



Route map to net zero by 2045

Securing a Green Recovery
on a Path to Net Zero

Skills for a Green Recovery

What does **Net Zero** mean?



Part 1 - **Why** now?

- > Who cares



Part 2- **What** now?

- > Opportunities in each of the 8 key sectors identified



Part 3 - **How** now?

- > What, Why, Who, When, Where, How, How much



Part 4 - **Resources**

- > Policy, references, publications

Agenda – Part 1 & 2

What does **Net Zero** mean?



Part 1 – **Why** now?

- > Your customers care
- > Your employees care
- > Your competitors care
- > You care
- > The World cares
- > Europe cares
- > The UK cares
- > Scotland cares



Break

Part 2- **What** now?

Opportunities: governmental ambitions and actions

- > Electricity
- > Buildings
- > Transport
- > Industry
- > Waste and Circular Economy
- > Land use and Forestry
- > Agriculture
- > Negative emissions technologies (NET)



What does Net Zero means?



- **36%** of UK businesses currently have a strategy to achieve net zero carbon or plan to make one
- These businesses expect to reach net zero carbon by **2029**
- **47%** of these companies do not have a plan in place to achieve net zero by their target date

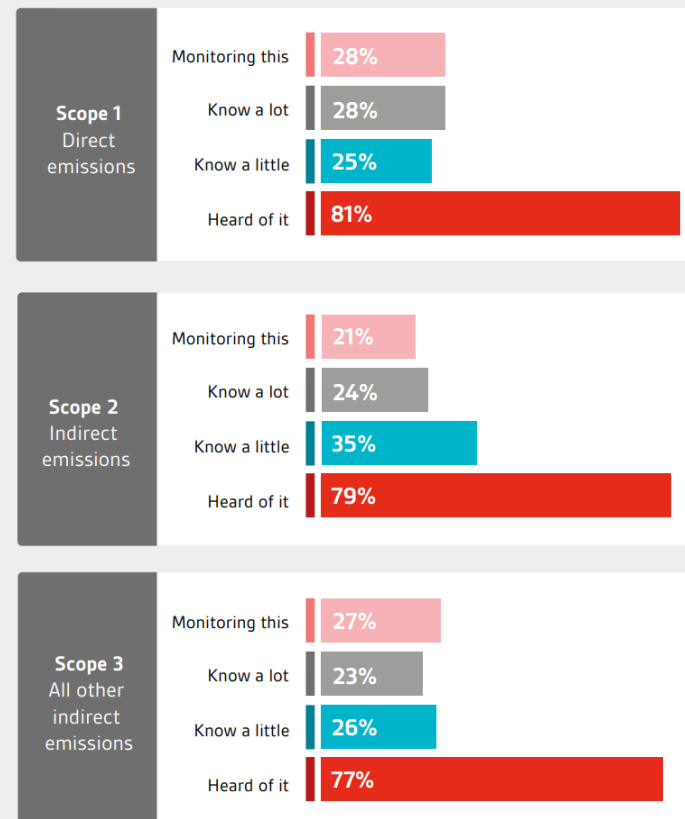
The top five most common activities used for a carbon reduction strategy are:

- Reducing and reusing resources (56%)
- Reducing energy/carbon in offices (52%)
- **Staff education (44%)**
- Procuring green energy (39%)
- Reducing the amount of travel (39%)

“Net zero means any emissions would be balanced by schemes to offset an equivalent amount of greenhouse gases from the atmosphere.”

Department for Business, Energy and Industrial Strategy

Familiarity with greenhouse gas emission scopes



Scope 1 - direct emissions of greenhouse gases (GHGs)

Scope 2 - indirect emissions from generation of purchased energy

Scope 3 - GHG emissions generated within supply chain in producing products and in the use of products by consumers and others



Part 1

Why now?

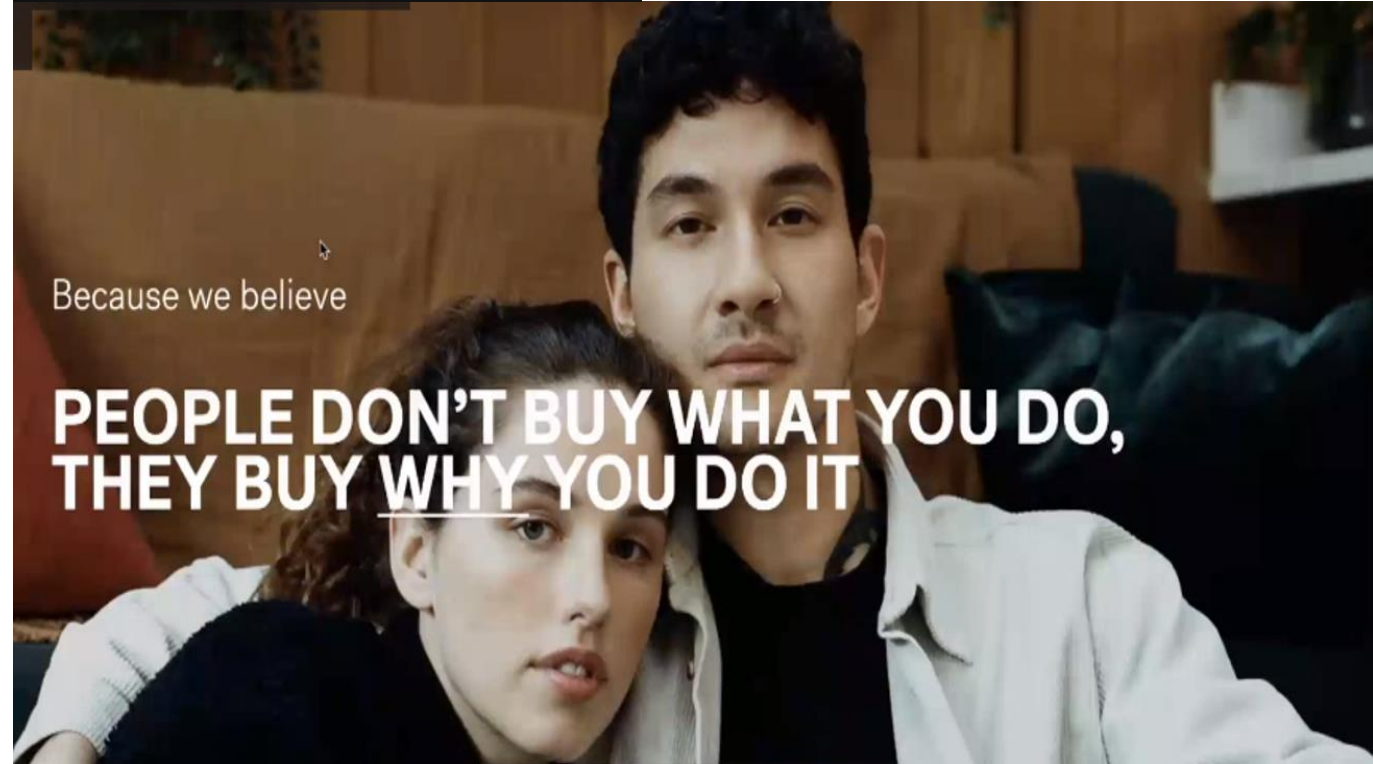


Your **customers** care

- > Your customers care
- > Your employees care
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THE CAUSES THAT COUNT: 2021

Climate change is no.2 in the top 50 but no.1 in the UK above unemployment and job security



Do you think the way that you buy in the future will change?

55%

Local: I'm keen on supporting local businesses

45%

Sustainable: I'm keen on buying more consciously

45%

Investment: I'm keen on buying less but better

38%

Reduction: I'm keen on buying less

4%

Enjoyment: I'm keen on splurging because, YOLO

53%

YES!

Consumers said that they actively avoid consuming from companies that have a negative environmental or social impact

that jumped to 66% among the early adopters

73%

BRANDS SHOULD DO MORE

Consumers said brands have a responsibility to do more than simply generate profit

that jumped to 84% among the early adopters

73 %

of millennials don't believe government can solve today's issues alone, and 83% want business to get more involved.

In 2025, expect to see:

- > Waste: water consumption
- > Transport: AI, public,...
- > Purpose: stakeholders, not only shareholders

In 2030, expect to see:

- > Pollution: clean air
- > Transport: less cars owned and on the road
- > Urbanisation: 20' neighbourhood

IN 2025, EXPECT TO SEE:

- At-home DNA testing kits become mainstream for personalised wellness, from diet to skin and hair solutions.
- Benefits of blood-based solutions in beauty, drink, food and personal care become widely acknowledged.
- Alternative ways of working and studying emerge to counter the stress of the automation threat.
- Government-led changes to water consumption, focusing on filtration and preservation.**
- Red meat consumption move from mainstream to luxury to taboo.

IN 2030, EXPECT TO SEE:

- Development of micro-robotics in the bloodstream to proactively and preemptively fight threats.
- Over-population and geo-political changes create new ways of existing in communities, with shared facilities and resources becoming essential.
- Vehicle ownership shrink as physical space and the environmental impact of air pollution become a priority.**
- Clean air as a selling point for high-street retailers, venues, and public buildings.

IN 2025, EXPECT TO SEE:

- 5G reach half of all mobile users globally, 4D VR experiences as 'the new luxury', bluetooth monitors replace TVs, and AR navigation and online medical consults become the norm.
- Fully unmanned retail operations limited to discount and convenience stores as more consumers demand human interaction when shopping.
- More AI-enabled autonomous public transportation systems thanks to improved energy storage.**
- Cashless biometric payments and urban vertical farms widely used.
- Reduced business travel thanks to better video conferencing.

IN 2030, EXPECT TO SEE:

- Social disruptor enterprises create new wealth at local grassroots levels.
- Tribes of like-minded interest groups form globally via the internet.
- The 'rewilding' of both rural and urban spaces continue to expand.
- Modular, movable, and micro-homes available to buy or rent, for flexible, possession- and location-light living.
- Political, social, scientific, and economic ethics drive the direction of innovation, while people learn to deal with a new climate reality.
- More public spaces as the result of smaller roads because more people have switched to public transport.**
- More publicly owned, shared, and pop-up commerce, recreation spaces fostering local, micro-business, and shared gardening and agricultural space.

IN 2025, EXPECT TO SEE:

- Rapid, mainstream growth in the second-hand economy.
- Purposefulness and ethical business philosophy rise to the top.
- Brands prioritise people and the planet over profitability.**
- Greater value placed on inner journeys rather than outer appearances.
- Sharing economy services continue to evolve, moving beyond economic benefits to the environmental and social benefits.**
- The luxury goods market grow as more consumers opt for longer-lasting, sustainable goods.

IN 2030, EXPECT TO SEE:

- A decline in retail store branding in favour of branding the seamless online-to-offline (O2O) retail services.
- 5G blurring the lines between work, learning, leisure, and travel time.
- Cashless payment pushback.
- Urban and vertically farmed food and local micro farms produce the majority of the food people consume.**
- VR/AR as the norm for tourism and entertainment.
- Intravenous nanobots that continuously monitor body functions and vitals.
- Subcultures identify with media-stream brands.
- 5G-enabled virtual esports overtake physical sports in popularity.
- Entire cities designed around autonomous transportation with built-in AR features.
- Home-setting apps meant to recreate preferred home settings.

FIGURE 13 | Nine supply-chain initiatives chief executive officers should push for

Your **customers** care

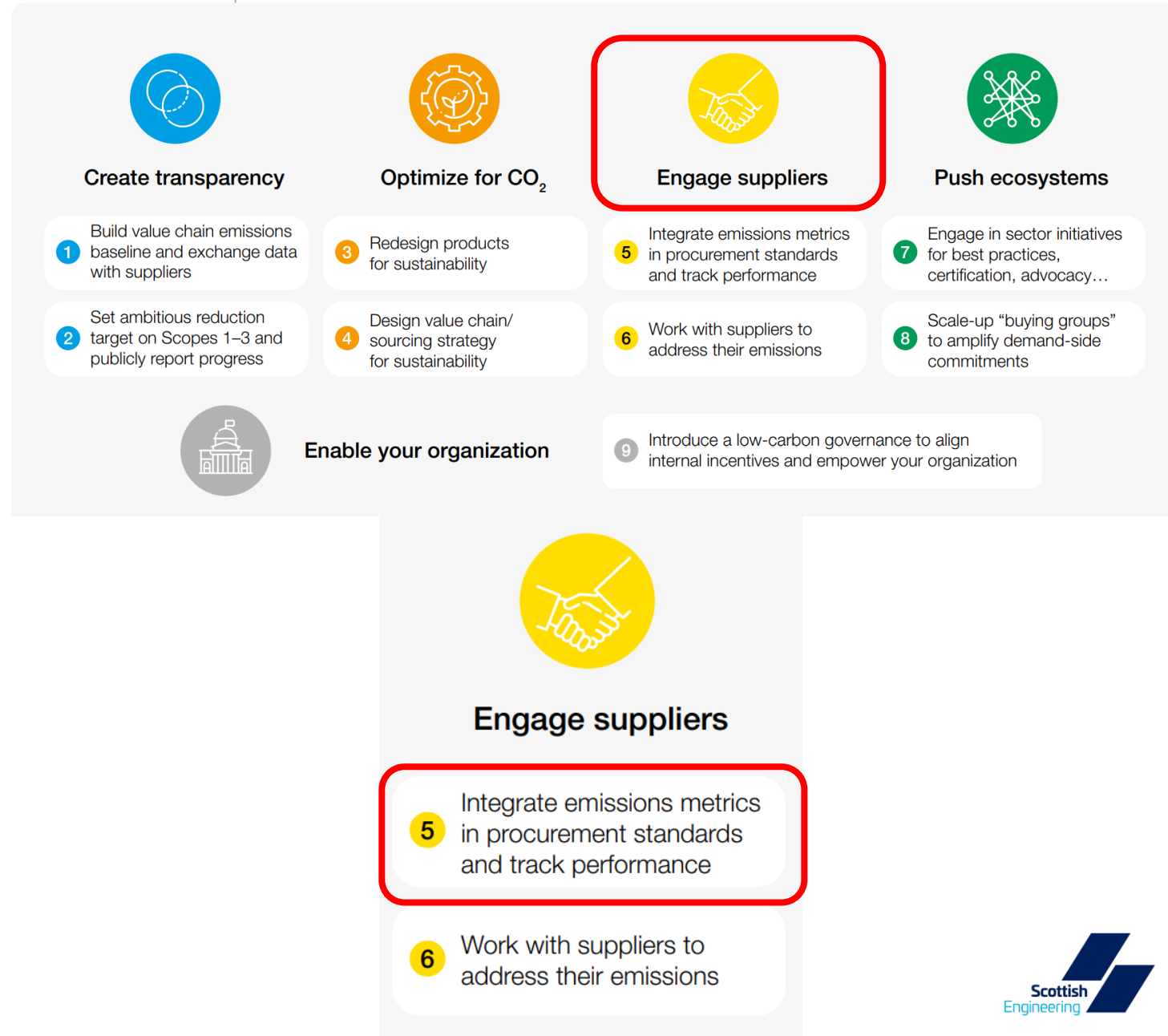
Scope 3 – Supply Chain



> Many industrial companies are looking to incentivise their **supply chain** to help reduce their carbon footprint as part of their own decarbonisation strategy.  Pinsent Masons

> Supply-chain decarbonization will be a 'game changer' for the impact of corporate climate action. Addressing **Scope 3 emissions** is fundamental for companies to realize credible climate change commitments.

—Nigel Topping, UNFCCC's High-Level Climate Action Champion



Part 1

Why now?



Your **employees** care

- > Your customers care
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Employees want to work for company with a purpose

58% consider a company's social and environmental commitments when deciding where to work

55% would choose to work for a socially responsible company, even if the salary was less

51% won't work for a company that doesn't have strong social or environmental commitments

Sustainability and net zero is one of these fundamental purposes to which people can connect easily

75% say it's important their company shares its goals, progress and related achievements

71% want their company to provide opportunities for them to help make a positive impact on the company's social and environmental commitments

77% say it's important their employer provides them with hands-on activities around environmental responsibility

47% believe companies need to find a balance around providing opportunities that focus on individuals' personal interests and the social and environmental issues most important to the business

Employees want a job that add value to this purpose

88% feel their job is more fulfilling when they are provided opportunities to make a positive impact on social or environmental issues (vs. 74% U.S. average)

79% consider a company's social and environmental commitments when deciding where to work (vs. 58% U.S. average)

76% would choose to work for a socially responsible company, even if the salary would be less than at other companies (vs. 55% U.S. average)

Will Robots really steal our jobs

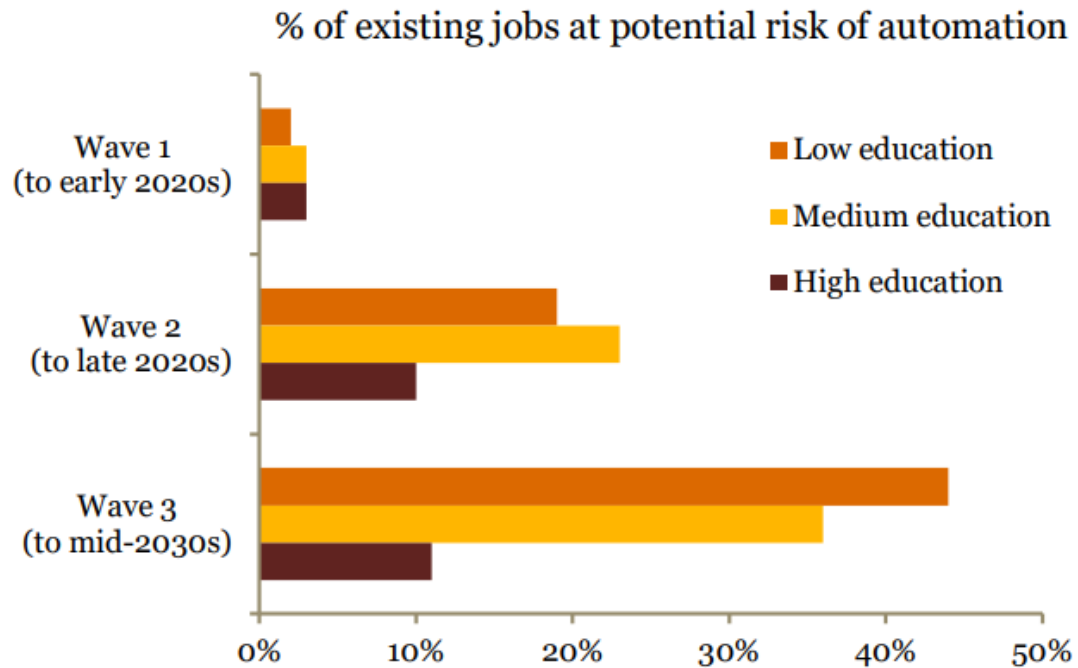


37%

are worried about automation putting jobs at risk – up from 33% in 2014.

70%

would consider using treatments to enhance their brain and body if this improved employment prospects in the future.



Source: PwC estimates based on OECD PIAAC data (median values for 29 countries)

Waves	Description and impact
Wave 1: Algorithmic wave (to early 2020s)	Automation of simple computational tasks and analysis of structured data , affecting data-driven sectors such as financial services.
Wave 2: Augmentation wave (to late 2020s)	Dynamic interaction with technology for clerical support and decision making. Also includes robotic tasks in semi-controlled environments such as moving objects in warehouses.
Wave 3: Autonomous wave (to mid-2030s)	Automation of physical labour and manual dexterity, and problem solving in dynamic real-world situations that require responsive actions, such as in transport and construction.

Recommendations:

- Boosting education and **skills** levels to help people of all ages to adjust to new technologies;
- Supporting job creation through government investment that can also help to lever in private investment

Part 1

Why now?

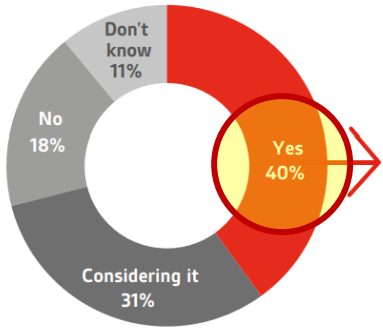


Your **competitors** care

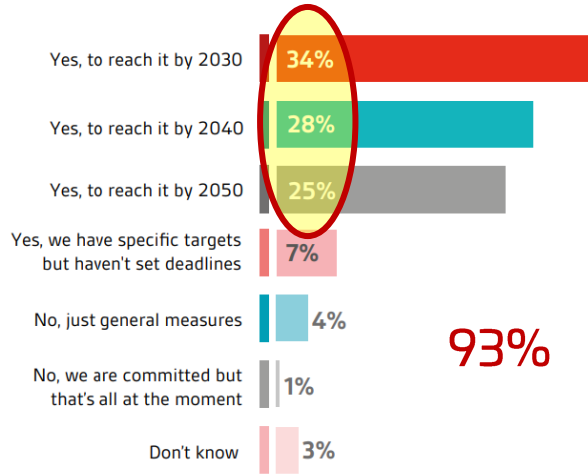
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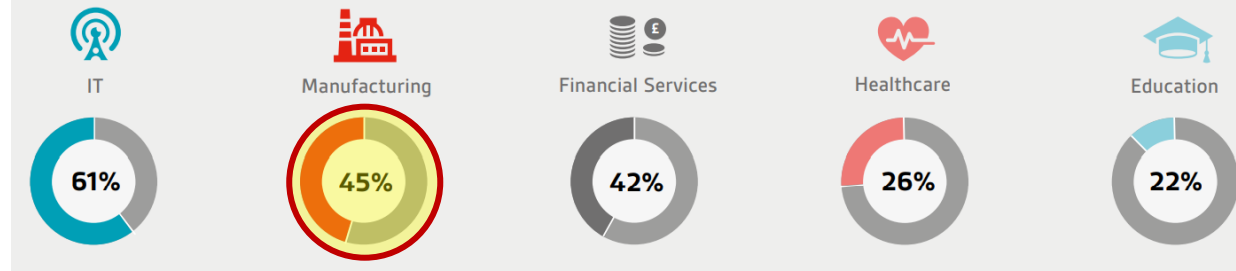
Has your organization made a commitment to net zero?



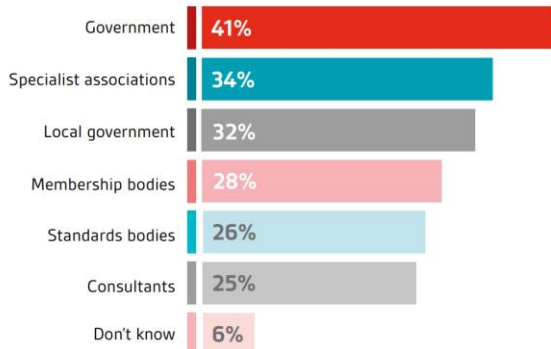
Have specific targets and deadlines been set to achieve net zero?



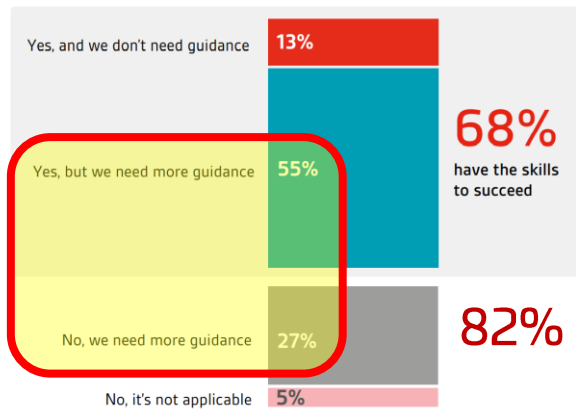
Percentage of organizations that have committed to net zero, according to sector



Organizations that business leaders are looking to for advice



Capability of organizations to achieve net zero



Capability of organizations to achieve net zero



Part 1

Why now?



You care

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The Quarterly Review

We collect the latest data from Scottish industry to help you plan the future of your business

A dark blue banner with diagonal stripes in light blue and red. The text 'The Quarterly Review' is in white, and the subtitle is in light blue.

Scottish industry view on the impact of human activity on climate change



A strong majority of respondents (92%) reported that their organisations recognise that the declared climate emergency is real and requires an urgent response

Close to two thirds (64%) say their organisation is actively pursuing operational changes that will support reduced climate impact, with more than half (53%) stating they are actively pursuing product/service design changes or diversification to support reduced climate impact

When asked to describe the organisation's view of the threat or opportunity that the business faces from this, 43% stated they were concerned, 3% deeply concerned, 36% neutral, and 16% and 2% saw opportunity and strong opportunity respectively

Financing – Conditionality & Taxonomy

BLACKROCK®

The investment company BlackRock now prioritises sustainability criteria in their investment plans, and Larry Fink, BlackRock Chairman and CEO, recently spoke in an open letter about how “purposeful companies, with better environmental, social, and governance (ESG) profiles, have outperformed their peers.” Institutional investors and pension funds are moving away from fossil fuels, and customers want to deal with sustainable companies.



“While businesses overwhelmingly recognise the importance of sustainability many, especially SMEs, struggle to translate good intentions into a clear plan and are worried about the cost and time involved in implementing an ESG programme.

“This is why we partnered with Future-Fit Foundation, to help SMEs and other businesses manage and measure sustainability. The benchmarking tool enables us to identify those businesses with capabilities that proactively drive other companies or consumers to create a more sustainable society and the loans will help these companies grow faster and help relieve some of the cost pressure. We firmly believe that we, and other banks, have a duty to direct capital responsibly.”

Graeme Sands, Corporate and Mid-Market Director, at Virgin Money

Santander X Environmental Challenge: a global call for entrepreneurs with innovative ideas aimed to build a more sustainable future

BE SUSTAINABLE, BY FOSTERING GREEN FINANCING AND INVESTMENTS

BE MINDFUL, ABOUT ENVIRONMENTAL IMPACT →

 **Santander**
Corporate & Investment Banking

TCFD | TASK FORCE ON CLIMATE-RELATED
FINANCIAL DISCLOSURES

A Roadmap towards mandatory climate-related disclosures

John Glen MP, Economic Secretary to the Treasury, outlined the important role of a **UK Green Taxonomy** in achieving net zero: “... the government announced exciting plans to implement a green taxonomy ... that will allow us to create green jobs and ultimately achieve our goal of net-zero by 2050.”

Part 1

Why now?



The **World** cares

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**SUSTAINABLE
DEVELOPMENT
GOALS**

NO PLAN-ET B

1 NO POVERTY



Economic growth must be inclusive to provide sustainable jobs and promote equality.

2 ZERO HUNGER



The food and agriculture sector offers key solutions for development, and is central for hunger and poverty eradication.

3 GOOD HEALTH AND WELL-BEING



Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development.

4 QUALITY EDUCATION



Obtaining a quality education is the foundation to improving people's lives and sustainable development.

5 GENDER EQUALITY



Gender equality is not only a fundamental human right, but a necessary foundation for a peaceful, prosperous and sustainable world.

6 CLEAN WATER AND SANITATION



Clean, accessible water for all is an essential part of the world we want to live in

7 AFFORDABLE AND CLEAN ENERGY



Energy is central to nearly every major challenge and opportunity.

8 DECENT WORK AND ECONOMIC GROWTH



Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



Investments in infrastructure are crucial to achieving sustainable development

10 REDUCED INEQUALITIES



To reduce inequalities, policies should be universal in principle, paying attention to the needs of disadvantaged and marginalized populations

11 SUSTAINABLE CITIES AND COMMUNITIES



There needs to be a future in which cities provide opportunities for all, with access to basic services, energy, housing, transportation and more

12 RESPONSIBLE CONSUMPTION AND PRODUCTION



Responsible Production and Consumption

13 CLIMATE ACTION



Climate change is a global challenge that affects everyone, everywhere

14 LIFE BELOW WATER



Careful management of this essential global resource is a key feature of a sustainable future

15 LIFE ON LAND



Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss

16 PEACE, JUSTICE AND STRONG INSTITUTIONS



Access to justice for all and building effective, accountable institutions at all levels

17 PARTNERSHIPS FOR THE GOALS



Revitalize the global partnership for sustainable development



UNITED NATIONS



People are prepared to pay the right price

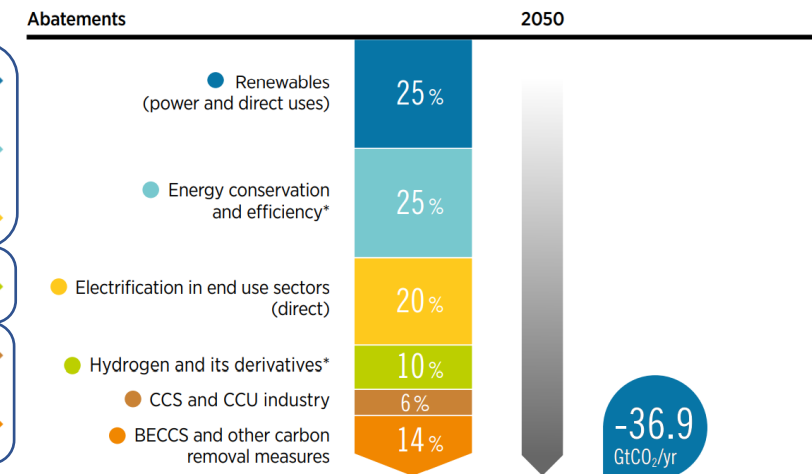
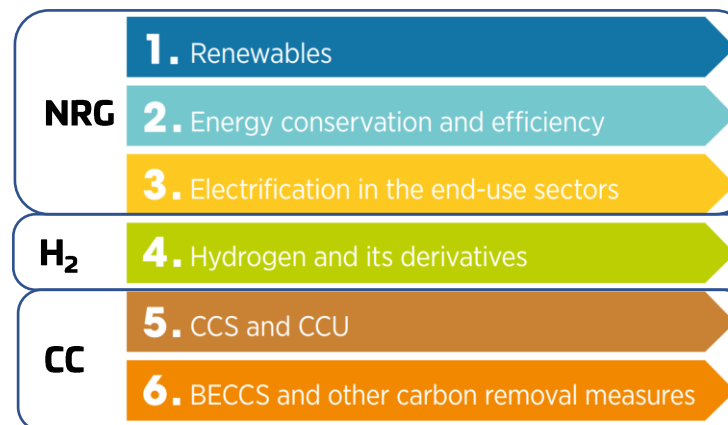


The desire (need)

- > **80%** of people around the world believe we are 'headed for environmental disaster unless we change our habits quickly'
- > **63%** of people globally are willing to pay more for food products that don't harm the environment

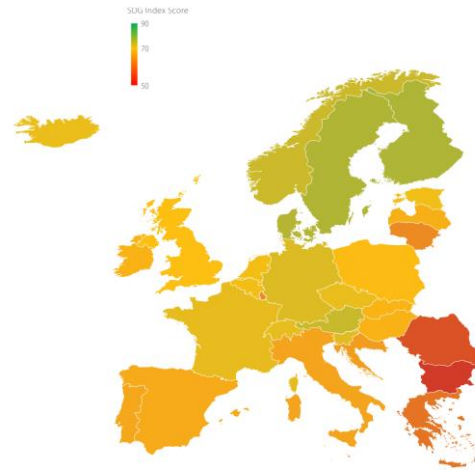
The opportunities

The World Energy Transitions Outlook identifies six main components of the CO₂ emissions abatement:



Part 1

Why now?



Europe cares

- > Your customers care
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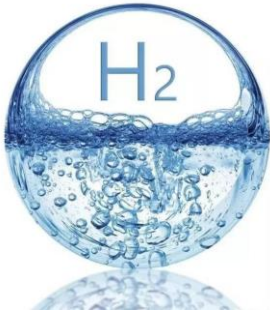
2021 Call deadlines and budgets

Destination	Theme	2021 Call Deadlines	Number of topics	Total budget (M€)
3	Renewable energy technologies	26 Aug 2021	4	55
		5 Jan 2022	16	280
3	Energy systems, grids and storage	26 Aug 2021	10	152
3	Carbon capture, utilisation and storage	26 Aug 2021	2	32
3	Cross-cutting	26 Aug 2021	3	65
4	Energy efficient buildings	19 Oct 2021	3	36
		25 Jan 2022	3	38
4	Industrial decarbonisation	19 Oct 2021	2	30
	Total		43	688



DRAFT

Europe means it (e.g. H₂ worth over €1.3billions)



SCOTTISH DEVELOPMENT INTERNATIONAL

METROPOLITAN FRANCE: CURRENT PROJECTS

H2V - NORMANDY REGION

- Two identical hydrogen production units, each producing an average of 14,000 t/year of hydrogen per year
- Eur 230-250 M investment
- Commissioning 2022 - 2023

HYD'OCC - OCCITANIE REGION

- Creation of a green hydrogen production plant by 2023
- Project company created in July 2020
- EUR 50M production unit EUR 100 M supply chain development
- 6,000 t/year of hydrogen produced by water electrolysis (50MW electrolysers)

H2 CORRIDOR - OCCITANIE REGION

- Eur 110 M project with €40 M loan from EIB
- Development of hydrogen distribution stations on a North/South axis
- 1st semester 2021 call for project
- Corridor operational in 2023

H2 - AIRPORT EOI

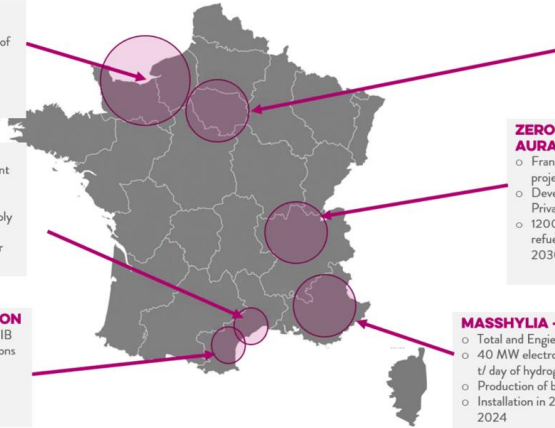
- Consortium of ADP Group, Airbus, Air France, Paris region
- From upstream Hydrogen Value Chain to Downstream Hydrogen Value Chain and Circular Economy
- Application deadline 19th March

ZERO EMISSION VALLEY - AURA REGION

- France largest hydrogen mobility project
- Developed by Hymulsion: Private/public investment
- 1200 hydrogen vehicles, 20 hydrogen refuelling stations to be delivered in 2030

MASSHYLIA - REGION SUD

- Total and Engie
- 40 MW electrolysis producing 5,000 t/day of hydrogen
- Production of biofuels
- Installation in 2022 and operation in 2024



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GERMANY: CURRENT PROJECTS

PROJECT GET H2 NUCLEUS

- 100 MW industrial green project - Onshore wind Lower Saxony with 130KM hydrogen pipeline linking industrial clients BP refinery Lingen, Marl Chemical park and Ruhr oil refinery Gelsenkirchen

PROJECT RH2INE

- S Holland and North Rhine Westphalia join collaboration - H2 inland shipping and port infrastructure (Rotterdam and Duisburg)

Project H2 Startnetz 2030

- Covert 1,200 km gas pipelines to hydrogen pipelines creating national hydrogen grid
- \$715.8m project would link 31 green gas projects with consumption centres in NRW, Lower Saxony and links to S Germany

OFFSHORE WIND - P2X

- Westkuste 100 - Orsted and partners 30 MW electrolyser
- Aquaventus - Floating electrolysers goal of 10GW 2035 producing 1 million metric tonnes green hydrogen
- Hamburg Port - 100 MW electrolyser with Vattenfall, Mitsubishi, Shell and Warme

Important Project Common European Interest (IPCEI)

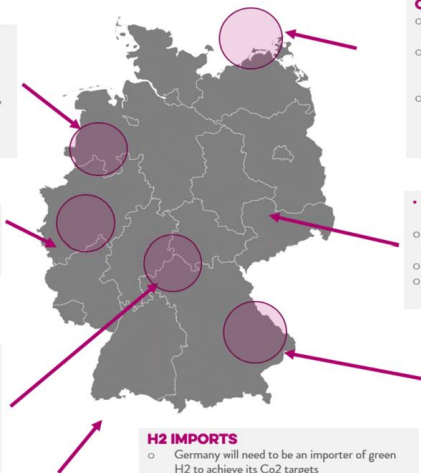
- Jan 21 German gov launches call for IPCEI hydrogen projects
- Feb 21 200 applicants received
- Example - Thyssenkrupp steel plant - 500 MW electrolyser using wind and solar

BAVARIA

- 6MW Siemens / Wun H2 GMBH - 900 tonnes green H2 industrial park
- Bavarian Hydrogen Centre - R&D SMEs / Academia / Industry
- 100 H2 refuelling stations target near term
- Germany has circa 85 H2 stations to date

H2 IMPORTS

- Germany will need to be an importer of green H2 to achieve its Co2 targets
- Signed MOU with Morocco €701 million to import green hydrogen from solar pv



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THE NETHERLANDS: CURRENT PROJECTS

PORT OF ROTTERDAM PROJECTS

- Backbone: Public infrastructure to connect import & export projects
- Prothos CCS project
- Offshore Wind to H2, 2GW conversion park
- Import terminals: for international H2 import

ZEELAND AREA

- Already the largest grey hydrogen economy in the Netherlands (520,000 tons per year)
- Multiple projects in pipeline
- Ørsted & Yara are producing green ammonia which will require a 100MW electrolyser powered by offshore wind

NORTH2

- Offshore Wind to H2
- 4GW in 2030
- 10 GW in 2040
- Shell, Gasunie, Groningen Seaports, Equinor & RWE

HEAVENN HYDROGEN VALLEY

- Project size: 90 million euro (incl. subsidy)
- 6 year project, started in 2020
- 31 public & private partners
- By the New Energy Coalition



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THE NORDICS: CURRENT PROJECTS

H2 FUEL CELLS DEVELOPMENT

- Maritime industry Partnership Corvus Energy & Toyota, Bergen.
- The production will be Norway's first of its kind, strengthening the country's pole position in the global efforts towards decarbonizing shipping.

HAMMERFEST LH2, NH3

- Feasibility Study via Vår energi.
- Ammonia Plant Font End Review.
- Hydrogen-enriched compounds which are liquid at mild conditions, such as ammonia, methane and methanol, have recently gained attention as a distribution medium or for storage of hydrogen.

NORDIC HYDROGEN CORRIDOR

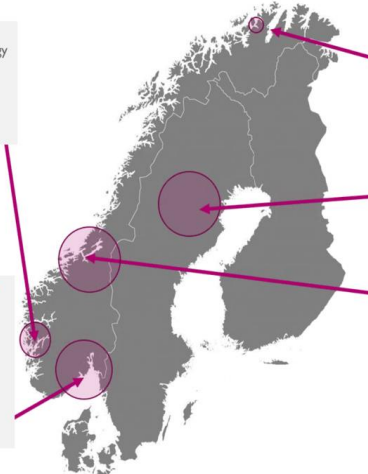
- Statkraft and Everfuel to join Hyundai, Toyota and Hydrogen Sweden in an EU-supported initiative to explore hydrogen road transport in Sweden.

YARA-NEL: GREEN AMMONIA PLANT.

- full-scale green ammonia project in Porsgrunn (500,000 tons per year)
- Ammonia is the most promising hydrogen carrier and zero-carbon shipping fuel.
- Ammonia's chemical properties make it ideally suited for the hydrogen economy. It does not require cooling to extreme temperatures, and has a higher energy density than liquid hydrogen, making it more efficient to transport and store.

TRØNDELAG H2 HIGH-SPEED FERRIES

- The funded competition requested proposals for boats that could carry 100-250 passengers, and travel at over 30 knots (55kmh / 34mph) with zero emissions.
- "We ordered something that didn't really exist"
- "groundbreaking technology we have come to see will have a ripple effect into the international market."



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Part 1

Why now?



The UK cares

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	2020s	2030s	2040s
LAND USE	Afforestation and peatland restoration		
AGRICULTURE	Healthier diets, reduced food waste, tree growing and low-carbon farming practices		
WASTE	Reduce waste, increase recycling, landfill ban on biodegradable waste	Limit emissions from combustion of non-bio wastes, deploy measures to reduce emissions from waste water	
BUILDINGS	Efficiency, heat networks, heat pumps (new-build, off-gas, hybrids)	Widespread electrification, expand heat networks, gas grids potentially switch to hydrogen	
ROAD TRANSPORT	Ramp up EV market, decisions on HGVs	Turn over fleets to zero-emission vehicles: cars & vans before HGVs	
INFRASTRUCTURE	Industrial CCS clusters, decisions on gas-grid & HGV infrastructure, expand vehicle charging & electricity grids	Hydrogen supply for industry & (potentially) buildings, roll-out of infrastructure for hydrogen/electric HGVs, more CCS infrastructure, electricity network expansion	
HYDROGEN	Begin large-scale hydrogen production with CCS	Widespread use of hydrogen in industry, use in back-up electricity generation, heavier vehicles (e.g. HGVs, trains) and (potentially) heating on coldest days	
GREENHOUSE GAS REMOVALS	Develop options and policy framework	Deployment of BECCS in various forms, demonstrate direct air capture of CO ₂ , other removals depending on progress	
ELECTRICITY	Largely decarbonise electricity: renewables, flexibility, coal phase-out	Expand electricity system, decarbonise mid-merit/peak generation (e.g. using hydrogen), deploy bioenergy with CCS (BECCS)	
INDUSTRY	Establish industrial CCS and hydrogen clusters; improve energy & resource efficiency	Further CCS, widespread use of hydrogen, some electrification	
F-GASES	Move almost completely away from use of F-gases		
AVIATION	Operational measures, new plane efficiency, constrained demand growth, limited sustainable biofuels		
SHIPPING	Operational measures, new ship fuel efficiency, use of ammonia		
CO-BENEFITS	Health benefits due to improved air quality, healthier diets and more walking & cycling. Clean growth and industrial opportunities. Improved biodiversity. Improved resilience to climate change.		

Prime Minister's ten points



1. **Offshore wind:** producing enough offshore wind to power every home
2. **Hydrogen:** generating 5GW of low carbon hydrogen production capacity by 2030 for industry, transport, power and homes
3. **Nuclear:** advancing nuclear as a clean energy source and developing the next generation of small and advanced reactors.
4. **Electric vehicles:** accelerating the transition to electric vehicles, and transforming our national infrastructure accordingly.
5. **Public transport, cycling and walking:** Making it more attractive ways to travel and investing in zero-emission public transport.
6. **Jet Zero and greener maritime:** becoming greener through research projects for zero-emission planes and ships.
7. **Homes and public buildings:** homes, schools and hospitals greener, target to install 600,000 heat pumps every year by 2028.
8. **Carbon capture:** Becoming a world-leader in technology to capture and store harmful emissions away from the atmosphere.
9. **Nature:** Protecting and restoring our natural environment.
10. **Innovation and finance:** Developing the cutting-edge technologies needed to reach these new energy ambitions.

Part 1

Why now?

Scotland cares

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SDG
NETWORK
SCOTLAND



Part 1

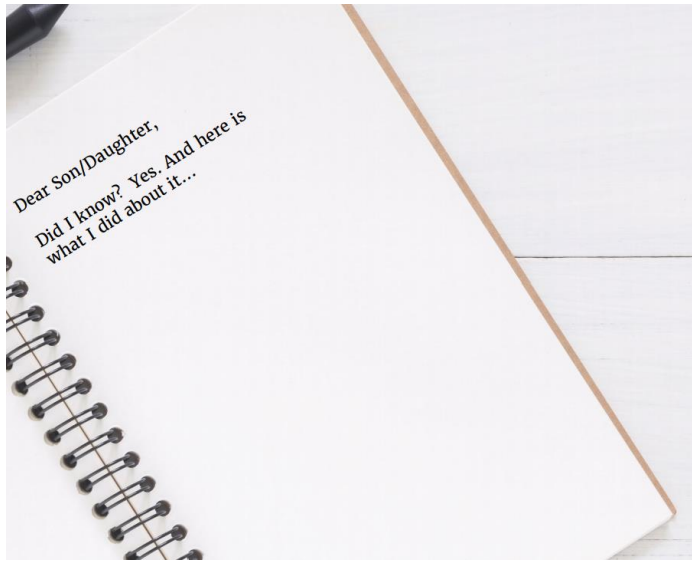
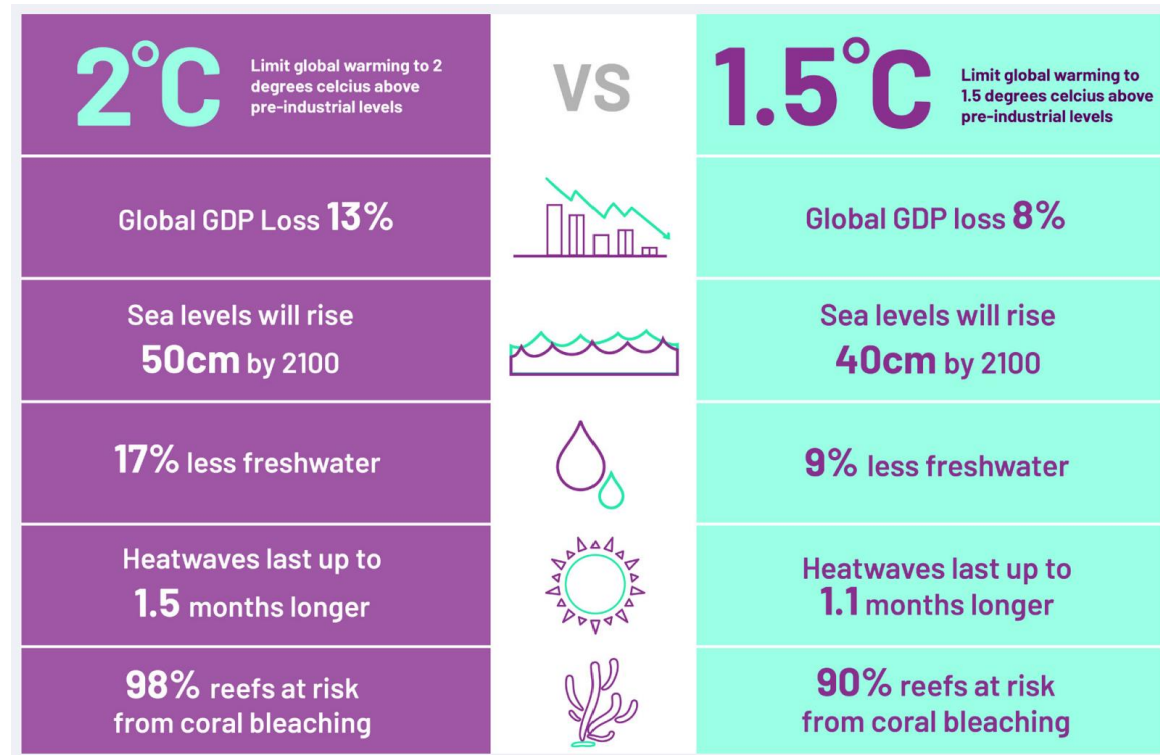
Why now?



Because it is the Right thing to do

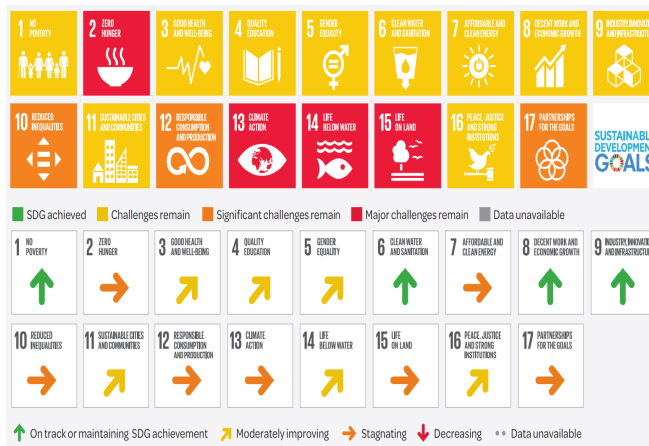
Because it is an unique opportunity to leave a positive Legacy

Because if you do not, someone else will





United Nations SDG (17 goals)



Europe tracking of UN SDG (2050)

	2020s	2030s	2040s
LAND USE	Afforestation and peatland restoration		
AGRICULTURE	Healthier diets, reduced food waste, tree growing and low-carbon farming practices		
WASTE	Reduce waste, increase recycling, landfill ban on biodegradable waste	Limit emissions from combustion of non-bio wastes, deploy measures to reduce emissions from waste water	
BUILDINGS	Efficiency, heat networks, heat pumps (new-build, off-gas, hybrids)	Widespread electrification, expand heat networks, gas grids potentially switch to hydrogen	
ROAD TRANSPORT	Ramp up EV market, decisions on HGVs	Turn over fleets to zero-emission vehicles: cars & vans before HGVs	
INFRASTRUCTURE	Industrial CCS clusters, decisions on gas-grid & HGV infrastructure, expand vehicle charging & electricity grids	Hydrogen supply for industry & (potentially) buildings, roll-out of infrastructure for hydrogen/electric HGVs, more CCS infrastructure, electricity network expansion	
HYDROGEN	Begin large-scale hydrogen production with CCS	Widespread use of hydrogen in industry, use in back-up electricity generation, heavier vehicles (e.g. HGVs, trains) and (potentially) heating on coldest days	
GREENHOUSE GAS REMOVALS	Develop options and policy framework	Deployment of BECCS in various forms, demonstrate direct air capture of CO ₂ , other removals depending on progress	
ELECTRICITY	Largely decarbonise electricity: renewables, flexibility, coal phase-out	Expand electricity system, decarbonise mid-merit/peak generation (e.g. using hydrogen), deploy bioenergy with CCS (BECCS)	
INDUSTRY	Establish industrial CCS and hydrogen clusters, improve energy & resource efficiency	Further CCS, widespread use of hydrogen, some electrification	
F-GASES	Move almost completely away from use of F-gases		
AVIATION	Operational measures, new plane efficiency, constrained demand growth, limited sustainable biofuels		
SHIPPING	Operational measures, new ship fuel efficiency, use of ammonia		
CO-BENEFITS	Health benefits due to improved air quality, healthier diets and more walking & cycling. Clean growth and industrial opportunities. Improved biodiversity. Improved resilience to climate change.		

UK 10 point plan (2050)



Scotland's National Performance Framework (11 goals - 2045)



Environment



Break



Part 2

What now?

Opportunities

- > Electricity
- > Buildings
- > Transport
- > Industry
- > Waste and Circular Economy
- > Land use and Forestry
- > Agriculture
- > Negative emissions technologies (NET)



Scotland's National Performance Framework



2 ZERO HUNGER



5 GENDER EQUALITY



7 AFFORDABLE AND CLEAN ENERGY



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



- Environment
- Poverty

- Health
- Education

- Economy
- Children

- Human Rights
- Culture
- Children
- Economy

- Environment
- Health
- International
- Poverty

- Fair Work and Business
- Education
- Communities

- Environment
- Fair Work and Business
- Poverty
- Communities
- Children

- Environment
- Fair Work and Business
- Economy
- International
- Communities

12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



- Economy
- Poverty

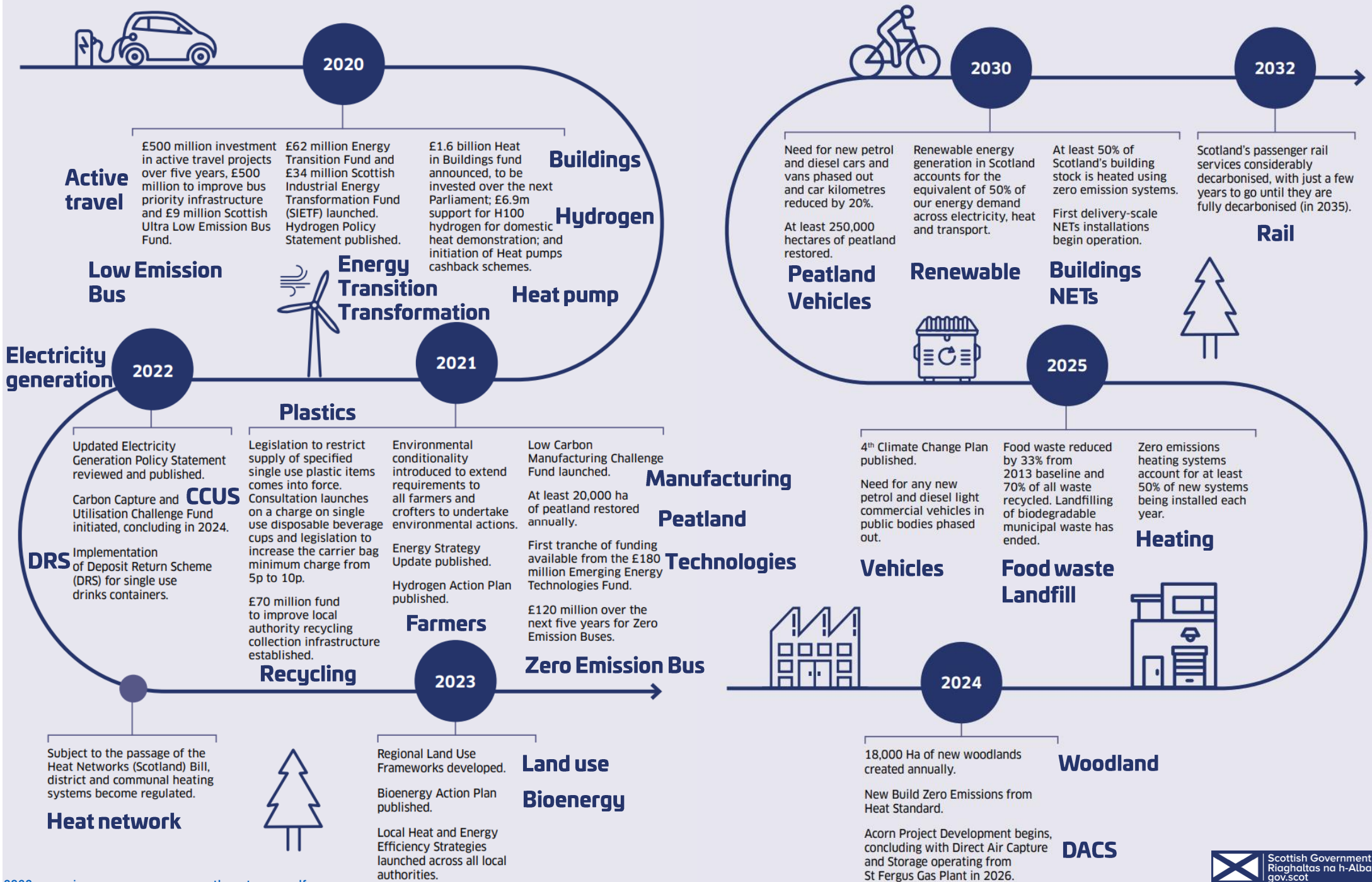
- Environment
- Health

- Fair Work and Business

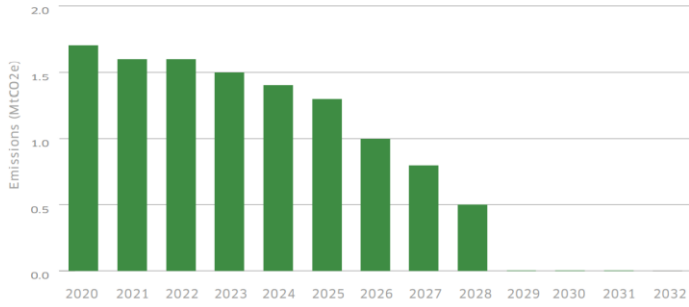
- Environment
- Economy

- Environment

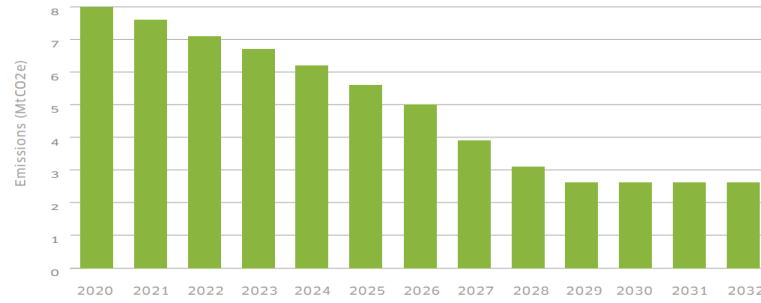
- Environment



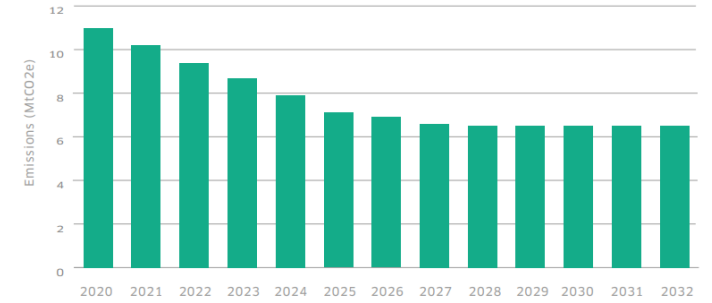
Electricity



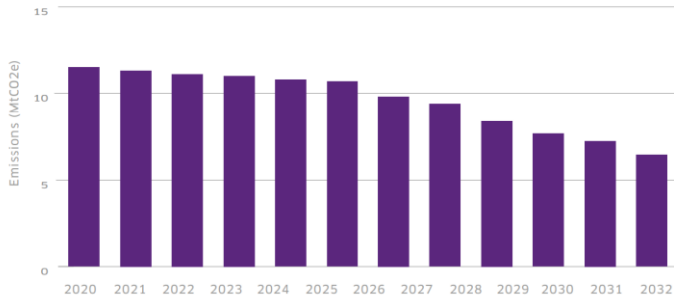
Buildings



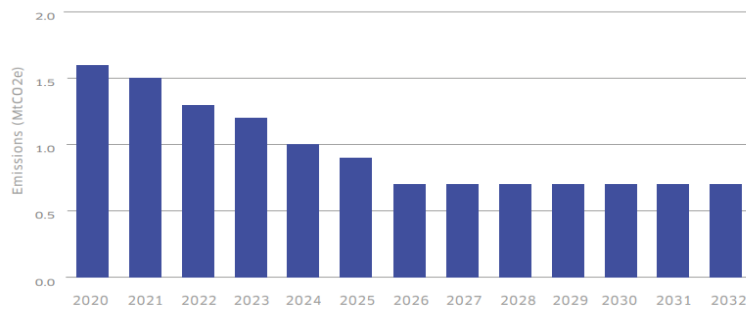
Transport



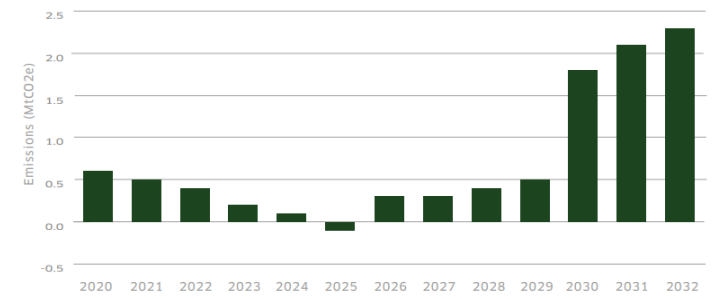
Industry



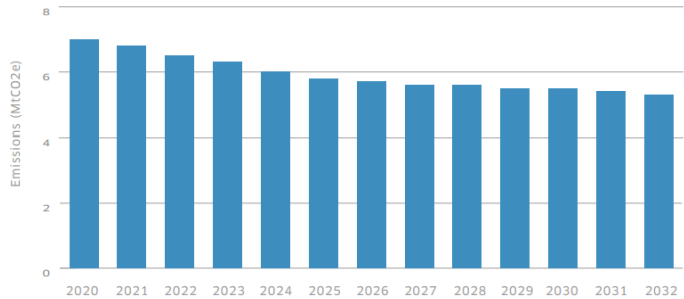
Waste



LULUCF



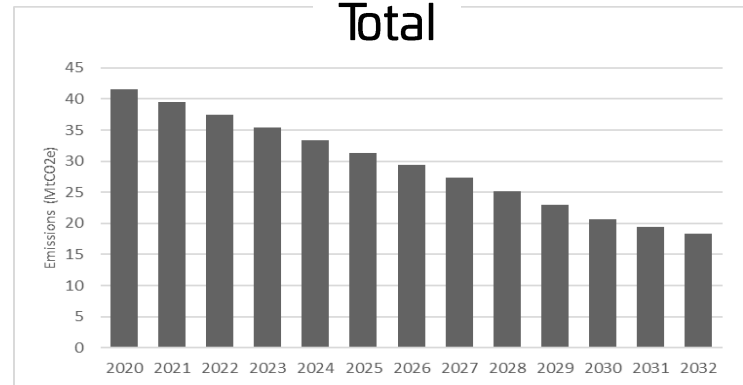
Agriculture



Negative Emission Technologies



Total



Part 2

What now?

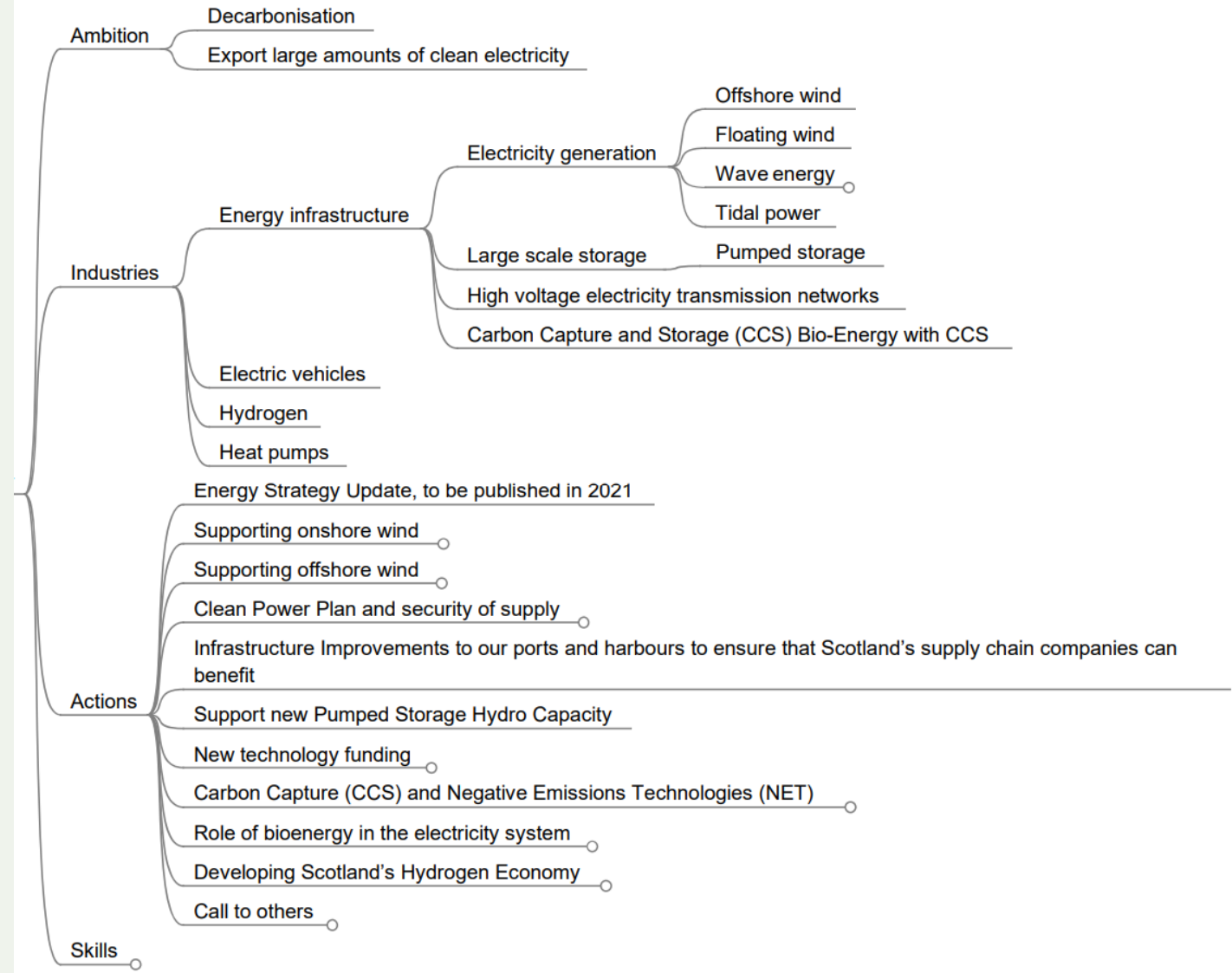
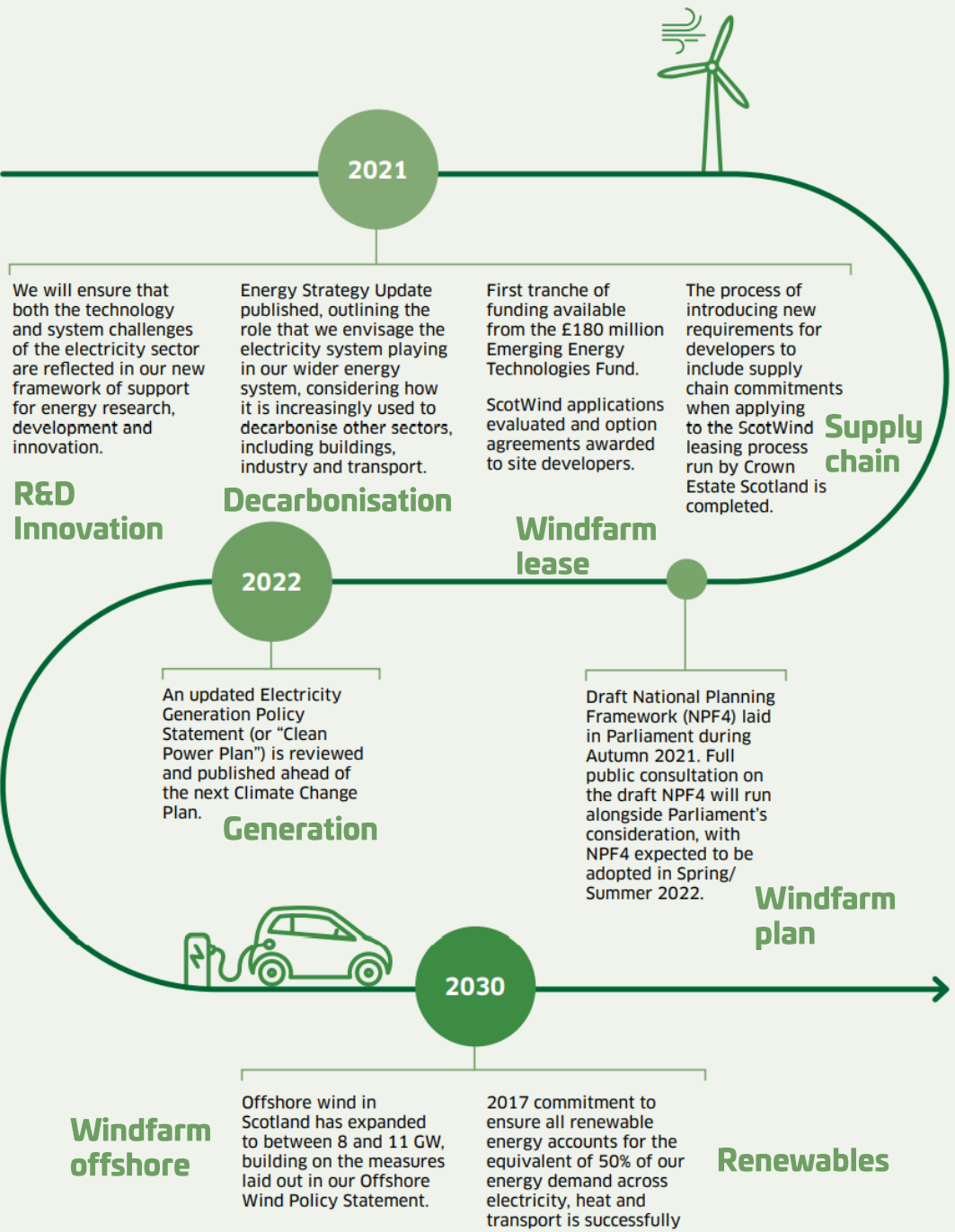


Electricity

- > Electricity
- > Buildings
- > Transport
- > Industry
- > Waste and Circular Economy
- > Land use and Forestry
- > Agriculture
- > Negative emissions technologies (NET)

Chapter 1 Electricity





Part 2

What now?



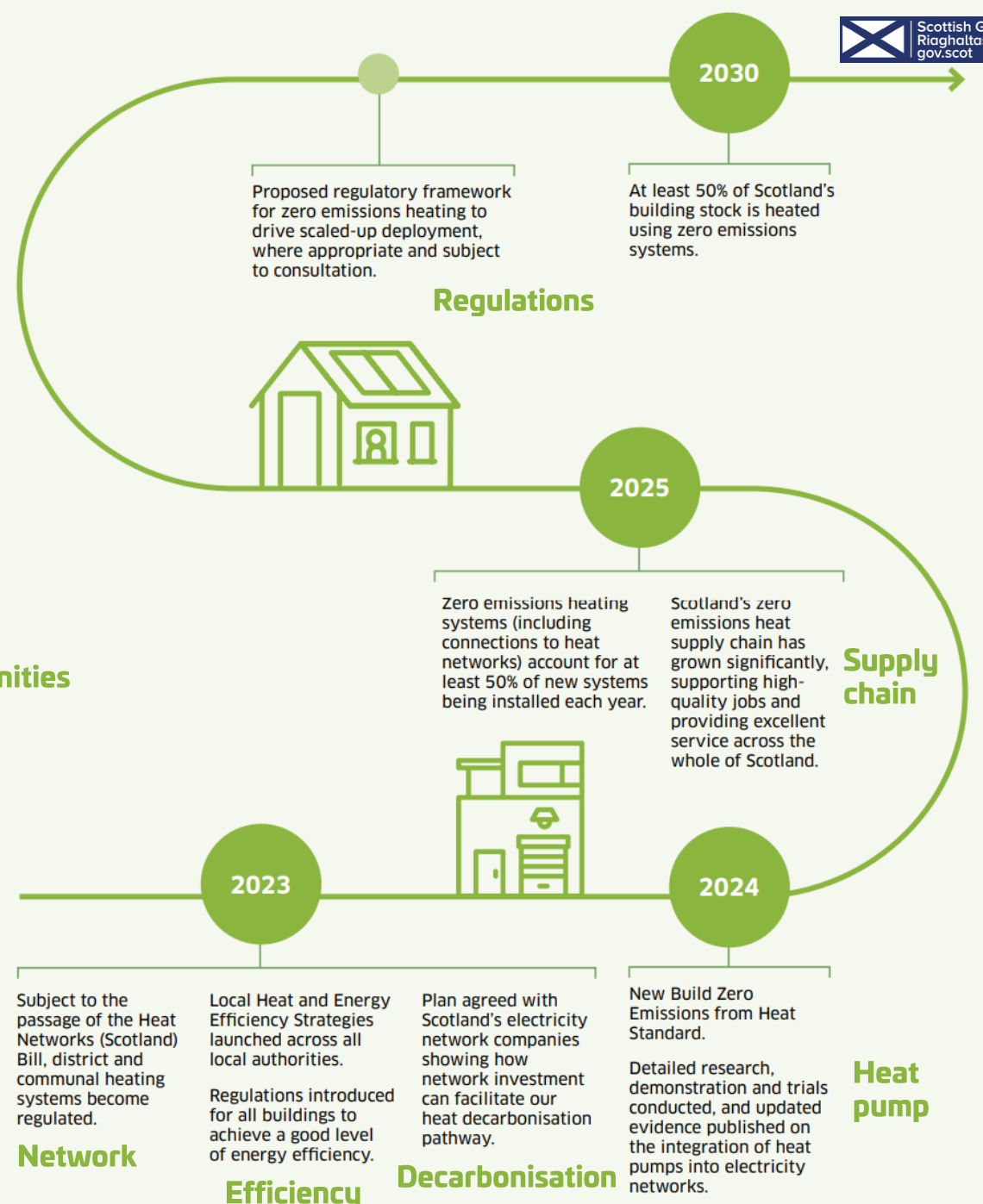
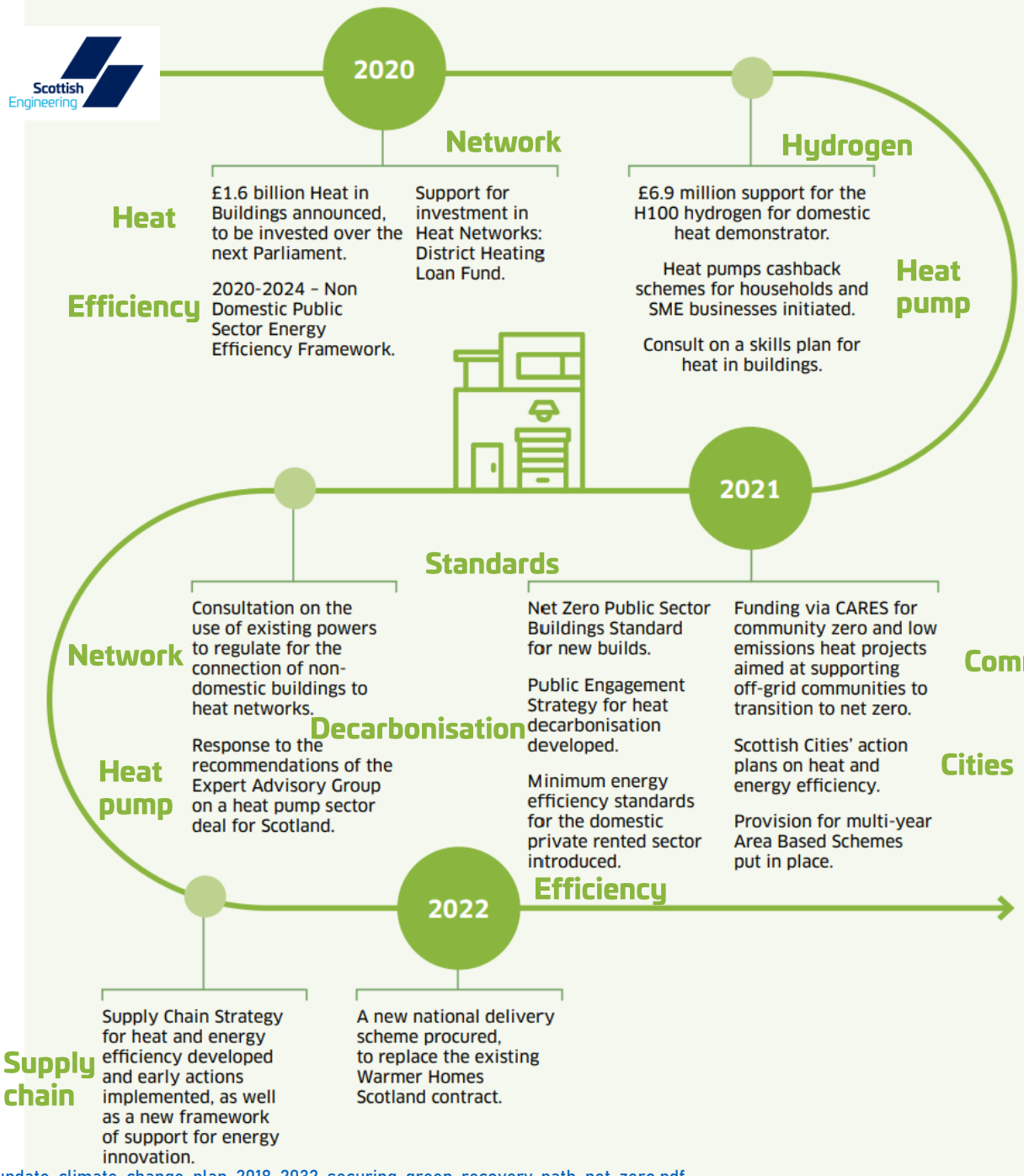
Buildings

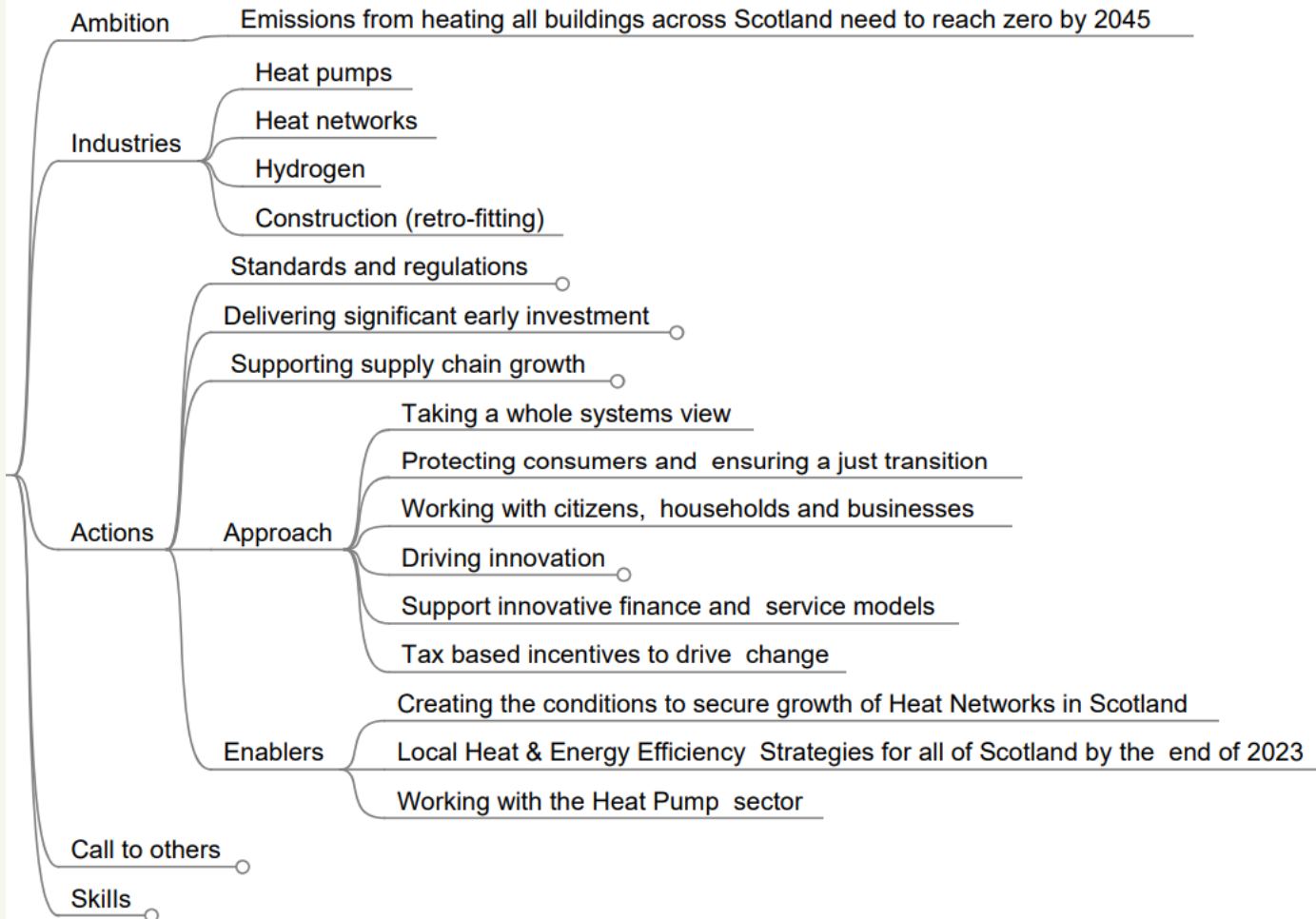
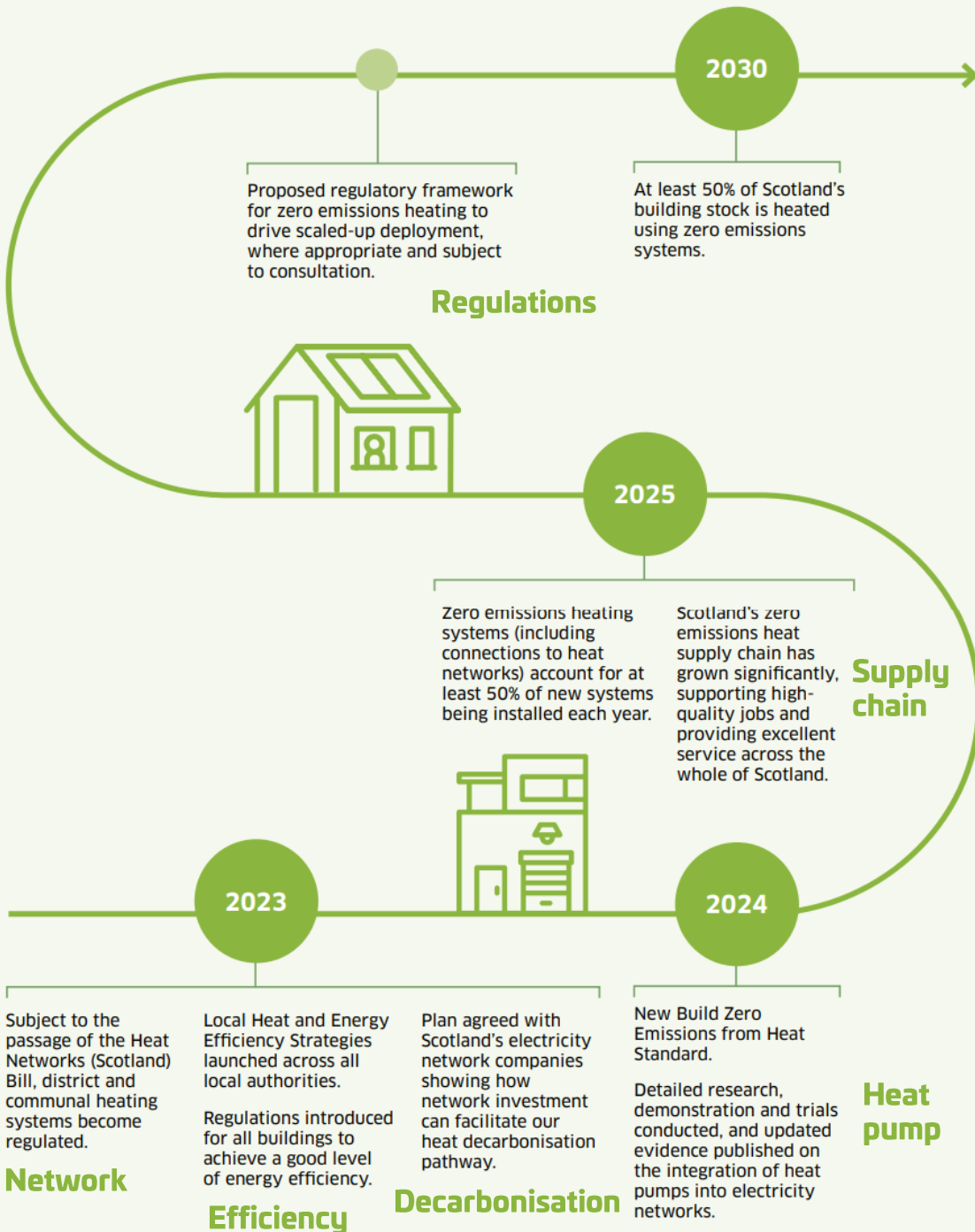
- > Electricity
- > Buildings
- > Transport
- > Industry
- > Waste and Circular Economy
- > Land use and Forestry
- > Agriculture
- > Negative emissions technologies (NET)



Chapter 2 Buildings







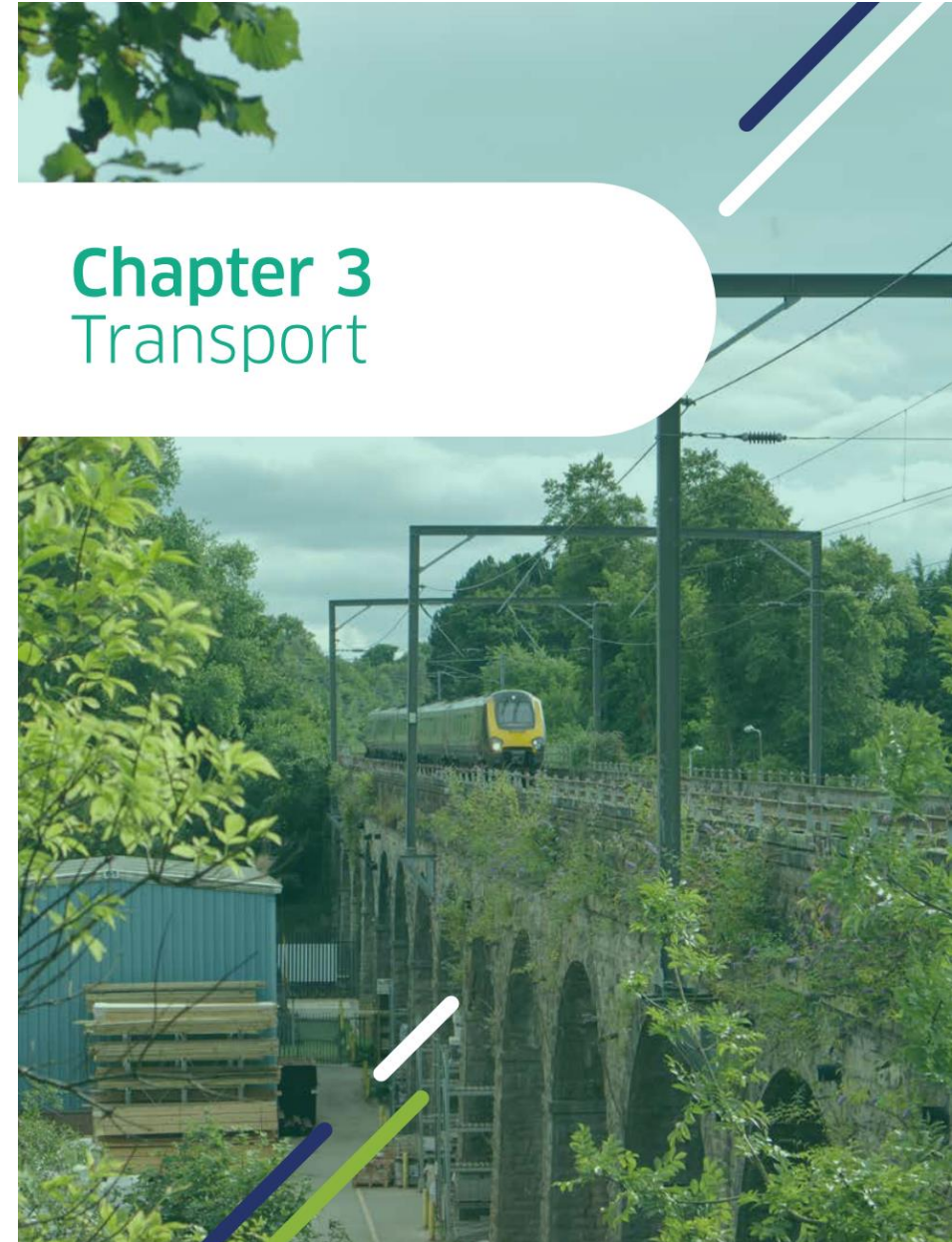
Part 2

What now?



Transport

- > Electricity
- > Buildings
- > Transport
- > Industry
- > Waste and Circular Economy
- > Land use and Forestry
- > Agriculture
- > Negative emissions technologies (NET)





2020

2021

Active travel

£500 million investment in active travel projects over five years with £39 million invested through the Spaces for People programme in 2020.

£9 million Scottish Ultra Low Emission Bus Fund.
£500 million to improve bus priority infrastructure.

Bus

Publication of a route map to meet reduction of 20% car km by 2030.

Zero Emission heavy duty vehicle programme established and investment in new zero drivetrain testing facility.

£120 million over the next five years for Zero Emission Buses.

Car
HGV

2030

2025

Bus

2024

Need for new petrol and diesel cars and vans phased out.
Car kilometres reduced by 20%.

Conditions created to phase out the need for all new petrol and diesel vehicles in Scotland's public sector fleet.

Car

Car

Need for any new petrol and diesel light commercial vehicles in public bodies phased out.

Delivery of our first Active Freeways: segregated active travel routes on main travel corridors.

Active travel

Majority of new buses are zero emissions.

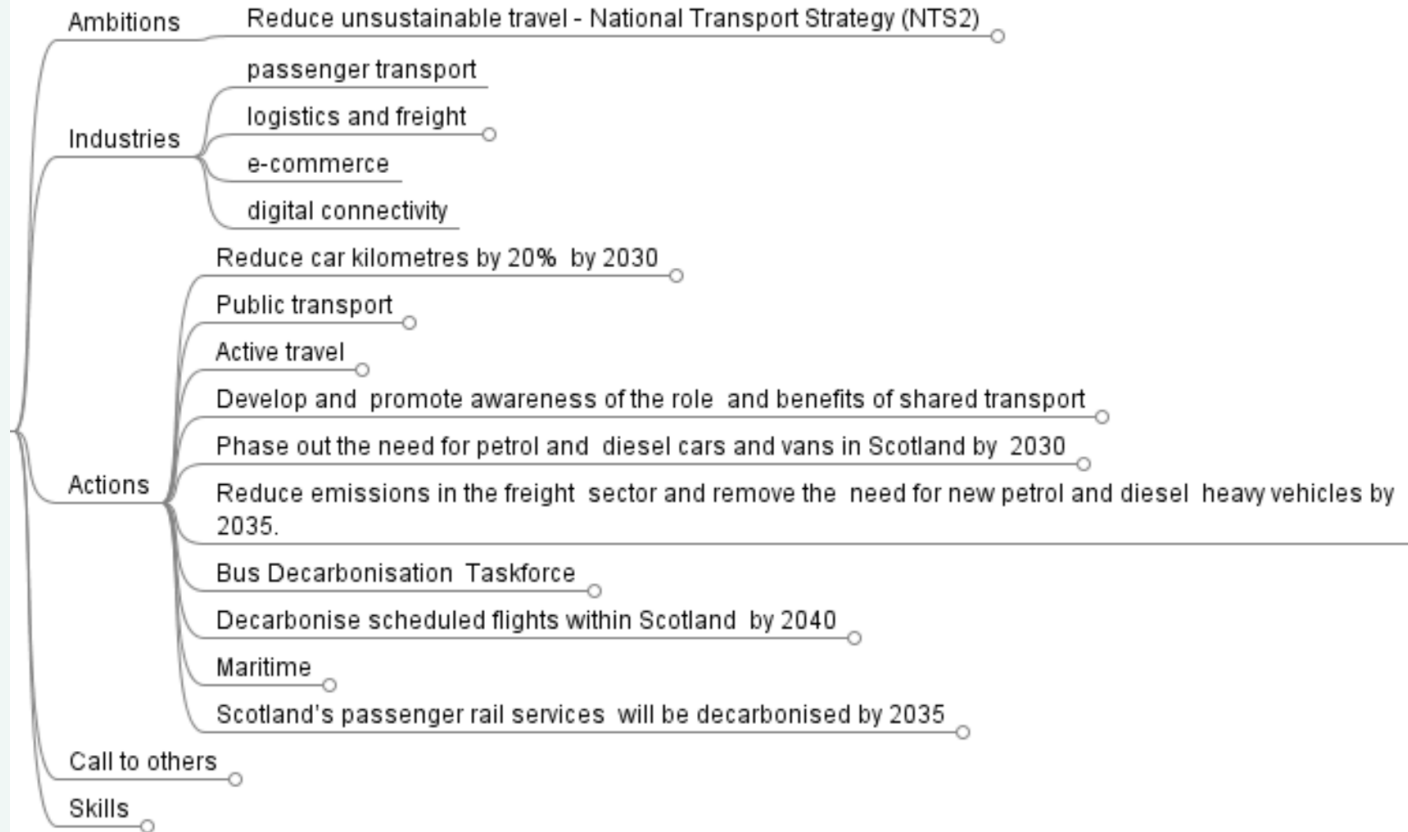
Bus

2032



Scotland's passenger rail services considerably decarbonised, with just a few years to go until they are fully decarbonised.

Rail decarbonisation



Part 2

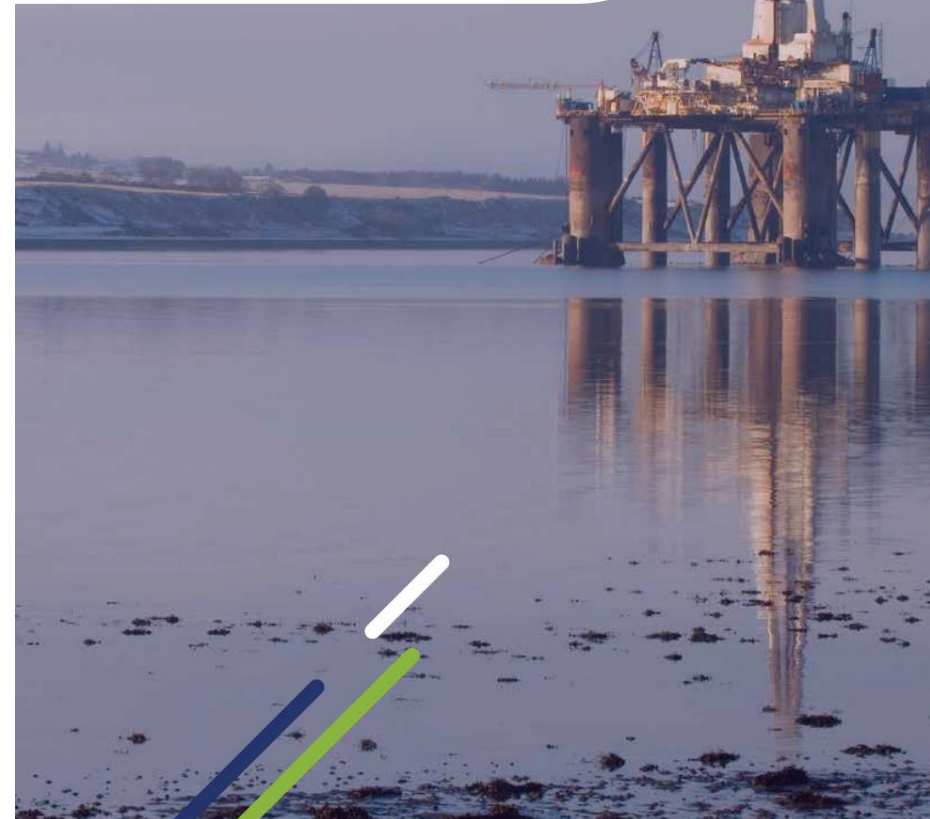
What now?



Industry

- > Electricity
- > Buildings
- > Transport
- > Industry
- > Waste and Circular Economy
- > Land use and Forestry
- > Agriculture
- > Negative emissions technologies (NET)

Chapter 4 Industry





2020

2021

Efficiency

Manufacturing

ETS

Energy Transition Fund launched.
Hydrogen Policy Statement is published.
Grangemouth Future Industry Board launched.

Scottish Industrial Energy Transformation Fund (SIETF) launched, including £34 million over 5 years (2021-2026) for projects at industrial sites for energy efficiency or deeper decarbonisation.

Hydrogen Action Plan is published.
Low Carbon Manufacturing Challenge Fund launched.

Scottish Industrial Decarbonisation Partnership launched.

On the basis that a UK ETS is implemented, a further joint UK Government & devolved administration consultation on changes to the UK ETS for consistency with Net Zero.

First tranche of funding available from the £180 million Emerging Energy Technologies Fund.

Hydrogen Decarbonisation Grangemouth

2022

Technologies

Scottish Net Zero Roadmap (SNZR) published.

Net Zero Transition Managers Programme launched.



Acorn – H2, CCS, CCU, DAC

2026

Carbon Capture and Utilisation Challenge Fund.

CCU

Jan 2023 or Jan 2024 UK ETS cap on emissions is changed following consultation, for consistency with Net Zero.

ETS

Acorn Project Development: 2024 – CCS Demonstration and commercialisation at St Fergus Gas Plant; 2025 – Acorn Hydrogen, hydrogen production with CCS; 2026 – Shipped imports of CO2 for storage in the Acorn store; 2026 – Direct Air Capture and Storage operating from St Fergus.

ETS

Mid-phase of UK ETS – this is when any changes as a result of system wide reviews could be implemented at the earliest: change to free allocation, offsetting, scope etc.

By 2032, emissions need to decrease by 43% on 2018 levels

Ambitions

Development of a carbon capture and storage (CCS) network is described by the Committee on Climate Change (CCC) as a “necessity, not an option”

Use of hydrogen to displace fossil fuels in industry

Industries

Partnerships

Negative Emissions Technologies (NETs)

Actions

Emissions Trading Scheme (ETS)

Support for commercialisation of Carbon Capture Utilisation and Storage (CCUS)

Emerging Energy Technologies Fund of £180 million

Industrial Cluster Representation and Roadmap

£5 million Carbon Capture and Utilisation Challenge Fund - technologies and innovations that can capture and create value in CO2, reduce emissions and develop new income streams

Opportunities for Hydrogen in Industry - supporting the development of the emerging hydrogen sector in Scotland

Green Jobs Fund - £100 million to help businesses create new, green jobs via the Green Jobs Fund

Investing with the industrial manufacturing sector

Net Zero Transition Managers Programme

Creating market benefit for Scottish industries that invest to decarbonise

Making Scotland's Future

Grangemouth Future Industry Board

Scotland's Climate Emergency Skills Action Plan and Manufacturing Skills Academy

£62 million pound Energy Transition Fund (ETF)

Call to others

Skills

Part 2

What now?



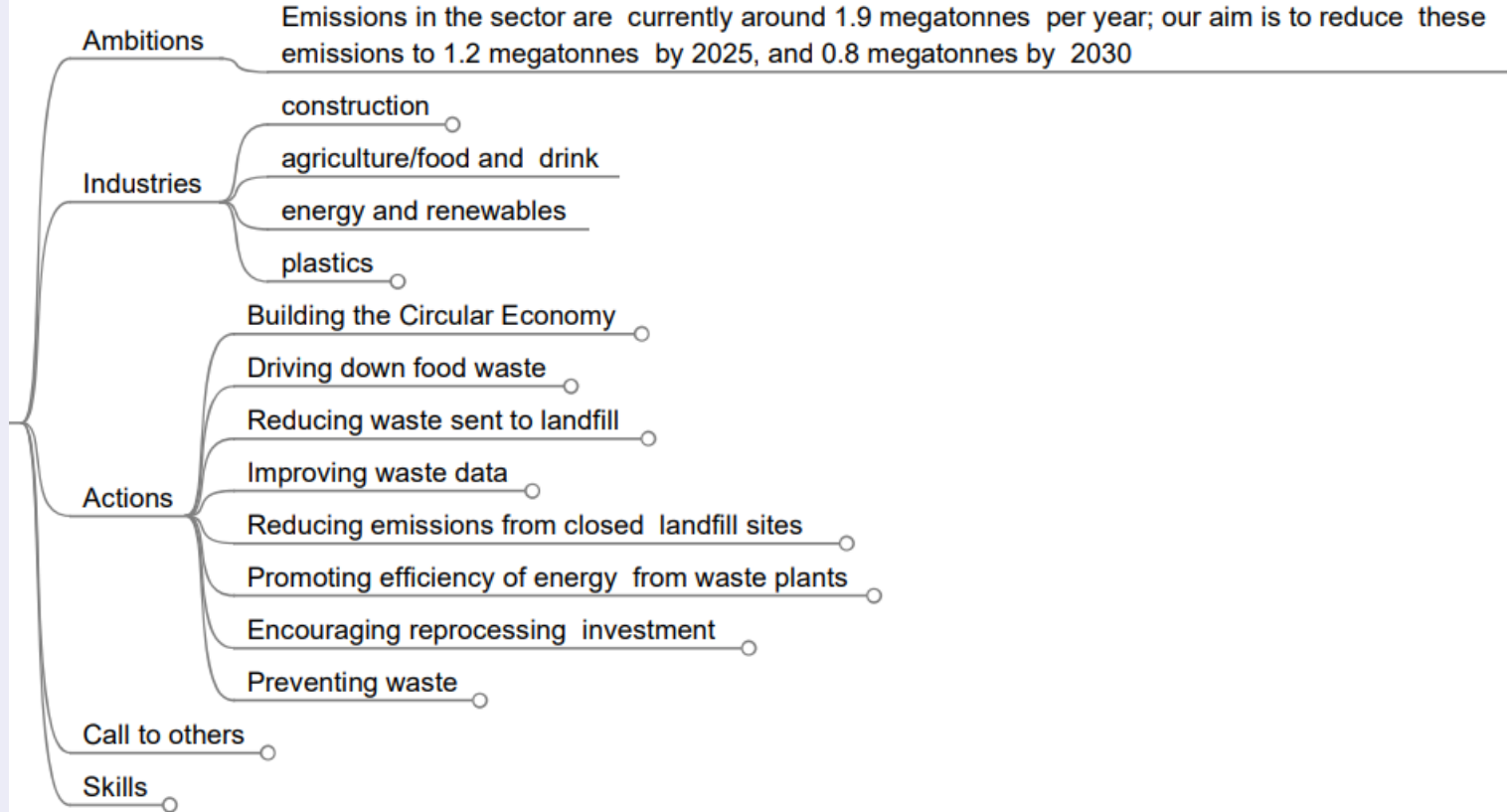
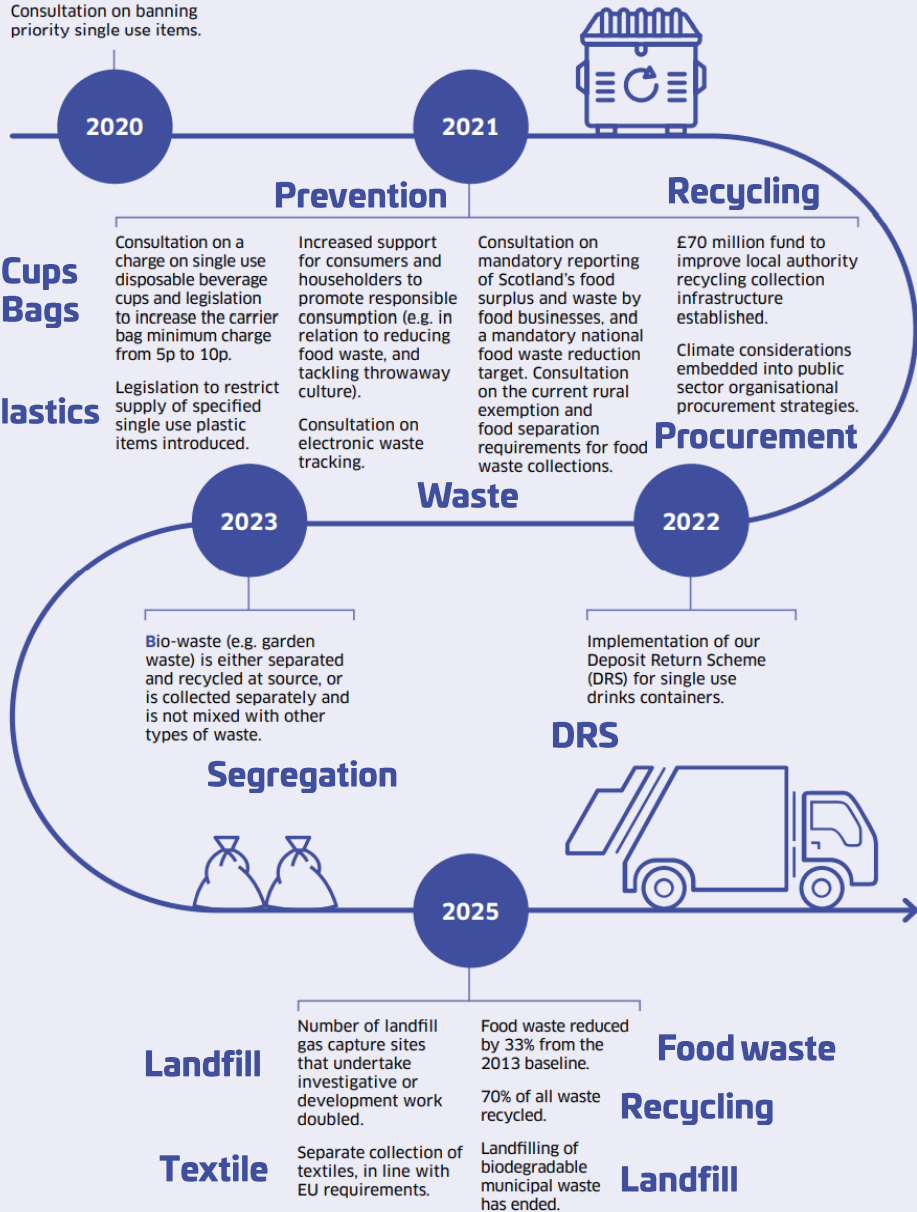
Waste and Circular Economy

- > Electricity
- > Buildings
- > Transport
- > Industry
- > Waste and Circular Economy
- > Land use and Forestry
- > Agriculture
- > Negative emissions technologies (NET)



Chapter 5 Waste and the Circular Economy





Part 2

What now?



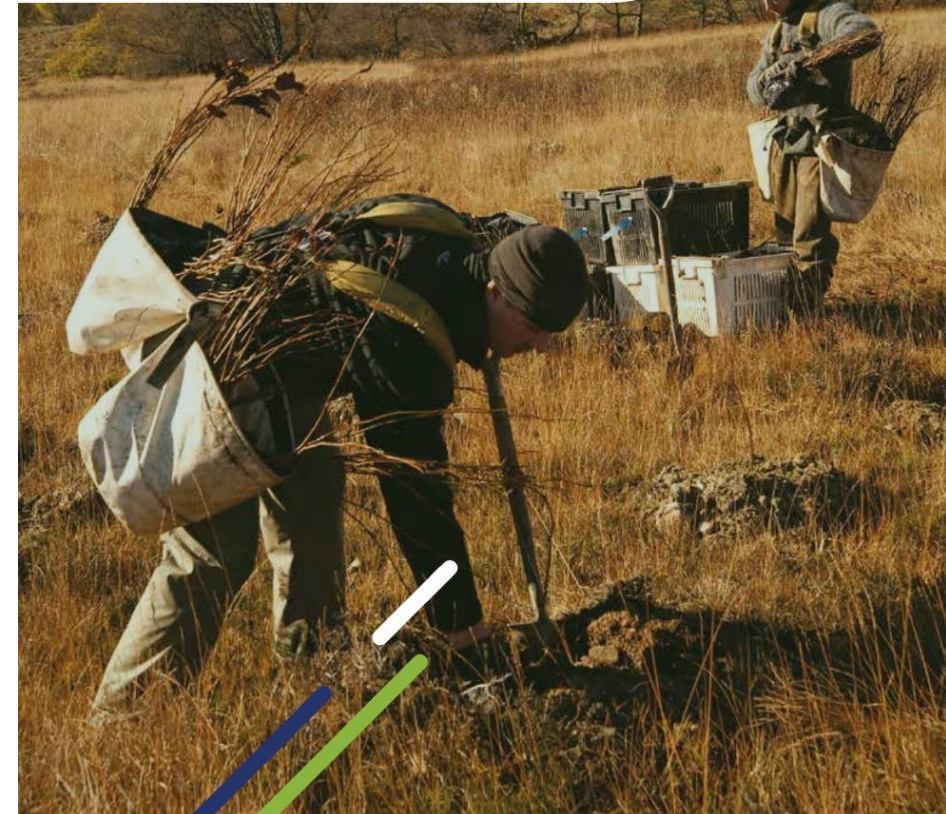
Land use and Forestry

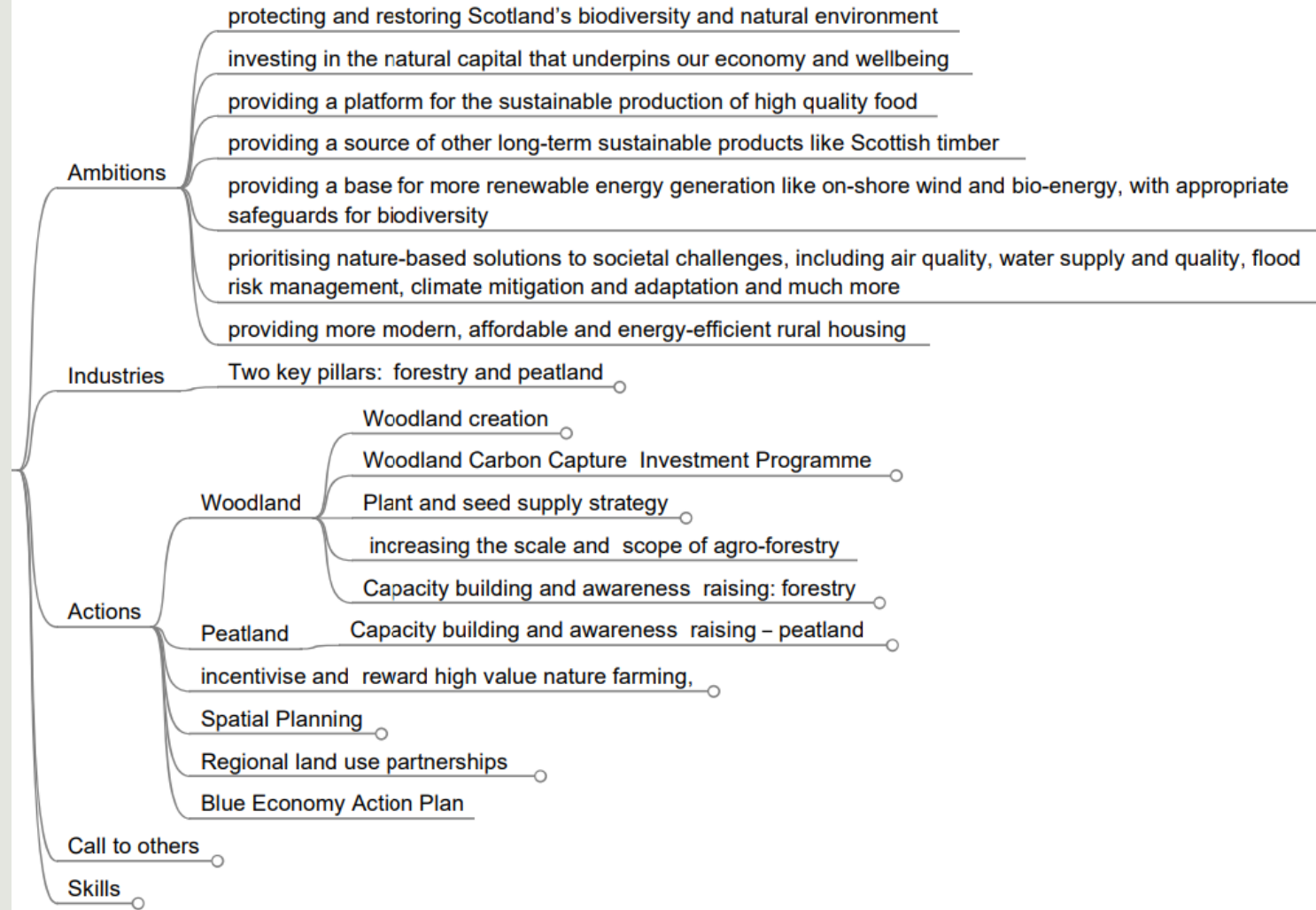
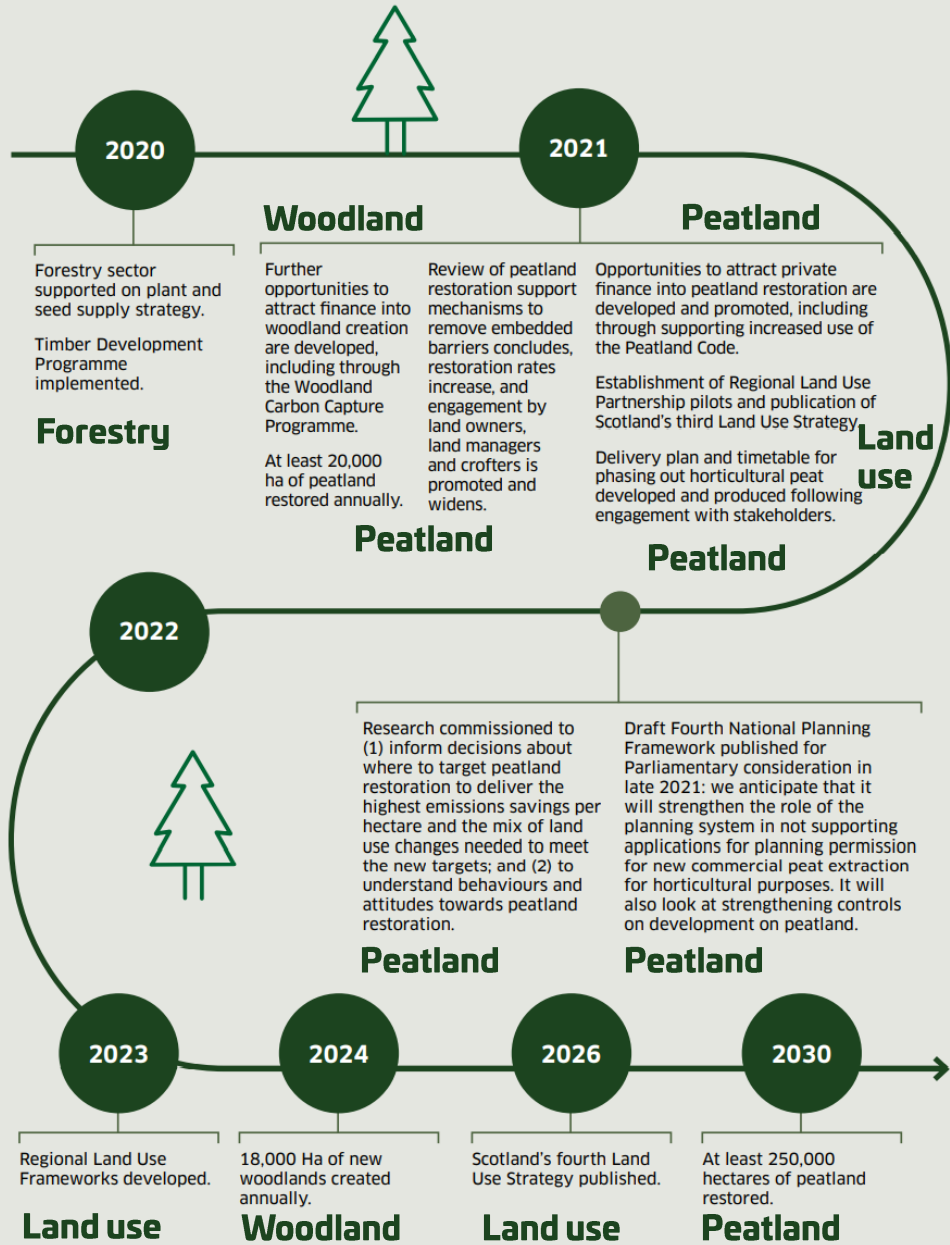
- > Electricity
- > Buildings
- > Transport
- > Industry
- > Waste and Circular Economy
- > Land use and Forestry
- > Agriculture
- > Negative emissions technologies (NET)



Chapter 6

Land Use, Land Use Change and Forestry





Part 2

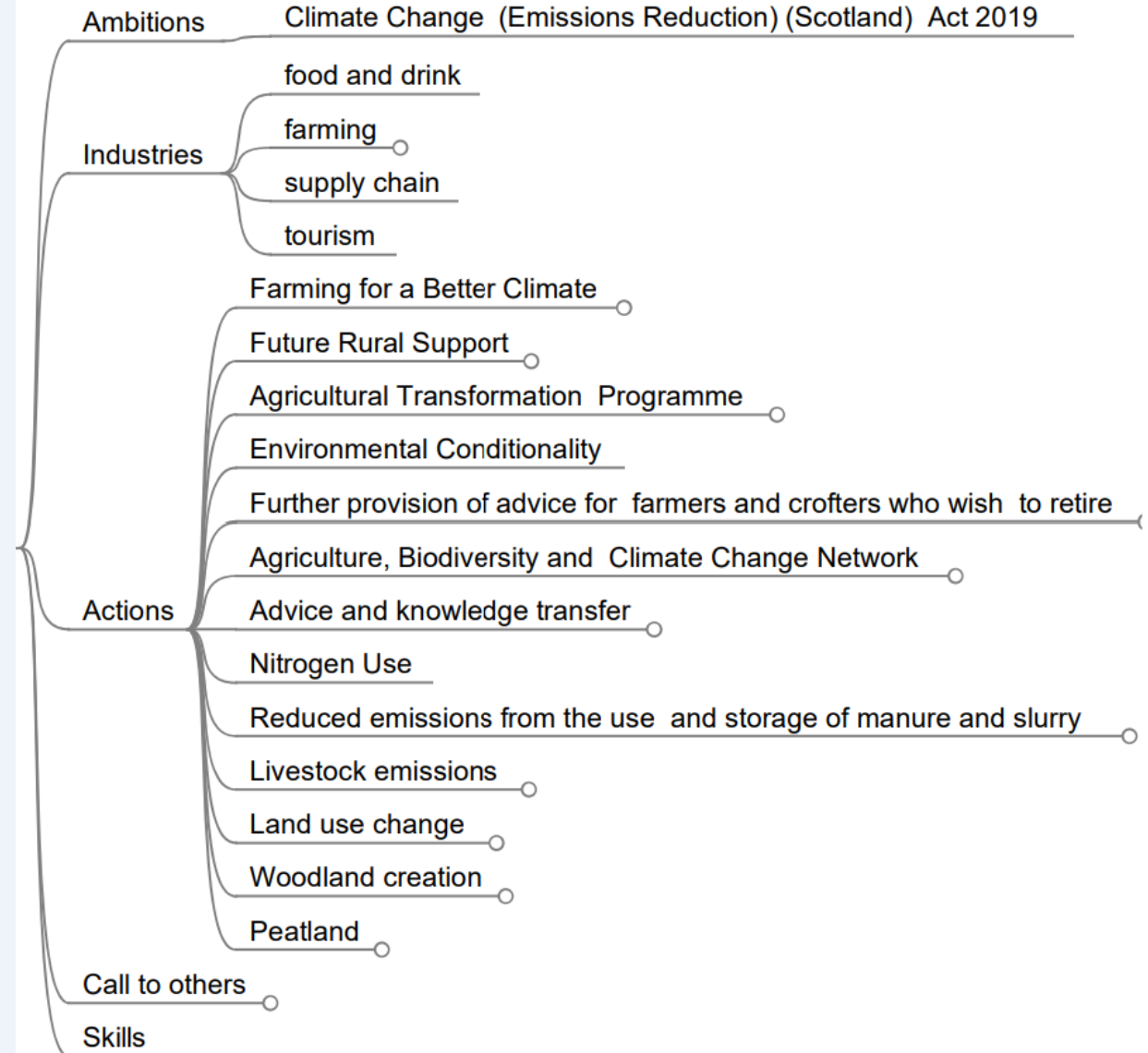
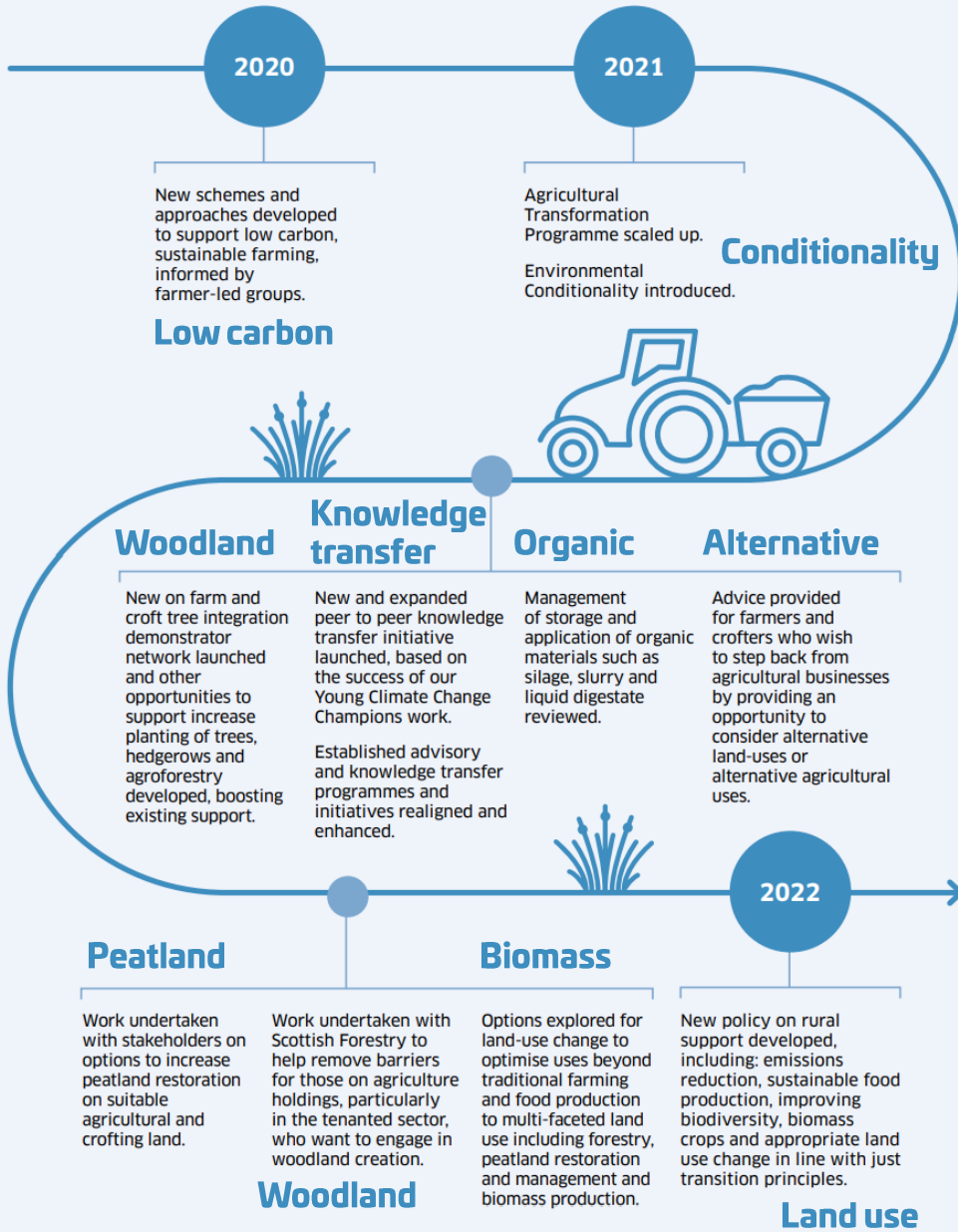
What now?



Agriculture

- > Electricity
- > Buildings
- > Transport
- > Industry
- > Waste and Circular Economy
- > Land use and Forestry
- > Agriculture
- > Negative emissions technologies (NET)





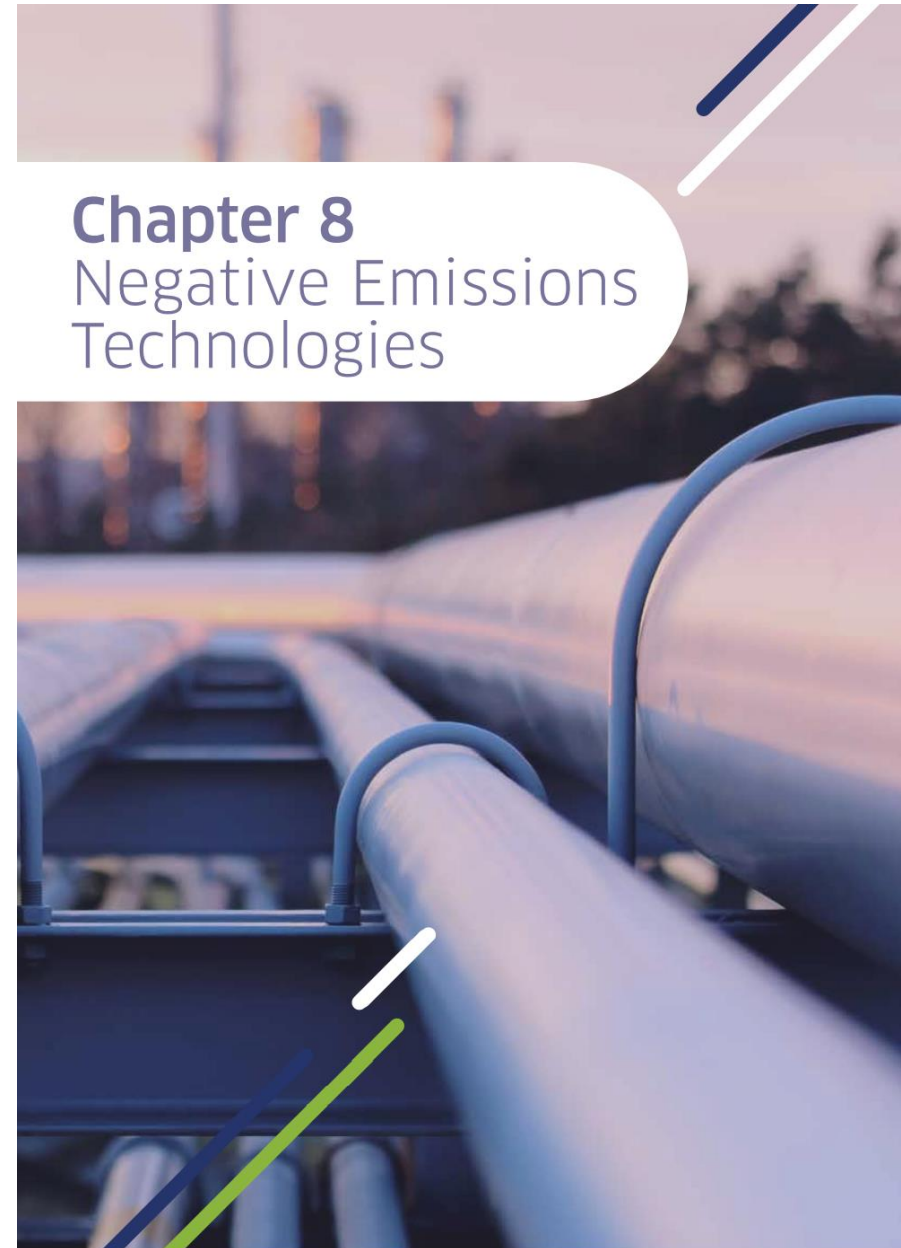
Part 2

What now?

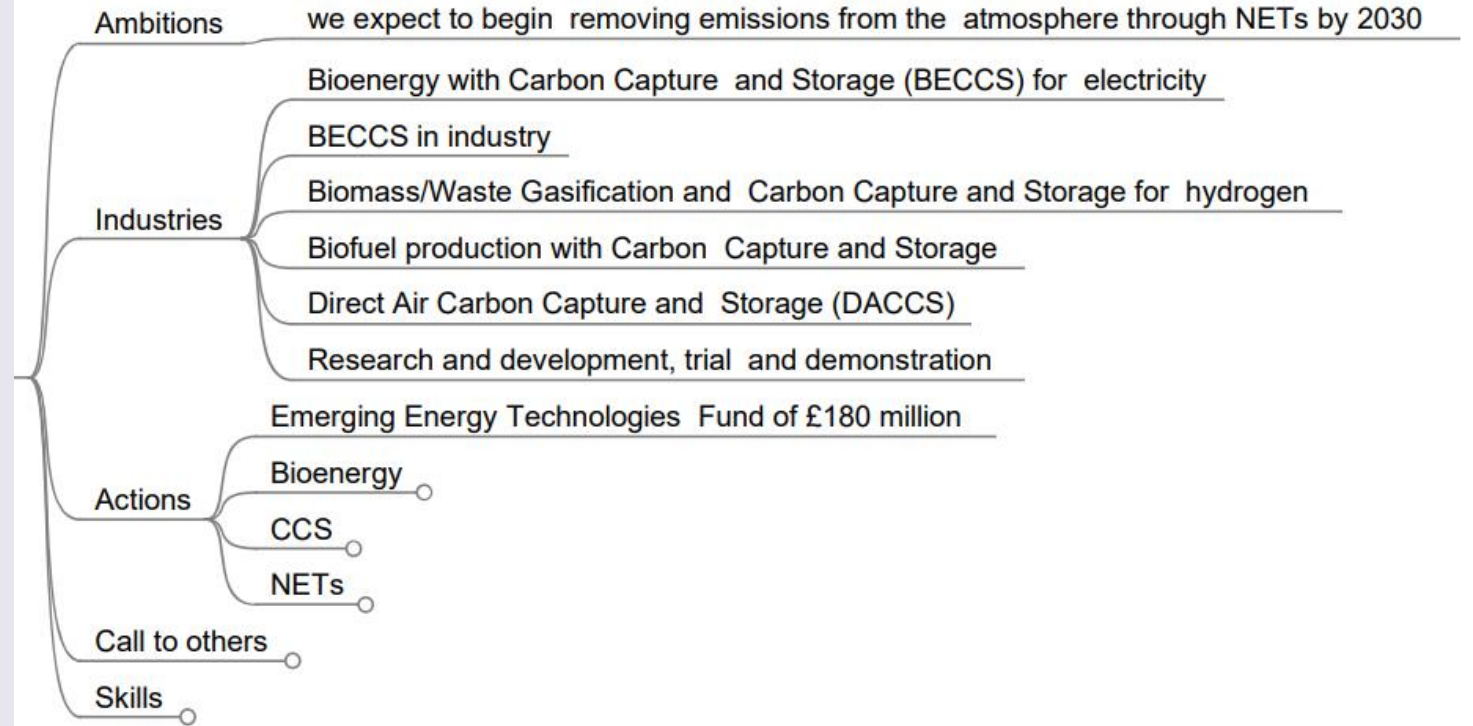
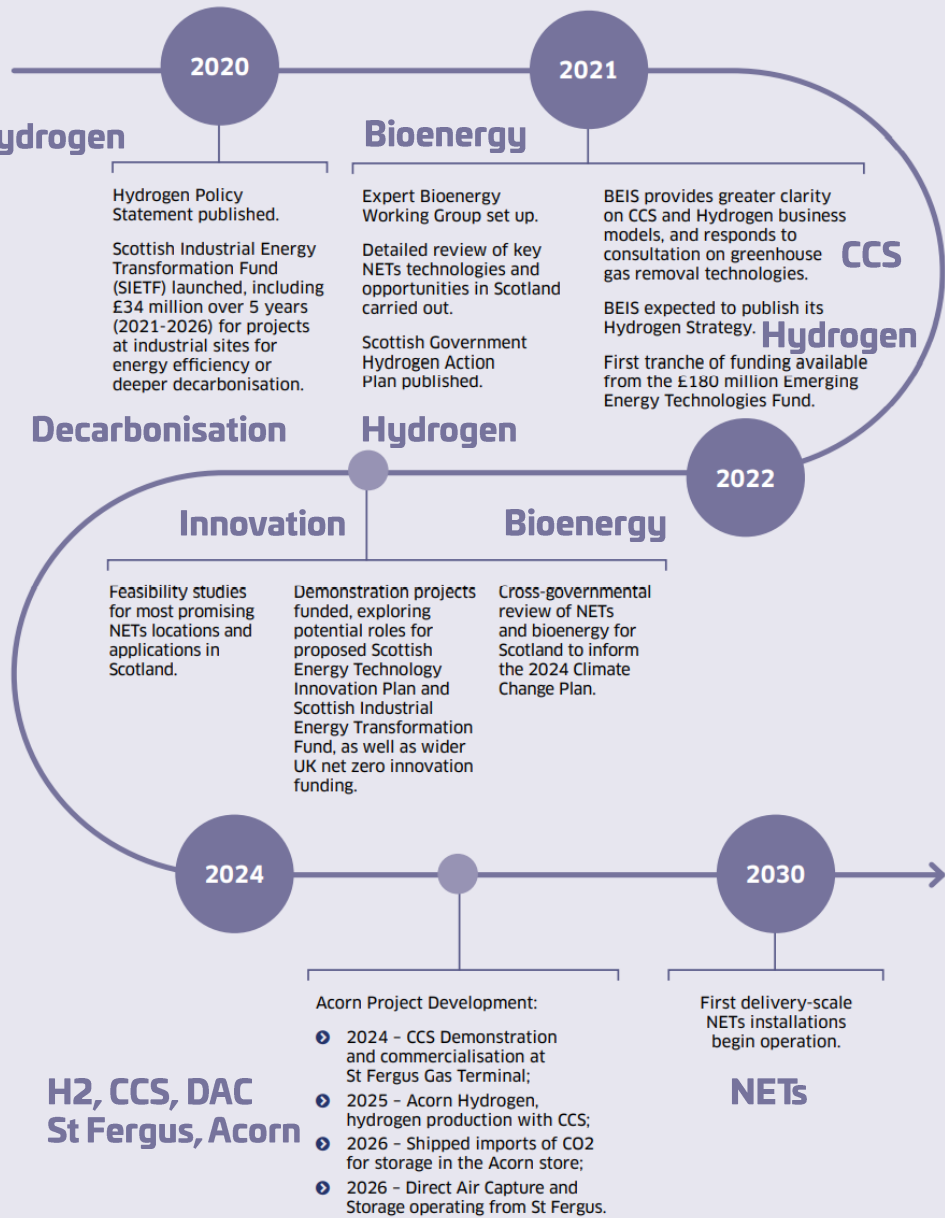


Negative emissions technologies

- > Electricity
- > Buildings
- > Transport
- > Industry
- > Waste and Circular Economy
- > Land use and Forestry
- > Agriculture
- > Negative emissions technologies (NET)



Chapter 8 Negative Emissions Technologies



Net-Zero Skills Support Programme



Eric Boinard
Project Lead Net Zero Skills
ericboinard@scottishengineering.org.uk



Webinars

- > <https://scottishengineering.org.uk/net-zero-skills/>
 - > Skills for a Green Recovery – Part 1&2 (April 27)
 - > Skills for a Green Recovery – Part 3&4 (May 4)
 - > Skills for a Green Recovery – Chapter specific
- (note: chapters and dates to be agreed)

One-to-One

- > Please make a note of interest to:
 - > scoteng.org.uk
 - > 0141 221 3181

Skills for a Green Recovery

What does **Net Zero** mean?



Part 1 - **Why** now?

- > Who cares



Part 2- **What** now?

- > Opportunities in each of the 8 key sectors identified



Part 3 - **How** now?

- > What, Why, Who, When, Where, How, How much



Part 4 - **Resources**

- > Policy, references, publications



Thank you



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