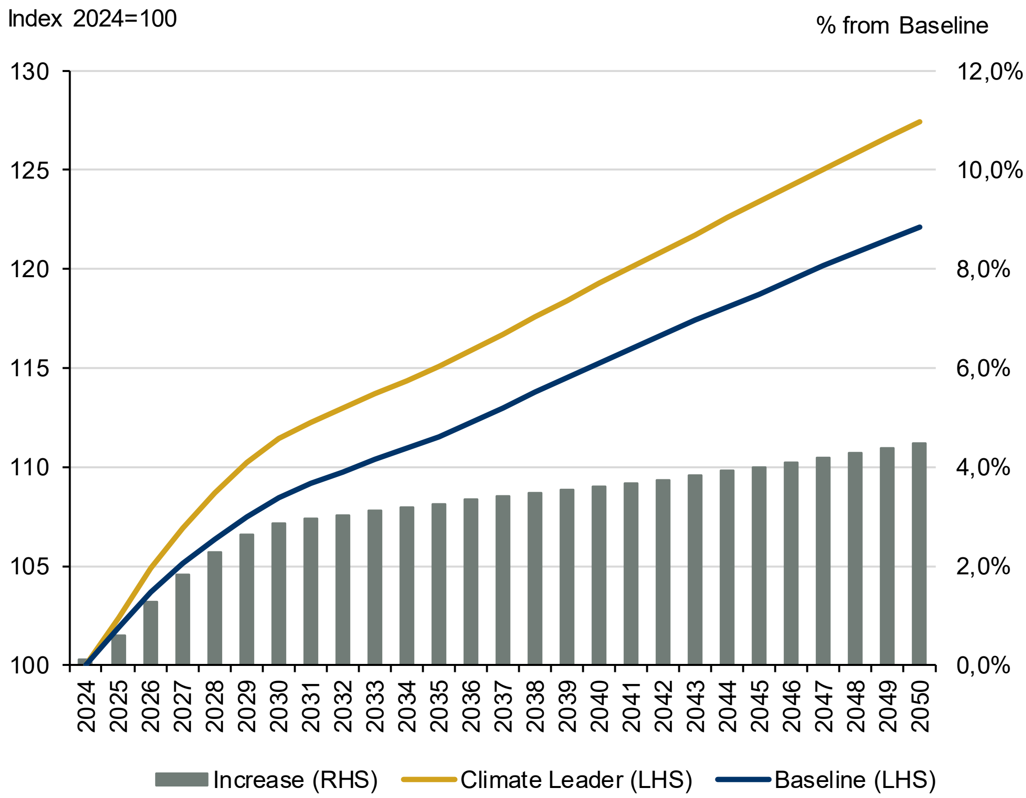
[42] CPI measures the average change over time in the prices paid by consumers for a basket of goods and services.

productivity during decarbonisation. Though efforts are likely to be concentrated in the hardest-to-abate sectors, such as transport and heavy industry, knowledge spillovers foster cross-sector benefits and support the wider aggregate economy. Across the Climate Leader scenario, total fixed investment grows at a CAGR of 1.1%, compared to 0.8% in the Baseline.

This means aggregate demand rises higher than Baseline, with less upward pressure on prices, as productivity gains are realised. Across the forecast horizon, the cumulative rise in real GDP in Finland amounts to €226 billion in the Climate Leader scenario compared to Baseline, which means GDP is 4.5% higher by 2050. This means real GDP grows by a CAGR of 0.94% from 2024-2050 compared to 0.77% in the Baseline, with impacts shown in Figure 3.

These strong benefits from innovation in the transition align with the literature discussed in this report from Nixon and Hannon (2022), who argue the supply side of the economy must adapt to the transition to allow for the benefits of decarbonisation to materialise.

Fig. 3. Finland GDP (LHS: Level indexed to 2024 = 100, RHS: Percentage difference to Baseline)



Source: Oxford Economics/Haver Analytics

Higher electricity **exports** in the scenario also support the rise in aggregate demand. This would likely support Finland's ambition to become a net exporter of clean energy. We use an estimate derived from Fingrid's Local Power Scenario[43] to project that Finland will transition into a net exporter of clean energy due to its electrification drive. By 2035, it is estimated that approximately 14 TWh of clean

[43] https://www.fingrid.fi/globalassets/dokumentit/en/news/fingrid_electricity_system_draft_scenarios.pdf

energy could be marketed to the rest of Europe. Combined with our electricity price forecasts, this results in a €12 billion boost to fuel exports across the forecast horizon, rising 23% higher than Baseline in 2035. This leads to higher total exports, which is also symptomatic of positive spillovers from the rest of the world which are also assumed to be transitioning and so demanding renewable energy. This positive shock to exports follows Vrontisi (2020) findings that early adoption of low-carbon solutions is shown to provide a comparative advantage to European economies.

Regarding the trade balance, increased exports are offset by higher **imports** from 2031 onwards in the Climate Leader scenario. Stronger import demand is associated with greater economic growth as the Finnish economy benefits from greater spending power thanks to the green transition.

The scenario assumes that Finland will maintain its market-based approach with limited direct government investment. Nonetheless, **government investment** between 2024-50 is 3.6% higher (or €11 billion) in Climate Leader relative to Baseline, and households benefit from government transfers as half of carbon revenues are recycled back into the economy. Recycling revenues back into the economy supports the positive GDP impacts in this scenario. This agrees with recent literature from Kanzig and Konradt (2023) who argue if revenues are recycled, this produces greater upside impacts on the economy.

Revenues from higher carbon taxes, increased innovation, and stronger GDP growth compared to Baseline all enable the government to support the transition without compromising debt sustainability, a priority objective for the current Finnish administration[44]. Gross government debt as a percentage of GDP falls to 50.2% by 2040 in the Climate Leader scenario.

4.3 DELAYED PROGRESS: ECONOMIC OUTCOMES

4.3.1 Labour markets

> When we poll our industries, the availability of skilled labour is already a top three concern, even considering the current difficult economic situation. – Janne Peljo

In our Delayed Progress scenario, the **labour market** struggles to adapt to decarbonisation in Finland. Indeed, industries in Finland cite the availability of labour as a top three concern in Finland.

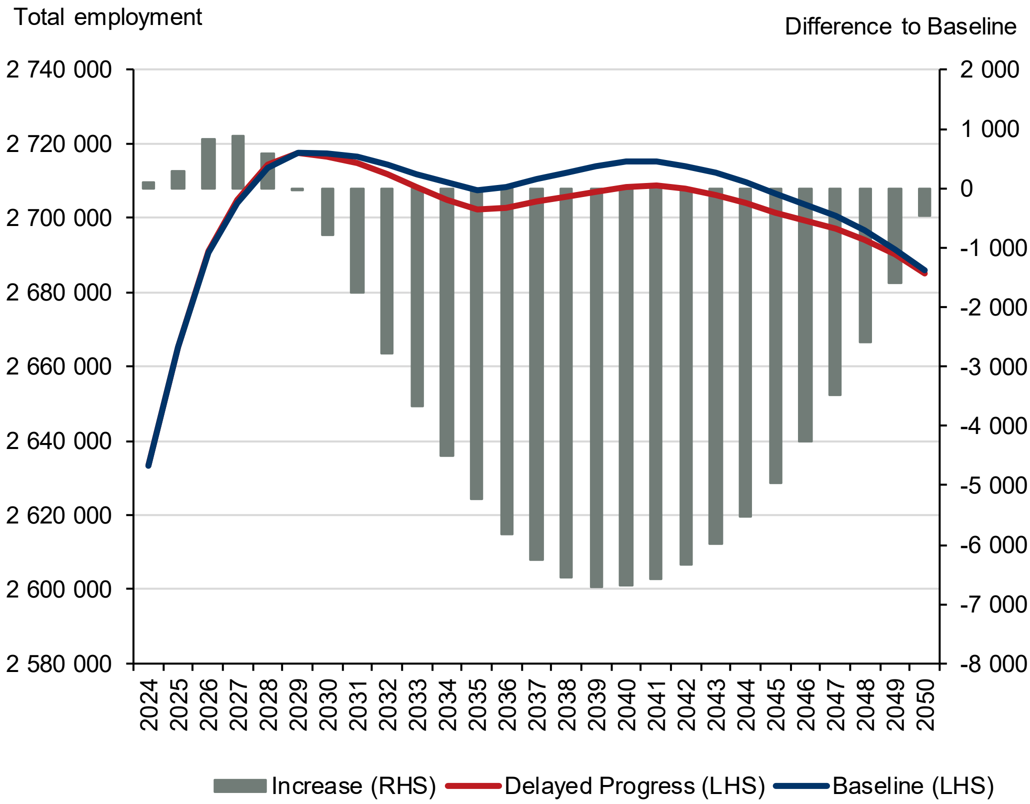
There is a shortage of highly skilled labour and the scenario forecasts a lower labour force participation rate compared to the Baseline. Without new educational programs, participation stands at 84.1% in 2030, slightly lower than 84.3% in the Baseline. From 2030 to 2040, participation declines slightly as education programmes do not meet the demands of the green transition and older generations opt for early retirement. Resultingly, 14,600 fewer people are part of the labour force by 2040. In the final decade of the forecast, skills catch up and employment begins to edge closer to Baseline, as shown in Figure 4.

In terms of total employment, the scenario sees a minor uptick in employment in the first five years of the forecast, at a maximum of 900 extra people employed in 2027. The investment drive boosts

[44] https://valtioneuvosto.fi/en/governments/government-programme#/

economic activity and businesses increase hiring intentions enough to offset the slower increase in the participation rate compared to Baseline. However, as longer-term demands for new high-skilled labour are not met by increased supply, employment begins to fall below Baseline. At its trough, employment is 6,700 lower in 2040, as high-polluting sectors are shut down and some employees retire early rather than choosing to reskill.

Fig. 4. Finland Employment (LHS: total, RHS: difference in Delayed Progress relative to Baseline)



Source: Oxford Economics/Haver Analytics

By 2045, unemployment in the Delayed Progress scenario is almost the same as the Climate Leader scenario at 5.7%. However, the change in labour supply in Delayed Progress means there is lower employment for the same unemployment rate in this scenario.

4.3.2 Earnings and inflation

This scenario creates winners and losers. After the fall in annual **nominal earnings** relative to Baseline from 2024-2030, they begin to rise after 2031. With the demand for skilled labour exceeding supply, those in work have higher bargaining power for wages and by 2040, nominal wages reach €67,400, €1,300 above Baseline. However, this growth then decelerates towards Baseline levels, as labour force participation increases thanks to green educational programmes. By 2050, nominal earnings average €89,100, which is 3% higher than in the Baseline. Over the forecast horizon, average earnings grow by a CAGR of 2.86%, only 0.13 percentage points above that in the Baseline.

At the aggregate level, **real earnings** fall short of our Climate Leader scenario. From 2024-2050, real earnings growth by a CAGR of 0.75%, only slightly above 0.72% in the Baseline. R&D funding remains at 3% across the forecast, missing the government's 4% target, which means the innovation gains seen in the Climate Leader scenario are not realised here. Investment also holds back the emergence of technological breakthroughs necessary for productivity gains, and so higher real wages, because it is both constrained and not spent in ways to support material gains on the supply side of the economy.

The inflation profile in Delayed Progress is slightly below that of Climate Leader. This is because while carbon taxes have a similar impact on energy prices, as fossil fuels make up a small part of the energy mix, investment is meaningfully lower in Delayed Progress, meaning core inflation runs at a lower level through the scenario. **Inflation** rises to 2.1% in 2030, gradually falling towards Baseline across the forecast period. This 0.1 ppt rise compared to the Baseline is assumed to not warrant policy tightening from the ECB, as in the Climate Leader scenario.

Due to strong progress on decarbonisation already, the impact on inflation in Finland from carbon pricing is less severe than in other European countries. Therefore, we see more muted results compared to the literature discussed in Section 2 of this report. Nonetheless, our results show a modest hit to consumption as carbon prices rise in the early part of our scenarios, as in Kanzig (2023).

4.3.3 Economic activity

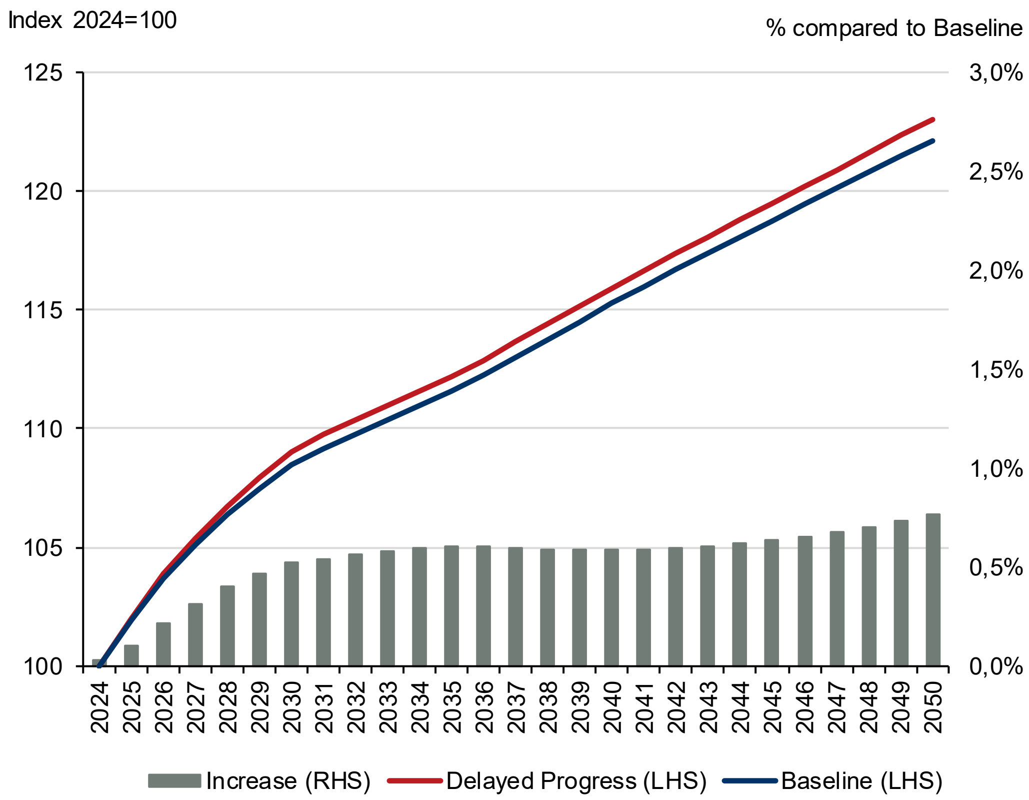
In the Delayed Progress scenario, **consumption** initially falls below Baseline, down 0.4% in 2027, due to higher energy prices outweighing earnings growth. Indeed, carbon taxes add some inflationary pressure which reduces purchasing power and therefore real consumption. As a share of GDP, consumption falls in the first six years of the forecast but investment picks up, meaning there is a rebalancing of the economy. Across the forecast horizon, consumption grows by a CAGR of 0.64% in the scenario, compared to 0.60% in the Baseline.

The green **investment** drive more than offsets the impact of lower consumption on aggregate demand. The scenario sees total fixed investment gradually rise to peak 2.3% above Baseline in 2030, as some new energy infrastructure projects on wind and solar go ahead. However, investment is a third of that in the Climate Leader scenario, partly held back because Finland's market-based approach cannot compete with convincing green subsidies in neighbouring Europe and the US. Moreover, the scenario sees **R&D spending** remain at 2021 levels of 3% of GDP, meaning the supply side does not benefit from new innovation and higher productivity, holding back longer-run growth.

Finland does not become a net **exporter** of clean energy in Delayed Progress, because lower investment holds back full electrification potential, which limits the GDP uplift. The trade balance is not that different from the Baseline in this scenario, meaning it moves into positive territory beyond 2032. This is due to the weaker gains for economic growth, meaning imports only rise marginally compared to the rise seen in the Climate Leader scenario.

Figure 5 shows the uplift in GDP in our Delayed Progress scenario relative to the Baseline forecast. We see positive impacts on aggregate demand from 2024-2050, with GDP rising 0.5% above Baseline by 2030 and 0.8% by 2050. Across the forecast horizon, the cumulative rise in real GDP in Finland is €38 billion in the Delayed Progress scenario compared to Baseline, with the economy benefiting from a CAGR 0.03 percentage points higher (0.8% compared to 0.77%).

Fig. 5. Finland GDP (LHS: Level indexed to 2024 = 100, RHS: Percentage difference to Baseline)



Source: Oxford Economics/Haver Analytics

Public **debt** as a share of GDP declines, as the government prioritises reducing the debt burden with increased revenue from carbon taxes. Although debt falls as a share of GDP in all three scenarios, debt is higher in Delayed Progress compared to Climate Leader, as the slower growth in the economy is unsupportive of the debt burden.

4.3.4 Internal risks

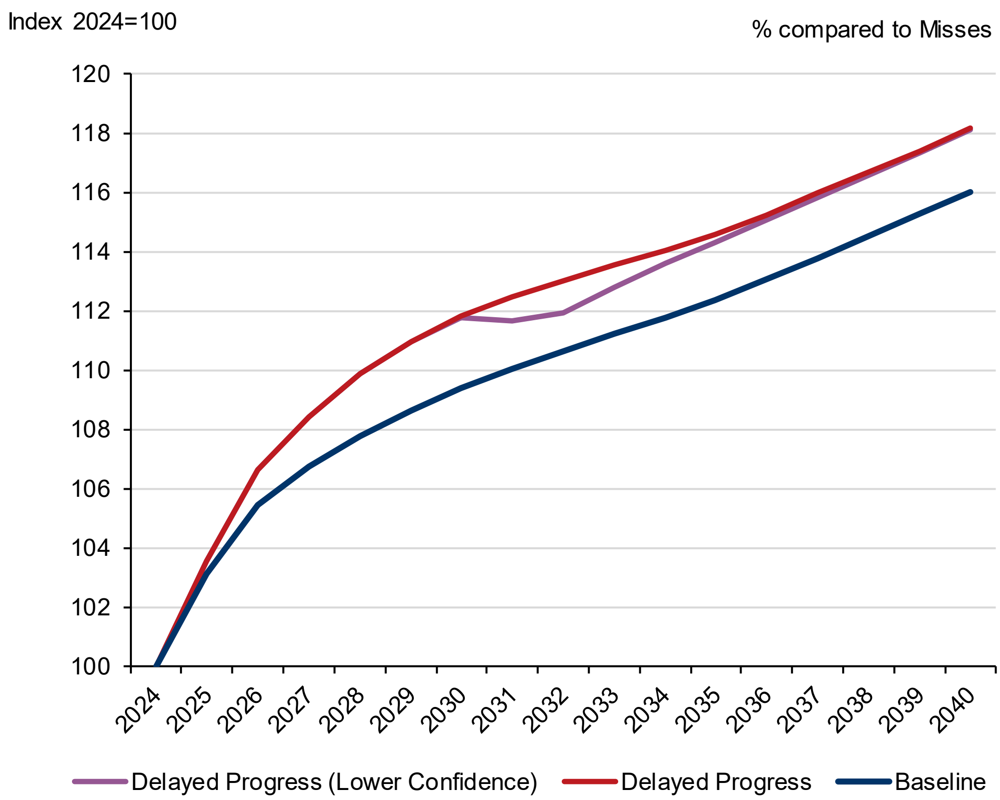
Lower confidence in the economy is already reflected in the Delayed Progress scenario through a lower investment profile and weaker electrification efforts. However, our interview with Tuuli Kaskinen highlighted that the predictability of climate legislation is very important to business planning. This can be attributed to both domestic and European-level policy making.

> The big question from our companies is can we trust that the current legislation in place continues to support the work and investments made. – Tuuli Kaskinen

Consequently, if Finland were to fall short of its 2035 carbon neutrality target, business roadmaps would need to be redrawn, and, in turn, this could cause a drop in investor and business confidence. We can model this fall in confidence by shocking the residual of private sector investment and equity prices in our GEM. This allows us to understand the impact of something outside of standard economic theory that would drive the behaviour of these variables.

The timing and magnitude of this shock is important. In Figure 6, confidence is hit in Q4 2030, assuming this is the point where it becomes clear that industry roadmaps will not be met. The magnitude of this shock is around a fifth of that seen during the Great Financial Crisis, factoring in that disruption could be significant but not near the scale of the 2007/8 crisis. In this scenario, we see total fixed investment stagnate at circa €56 bn from 2030 to 2033, being 1% lower than in Delayed Progress without a confidence shock. Resultingly, a €2.2 billion loss to GDP is experienced from 2030-35. The economy then recovers beyond this point as Finland continues on its trajectory.

Fig. 6. Finland real investment in Delayed Progress with a Confidence Shock



Source: Oxford Economics/Haver Analytics

The economic consequences of not meeting targets could be worse than this if the failure to hit climate targets leads to an aggregative policy response from the Finnish government. A heavier-handed policy action could cause stranded assets in high-polluting sectors and hurt the domestic economy in favour of meeting climate goals.

4.3.5 External risks

A disruption outside of standard economic theory could also come from **external** sources. Finland is not alone in decarbonisation efforts, and developments outside of its borders have implications for the impacts of climate policy. One discussed in this report has been **state intervention** from other nations, meaning the increased use of subsidies to promote green investment, which hurts Finland's market-based approach. We model this in our Delayed Progress scenario as a reason for lower green investment.

> Our trajectory depends on the next European Commission; it depends on the US presidential election; it depends on what happens in China.
> – Tuuli Kaskinen

Political instability, altering climate policy trajectories in Europe, the US, and China, serves as another potential source of disruption. A changing policy stance from the US could hinder decarbonisation efforts, limiting Finland's ability to leverage its competitive advantage as a transition leader. Additionally, political forecasts from the ECFR[45] expect the influence of more extreme parties to increase in the 2024 European Parliament elections and this may bring calls to review EU climate policy paths. For Finland, this could disrupt business planning akin to failing to achieve its carbon neutrality target. Indeed, changing climate legislation serves as both an internal and external risk to Finland. The same instability could be experienced in domestic politics within Finland, with parties experiencing pressure to ease back on commitments.

Supply-chain considerations also pose a potential risk to Finland's decarbonisation efforts. Notably, a slowdown in the extraction of critical minerals required for the transition could trigger significant disruptions. Given that a considerable portion of these minerals is concentrated in China, any geopolitical tensions could impede supply. This could lead to technological setbacks and, if mineral extraction declines, result in higher prices for materials essential to the transition, thereby holding back Finland's ambitious plans to expand clean energy capacity.

The EU Critical Raw Materials Act (2023)[46] acknowledges the need to mitigate the risks related to such dependencies on the imports of critical materials. This pursuit of regional self-sufficiency has strong implications for Finland, which, as highlighted by the latest Sector Report[47], is a significant producer of minerals within the EU. Indeed, improving the independence of the EU would both help to avoid the potential risks from dependency on China and also provide upside potential for the Finnish economy, with Finland being able to lean on its comparative advantage within the mining sector.

Another external risk involves countries failing to mitigate climate change leading to increased **physical risks**. This report primarily examines the transitional impacts of decarbonisation on the Finnish economy. However, failure to address climate change globally may result in higher global warming levels, temperature volatility, and more frequent extreme heat events. These climate-related damages would adversely affect the global economy and Finland would not be exempt from such climate-related damages.

[45] https://ecfr.eu/publication/a-sharp-right-turn-a-forecast-for-the-2024-european-parliament-elections/

[46] https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1661

[47] https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/165277/TEM_2023_4_T.pdf?sequence=1&isAllowed=y

5. CONCLUSION

Finland has the opportunity to establish itself as a leader in climate policy and innovation by achieving net zero emissions by 2035. The macroeconomics of climate change is extremely complex and scenario analysis is a useful tool for understanding future potential outcomes. Our analysis shows that to fully benefit from the clean energy transition Finland must deploy effective mitigation policies that also help to expand the supply side of the economy.

The Climate Leader scenario demonstrates the long-term growth potential for Finland, should it achieve its ambitious 2035 neutrality goal while simultaneously supporting the supply side of the economy. By retaining its position as a credible frontrunner in climate policy, Finland gains a comparative advantage relative to its European counterparts and builds investor confidence, helping to crowd in additional private investment and stimulate demand. Increased public and private investment in research, clean energy and upskilling the labour force also enables Finland to boost innovation and labour productivity which helps to ease capacity constraints and the inflationary pressures associated with carbon taxes.

In the Climate Leader scenario, a strong rise in green investment drives real GDP to grow by an average annual growth rate of 0.94% from 2024-2050, compared to 0.77% in the Baseline. As a result, real GDP is 4.5% (or €13 billion) higher in 2050. Educational programmes enable lower structural unemployment, leading the natural rate of employment to fall to 5.7% compared to 5.9% in the Baseline, while annual nominal earnings rise to €97,500 by 2050, 13% higher than our Baseline, supported by growth in the supply side of the economy.

In contrast, if Finland fails to progress quickly to meet its target, it will lose its ability to attract private investment. This is illustrated by the Delayed Progress scenario, where Finland encounters significant setbacks and frictions in its clean energy transition. In the Delayed Progress scenario, capacity constraints and labour market rigidities limit Finland's decarbonisation gains, resulting in a mere 0.8% (or €2 billion) increase in GDP by 2050, despite increased investment. This results in an average annual growth rate only slightly above Baseline in this scenario, at 0.80% for 2024-2050.

Furthermore, high skilled labour requirements are not met in the first half of the scenario, so employment is slightly lower than Baseline. By the end of the scenario, annual nominal earnings average €89,100, which is 3% higher than in the Baseline, but significantly lower than in Climate Leader due to inadequate supply-side improvements. Indeed, even with higher investment, this scenario demonstrates that if Finland fails to address the need for upskilling the workforce, investing in R&D, and expanding electricity storage capacity, the gains of the transition remain limited, and don't spill over across the economy to provide material benefits to households.

It is possible that Finland could also experience a shock to businesses and investor confidence in a scenario in which it fails to meet its climate goals. Our sensitivity analysis shows this could lead to a €2.2 billion loss to GDP during 2030-35 compared to the Delayed Progress scenario. Finland also faces a growing number of external risks including political instability altering climate policy trajectories in Europe and globally, and disruptions in global supply chains due to critical mineral shortages or green protectionist measures, such as investment subsidies and state aid. These risk factors are difficult to manage and could impede the realisation of both scenarios analysed in this report.

6. APPENDIX

OXFORD ECONOMICS: OUR GLOBAL ECONOMIC MODEL

6.1.1 What is the Global Economic Model?

Our Global Economic Model provides a rigorous and consistent structure for forecasting and testing scenarios. A globally integrated economic model, it can be used to address questions on a wide range of economic topics such as the impact of oil price changes, or the effects of slower Chinese growth. The model forms the foundation of all of our country, industry, and city forecasts.

Our Global Economic Model is the world's leading globally integrated macro model, relied upon by over 200 leading organisations around the world. The model replicates the world economy by interlinking 85 countries, six regional blocs, and the Eurozone. Our economists set underlying global assumptions and ensure that the data, forecasts, and formulas in the model are fully up-to-date. With a 35-year track record, the model provides a rigorous and consistent structure for forecasting and performing scenario analysis.

6.1.2 Modelling approach

In applied economics, we often use eclectic models, combining elements of various approaches and model types.

The OE model is:

- Partly estimated and partly calibrated: we want to explain the data, but also to satisfy stylised facts, in particular how the model reacts to shocks.
- It is structural: its equations represent our theory of how the economy works.
- It is an equilibrium model: Market clearing / accounting identities and behavioural equations consistent with optimal behaviour.
- These features make the model useful both for forecasting but also for policy analysis. The extended country coverage and strong international linkages make it particularly useful for scenario analysis.

6.1.3 Drivers Behind the Model

The Oxford model is an eclectic model designed to capture the key relationships in the global economy. It is Keynesian in the short run and Monetarist in the long run.

In the short run, shocks to demand will generate economic cycles that can be influenced by fiscal and monetary policy. But over the long run, output is determined by supply-side factors: investment, demographics, labour participation, human capital and productivity. Behavioural equations are estimated in error-correction form (ECM) to model long-term equilibrium relationships which are based on economic theory.

OXFORD ECONOMICS

Global headquarters
Oxford Economics Ltd
Abbey House
121 St Aldates
Oxford, OX1 1HB
UK
Tel: +44 (0)1865 268900

London
4 Millbank
London, SW1P 3JA
UK
Tel: +44 (0)203 910 8000

Frankfurt
Marienstr. 15
60329 Frankfurt am Main
Germany
Tel: +49 69 96 758 658

New York
5 Hanover Square, 8th Floor
New York, NY 10004
USA
Tel: +1 (646) 786 1879

Singapore
6 Battery Road
#38-05
Singapore 049909
Tel: +65 6850 0110

Europe, Middle East and Africa

Oxford
London
Belfast
Dublin
Frankfurt
Paris
Milan
Stockholm
Cape Town
Dubai

Americas

New York
Philadelphia
Boston
Chicago
Los Angeles
Toronto
Mexico City

Asia Pacific

Singapore
Hong Kong
Tokyo
Sydney

Email:
mailbox@oxfordeconomics.com

Website:
www.oxfordeconomics.com

Further contact details:
www.oxfordeconomics.com/about-us/worldwide-offices