UK Power Sector: Delivering a Sectoral Investment Roadmap

Final Report

August 2025

Baringa is a certified B Corp™ with high standards of social and environmental performance, transparency and accountability.

Table of contents

What are the objectives of this document?

The objectives of this document are to:

1. **Develop a transferable method for creating Sectoral Investment Roadmaps** that will be aggregated into the overall Net Zero Investment Plan (NZIP). The UK government should introduce both components of the Net Zero Investment Plan, (1) regularly-updated sectoral investment roadmaps; and (2) ongoing financial flow tracking, to support the delivery of the carbon budgets and other whole-of-government actions, and to enable delivery of the Net Zero Strategy, to be updated this year.

2. **Develop a proof-of-concept using the GB power sector**, based on pathways delivering the Clean Power 2030 Mission and aligned with the role of electrification in the wider economy beyond 2030. The proof-of-concept will include:

Current investment levels (from flow tracking) mapped against clear sectoral investment targets based on the best-value technology mix and pathway to deliver net zero.

Suite of policies, including public investment, regulation, incentives, and market reform to enable sector to align with pathway to net zero. Each policy quantifies expected impact on deployment figures, private investment leveraged, and emissions reductions realised.

Assessment of cross-cutting barriers and interdependencies and identification of policies to overcome them.

Clear milestones and timelines to enable delivery tracking against investment and emissions targets.

The economic opportunity of Net Zero is huge

Net zero is the economic opportunity of the 21st century and must be central to the UK Government's growth mission and upcoming industrial strategy. The transition can deliver skilled jobs, economic growth and clean energy security while re-establishing the UK as a global leader in tackling the climate and nature crises. It is estimated up to **£57 billion could be added to the UK economy by 2030 through the net zero transition**, while delivering **up to 1.6 million jobs**.

One of the major barriers to the UK delivering on its net zero goals, and accessing the economic benefits that will come with it, is attracting the required investment. The UK lags its G7 competitors in terms of investment, **UK companies have invested 20% less than those in the US, France and Germany since 2005**, placing Britain in the bottom 10% of OECD countries, and costing the economy 4% of GDP.

This must be turned around if the UK is to meet its net zero targets. **The Climate Change Committee (CCC) estimates that UK low-carbon investment will need to scale up to £50 billion per year to deliver net zero**, with most of this investment expected to come from the private sector.

By 2030 the net zero transition could result in…

~£57bn added to the UK economy

up to 1.6 million jobs

However, UK low-carbon investment will need to…

scale up to £50bn per year

Government must provide clear direction to enable green investment

Private finance will only be mobilised if government uses all the tools at its disposal, including regulation, policy, and strategic public spending to incentivise private investment to flow towards public policy priorities.

The Government has put in place some important building blocks thus far:

Clean Energy Mission – Government has established its Clean Power 2030 Mission, with an over-arching delivery plan released in December 2024. The plan sets out a path to delivering up to £40billion of annual investment, as well as thousands of skilled jobs.

Establishing GB Energy – Government has set up GB Energy to invest and drive clean energy deployment across the country. GB Energy will be headquartered in Scotland and backed by £8.3 billion of new money.

Establishing the National Wealth Fund (NWF) – The UK Infrastructure Bank has been relaunched as the NWF, with a focus on delivering catalytic capital into green industries. At least £5.8 billion of the NWF's capital will focus green hydrogen, carbon capture, ports, gigafactories and green steel.

Invest 2035: The UK's Industrial Strategy – The Government is consulting on its Industrial Strategy, to be finalised in the Spring of this year. Capturing the growth opportunities of the net zero transition is one of the core objectives of the proposed industrial strategy.

Commitment to reduce emissions by 81% by 2035 with work underway on updated Carbon Budget Delivery Plan – The UK announced its updated Nationally Determined Contribution of an 81% reduction in emissions by 2035. Government is now working to publish updated Carbon Budget Delivery Plan

But as investors and private sector stakeholders have highlighted, these interventions do not amount to an economy-wide investment plan. Further clarity is required to unlock investment across the economy. Lack of policy certainty is preventing the market from providing private capital at the quantity and pace required to kick start competitive green industries in the UK and meet official decarbonisation goals.

To deliver on the UK's updated NDC a step change will be required in Government policymaking. Investors and businesses have repeatedly called for further action – with **leading UK institutions managing over £3 trillion in AUM calling for a plan to deliver the investment required for the transition.**

Baringa

A comprehensive Net Zero Investment Plan will provide clarity for investors

The UK requires a robust plan for delivering the investment needed to meet its climate targets and capture the sizeable economic benefits of the green transition. E3G, alongside WWF-UK and a host of private sector partners, has been calling for Government to deliver a **Net Zero Investment Plan (NZIP).** The NZIP consists of:

SECTORAL INVESTMENT ROADMAPS

- A credible, and regularly updated view of the investment gap in each key sector
- A coherent set of incentives that the Government will put in place (policy, regulation, public investment) to overcome barriers to the flow of private finance within each sector
- A consistent sectoral view of financing plans, rather than a technology specific view

FINANCIAL FLOW TRACKING

- Monitoring and reporting of public and private financial flows towards net zero, highlighting progress and where investment gaps exist
- This would create an ongoing feedback loop, allowing government to update roadmaps based on the latest information, enabling rapid course correction, better strategy delivery, and more precise targeting of limited public funds

The roadmaps, taken together, would provide a **comprehensive, cross-economy strategy for crowding in the investment** needed to drive growth and meet the UK's net zero objectives. This would directly underpin the soon to be updated Carbon Budget Delivery Plan and Net Zero Strategy. This approach would:

- **Provide a clear and regularly iterated investment plan**, developed in partnership with industry to deliver on the Government's growth mission and decarbonisation goals
- **Enable identification of investment gaps and opportunities** to ensure that public investment, including via the National Wealth Fund and GB Energy, is strategically targeted to achieve maximum impact and crowd in private investment.
- **Establish open and impactful collaboration with investors and the private sector** to bolster confidence and boost much-needed investment into the UK economy.

Rather than reiterate the growing consensus around the need for a plan, this study sets out a clear methodology for how Government should develop the detailed sectoral investment roadmaps that underpin the NZIP. The Government's Clean Power Mission sets out the most ambitious plan for any sector and makes for a great example of what a sectoral investment roadmap needs to show.

Key: Focus for this report

Baringa

2. Developing Sectoral Investment Roadmaps

A transferable methodology across sectors

A structured approach is critical to effective investment planning across each of the sectors

Overall planning for Sectoral Investment Roadmaps :

Executing and Reviewing Individual Sectoral Investment Roadmaps:

	Laying the Foundations	Building the Roadmaps	Monitoring and Reassessing the Impact
OVERVIEW	*The sectoral investment roadmaps focus on the eleven sectors outlined in the CCC's Carbon Budgets and ladder up to an overarching plan (the Net Zero Investment Plan – NZIP).* *To ensure alignment and congruence across the sectors, it is critical for the UK Government to ensure the processes are set up for success.*	*The Sectoral Investment Roadmap aims to support effective policy making to bring forward Net Zero investment. As such, it must set out actions to leverage in private investment and to align the sector with the necessary emissions reduction pathway. It must also consider regulatory and fiscal incentives, as well as strategic public investment, required to unlock private sector investment. A clear, timed action plan with specific targets and milestones will be key to demonstrating commitment.*	*To ensure that the roadmaps remain a valuable resource for the public and private sectors, they must be tracked for progress and updated every three years in line with Spending Reviews. Interim annual light-touch updates are also required to monitor progress and update data. This should include progress assessments on deployment rates of key technologies, total investment flows, and expected and actual emissions reductions.*
ACTIONS REQUIRED	The UK Government should: • **Select appropriate Sectoral Decarbonisation Pathways** (see overleaf) • **Establish and co-ordinate a cross-Whitehall Programme Board** to oversee the development of the sectoral roadmaps • **Define concrete terms of reference** for the roadmaps, roles and responsibilities across three-yearly and yearly timelines • **Define reporting requirements** which should be the same, where possible, for all sectors • **Set up a cross-directorate internal HMT programme board** to coordinate cross-sector issues such as skills, supply chains, and carbon taxation • **Mandate departments to develop roadmaps** according to their relevant sectors and update them every three years in line with Spending Reviews, with interim annual light-touch updates to monitor progress and update data	Departments responsible for the sector roadmaps should: 1. **Undertake the fundamental analysis,** in partnership with business and key government departments, to determine: • What are the finance requirements? • What are the policy requirements? • What are the enabling requirements? • Are there cross-sectoral elements to consider? A methodology for carrying out the fundamental analysis is presented overleaf 2. **Develop the roadmap:** • Leverage the fundamental analysis to develop a **timed action plan** so it can be implemented within specific timeframes • Map this back against a counterfactual (i.e. if legislation does not go through) to **understand dependencies** • Define the **targets and identify the key milestones** against the flow of time	Departments responsible for the sector roadmaps should: • **Monitor outcome** against baseline and analyse **impact of evolving conditions, particularly under a changing UK transition context** • **Undertake market engagement** (in cooperation with HMT and the OBR) to collect feedback on barriers and investment gaps, which should then feed into adjustments to the roadmaps • **Reassess and course-correct** targets and milestones if required • **Undertake updates to the plans** to include progress assessments on prosperity and climate goals, and private investment leverage ratios • **Report progress and changes** in accordance with the reporting requirements set out by the UK Government

Source: "Boosting Growth, Building Resilience - How To Implement A Net Zero Test And Net Zero Investment Plan" by WWF-UK and E3G

Laying the foundations will ensure that the roadmaps build towards a plan that becomes a valuable tool to support Government with effective policy-making for net zero investment

Laying the Foundations → Building the Roadmaps → Monitoring and Reassessing the Impact

The UK Government should:

- **Select appropriate Sectoral Decarbonisation Pathways**
- *Establish and co-ordinate a cross-Whitehall Programme Board*
- *Define concrete terms of reference*
- *Define reporting requirements*
- *Set up an internal programme board for cross-sector issues*
- *Mandate departments to develop roadmaps*

Note: Items in grey, for 'Laying the Foundations", are outside Baringa's scope to further define

Sectoral Decarbonisation Pathways

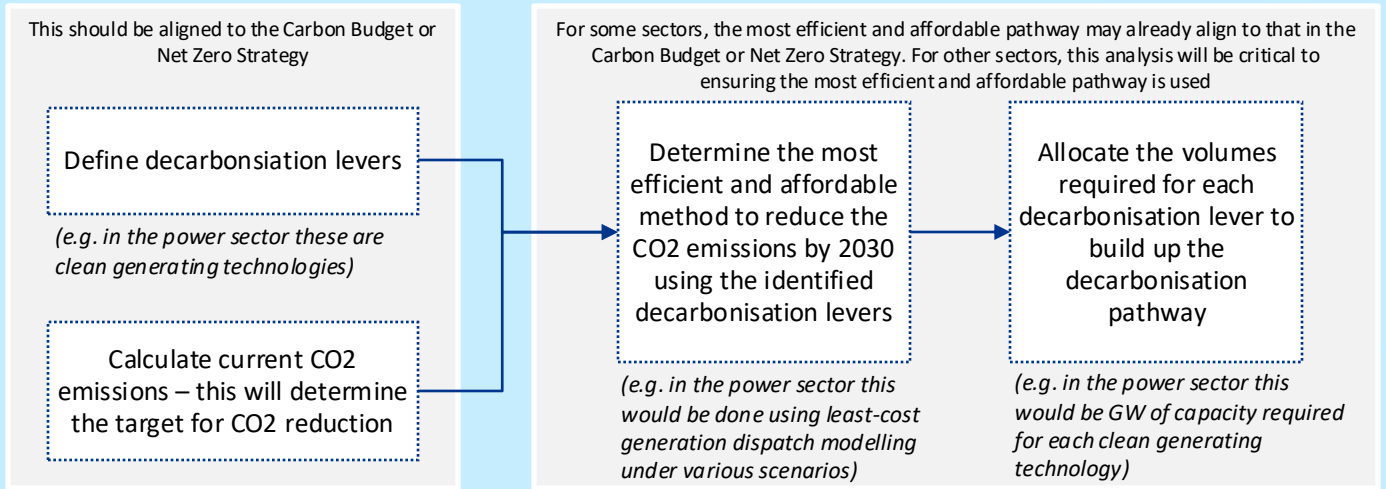
The Sectoral Decarbonisation Pathways will set out the overall 'goal' for building the roadmaps. This is a separate element that will form the basis upon which the Sectoral Investment Roadmaps will be built.

The CCC's Carbon Budget and Net Zero Strategy can be leveraged as a foundation for this work.

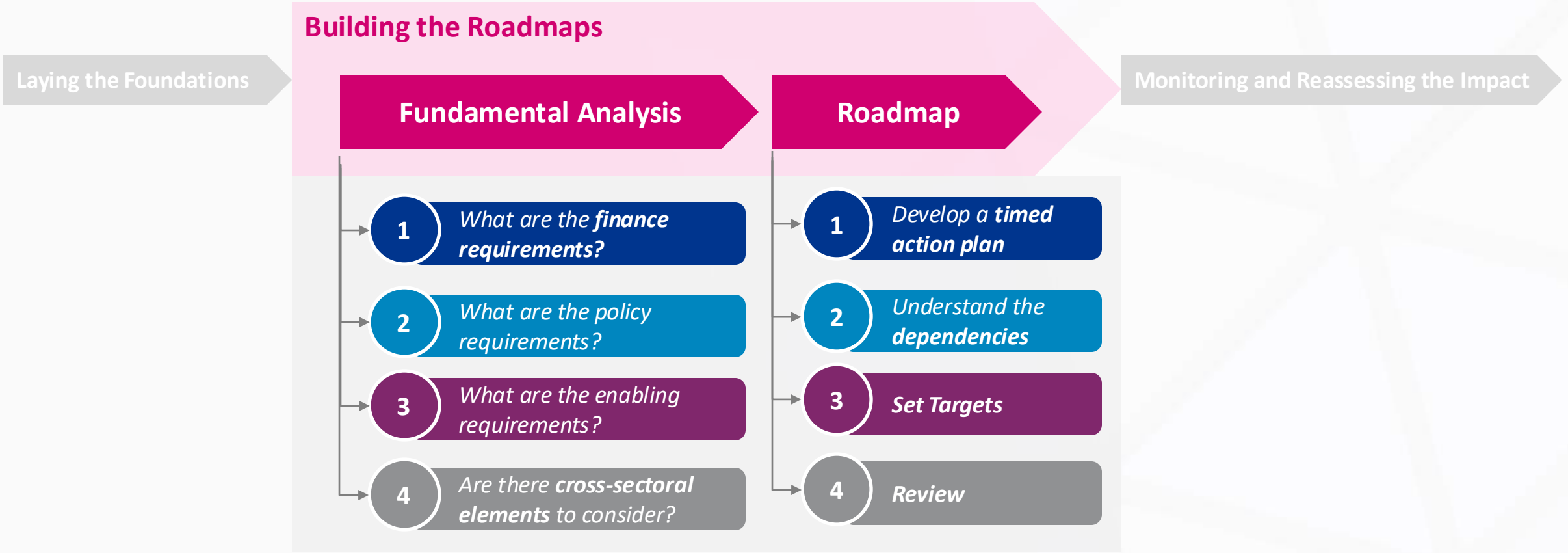
However, as there are many potential pathways to decarbonise a sector, it will be critical to select the most efficient and affordable pathway to reduce the CO2 emissions, whilst still aligning to Government's overall strategy.

A high-level methodology for doing so is set out below. The method should be transferable across sectors, noting that the detailed methodology will differ by sector and will depend on the availability of data.

Note that for individual sectors it will be essential to obtain input from industry and decarbonisation experts to further develop sector-specific detail into the high-level methodology below.



Building the roadmaps requires answering four fundamental questions that underpin the analysis and inform the action plan



The fundamental analysis identifies gaps in finance, policy, and delivery, alongside cross-sectoral issues

SCETORAL DECARBONISATION PATHWAYS

1 What are the finance requirements?

a Investment Quantum

- **Annual rate of spend required** on clean technologies (decarbonisation levers) to achieve sectoral decarbonisation targets

b Historical Spend

- **Historical spend** on clean technologies (decarbonisation levers)

c Finance Gap

- **Additional investment needed** to achieve sectoral decarbonisation targets

2 What are the policy requirements?

a Policy Direction

- The degree to which policies make **low-carbon investments profitable** relative to incumbent fossil fuel

b Policy Ambition

- The **scale of policy support needed** to bring forward the target-consistent decarbonisation levers (e.g. is sufficient budget put towards policy mechanisms?)

c Policy Gap

- **Additional or change in policy required** to ensure that policies are **fit for purpose** to attract sufficient private sector finance to deliver the investment required?

3 What are the enabling* requirements?

a Supply Chain Capacity

- Define **any blockers** to spending the available capital

b Investor Appetite

- Assess for **sufficient capital** available from investors**
- Define if there are **any blockers** to spending available capital (e.g. are investors put off by high risks or lack of confidence in policy)

c Delivery Gap

- **Additional actions** to enable available capital

** **Enabling requirements** are based on the factors that enable available capital. For example, supply chain capacity and capbilities, availability of talent, etc.*

*** Note that **private sector investment** applies to both investment organisations and individual investors (e.g. homeowners who may invest in heat pumps etc.). The investment needs and appetite for both groups must be considered*

4 Are there cross-sectoral elements to consider?

a Cross Sectoral Challenges

- Opportunities and challenges from action in other sectors that impact this sectors

b Positive Spillovers

- Positive impact from action in this sector on any other sectors

Baringa

The finance gap is defined as the difference between required and historical rates of investment

Proposed methodology for Sectoral Investment Roadmap:

1 What are the finance requirements?

a) Investment Quantum	• This analysis should be based on the decarbonisation pathways (and the identified decarbonisation levers) that should have been developed as part of 'Laying the Foundations' • **Calculate quantum of CAPEX investment required** over a defined investment period to achieve the required decarbonisation pathway (calculation methodology may vary and will depend on sectoral data availability – see previous slide) • Note that the decarbonisation pathway should have been determined whilst considering the **efficiency of the decarbonisation levers** (e.g. for the power sector this would be ensuring that the most efficient and cost-effective generating technology stack is put forward)
b) Historical Spend	• Determine the **historical spend** for each of the decarbonisation levers in the sector. This is based on the average spend over the previous three years
c) Finance Gap	• Define the finance gap by **assessing scale of capex required relative to historical spend** to understand the growth challenges/opportunities (i.e. what is spent on clean technologies today vs. what will need to be spent each future year) • The finance gap should be further broken down by **public and private sector** finance. Note that, typically, public grants are used to bring forward private investment and this is assessed separately as part of (2b) Policy Ambition • Carry out an analysis on the finance gap to further understand whether the finance gaps has any **contingent investment implications** (e.g. in the power sector front-of-meter generation projects cannot be deployed without network investment)
d) Sensitivities	• Where relevant uncertainties are significant, determine scenarios for sensitivities for analysis – this will help to **develop a plan for 'no regrets' actions,** i.e. those that are required in all scenarios

Baringa

The policy gap checks for missing or inadequate policies

Proposed methodology for Sectoral Investment Roadmap:

2 What are the policy requirements?

a) Policy Direction	• **Review existing policy instruments** (e.g. CFD, RAB etc.) to bring forward CAPEX
	• **Map existing policy instruments against each relevant lever** for decarbonising the sector (e.g in the power sector this would be generating technology. In other sectors this might be tax on specific business components)
	• Assess the policy instruments' **fitness for purpose**:
	  • Is the policy **necessary**? (i.e. will the policy result in an increase in investment to support the relevant decarbonisation lever?)
	  • Is the policy **affordable**? (i.e. is this policy going to deliver the objective at the lowest cost to customers?)
	  • Is the policy of **minimum distortion**? (i.e. does this policy risk unintended consequences? e.g. distorting competition or industry's international competitiveness)

b) Policy Ambition	• Assess the historical government budget to understand whether a **scaling of budget is required** to draw forward the required investment to meet the investment gap. Note the 'scaling of budget' refers to the incremental increase in budget spend assuming an existing policy (i.e. what might be required to bridge the finance gap)
c) Policy Gap	• Define the policy gap by **leveraging historical use-cases** to compare against the current day baseline • Provide recommendations for new policy or policy modifications, or policy scaling if current policies are not considered to be fit for purpose. Note that any new policy recommendations will need to be assessed for their 'fitness for purpose', defined above. • Develop the policy roadmap required to bridge the policy gap

Note: See Slide 23 for decision tree illustrating at a high level how policy is assessed and rated

Baringa

The delivery gap pinpoints where supply chain capacity or investor appetite is insufficient

Proposed methodology for Sectoral Investment Roadmap:

3 What are the enabling requirements?

a) Supply Chain Capacity	• Determine the **CAPEX breakdown across equipment and labor** • Research equipment supply chain capacity against the CAPEX breakdown identified • **Identify any blockers to spending available capital** within the value chain (e.g. if historic CAPEX spend was much lower there is likely a scaling required in the supply chain to absorb any increase in CAPEX spend) • Recommend **enabling policies** that could alleviate these blockers
b) Investor Appetite	• Determine whether there is currently **sufficient capital available from investors** • Assess whether the cash-flow profile matches to some investment need (i.e. are projects bankable – e.g. in the power sector network regulatory asset base pays index linked returns over 40 years which align well with Pension Fund Liabilities) • **Identify any blockers to spending available capital** from the investor angle (e.g. are there high risks involved? Risks could include development risks, technology risks, project risks, regulatory risk, etc) • Recommend **enabling policies** that could alleviate these blockers
c) Delivery Gap	• Articulate the delivery gap (as per 3a and 3b) • Review the delivery gaps against the policy gaps to understand if there are any **interlinked impacts** (e.g. CfD policies will raise investor appetite by improving project bankability) • Build on the policy roadmap by including any enabling policy required to bridge the delivery gap

4 Are there cross-sectoral elements to consider?

a) Cross Sectoral Challenges	• Assess and idenfity any **opportunities and challenges from action in other sectors that impact this sector**, or vice versa
b) Positive spillovers	• Assess and identify whether **bridging the finance, policy and delivery gaps will result in positive impacts** in other sectors

Baringa

The roadmap should set out targets and milestones, with a clear understanding of any dependencies

Building the Roadmaps

Fundamental Analysis

1. *What are the **finance requirements?***
2. *What are the policy requirements?*
3. *What are the enabling requirements?*
4. *Are there **cross-sectoral elements** to consider?*

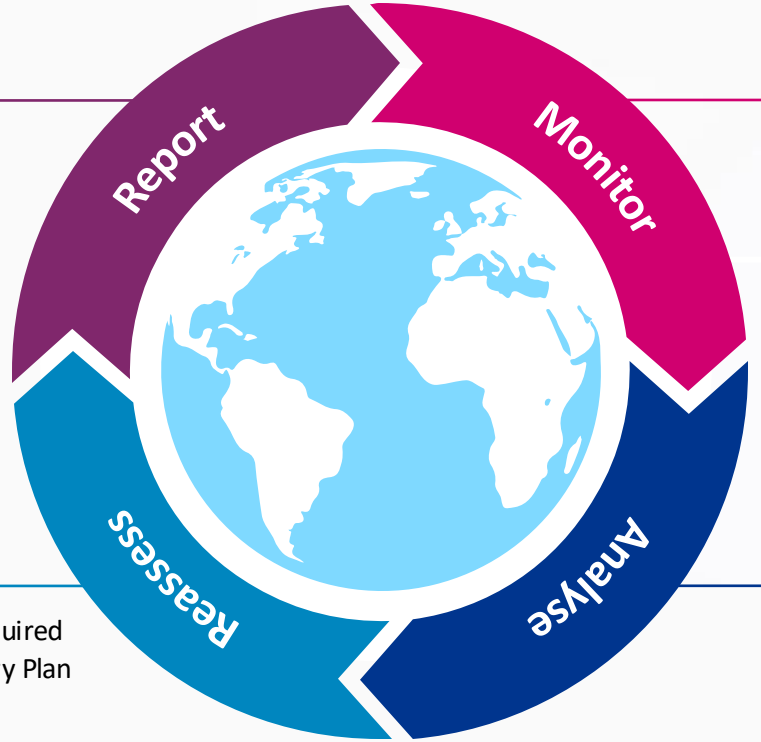
Roadmap

1. ***Develop a timed action plan***
   - Develop a timed action plan so policy can be implemented according to specific timeframes
2. ***Understand the dependencies***
   - Map this back against a counterfactual (i.e. if legislation does not go through) to understand dependencies
3. ***Set Targets***
   - Set out a timeline of targets and milestones
4. ***Review***
   - Review undertaken by programme board to ensure congruence and alignment with other sectors

Baringa

The review process should be accountable, clearly setting set out how and by whom regular reviews are conducted

Laying the Foundations | Building the Roadmaps | **Monitoring and Reassessing the Impact**



1. Monitor

- Monitor outcome against baseline and analyse impact of evolving conditions, particularly under a changing UK transition context

Success metrics should include:

- Volume of emissions reduced via each decarbonisation lever (actual vs.. planned)
- Investment brought forward for each decarbonisation lever (actual vs.. planned)
- Affordability – i.e. impact on customer's bills

2. Analyse changes

- Undertake market engagement (in cooperation with HMT and the OBR) to collect feedback on barriers and investment gaps, which should then feed into adjustments to the roadmaps
- This will also form valuable feedback for the overarching Carbon Budget Delivery Plan and Net Zero Strategy

3. Reassess targets

- Reassess and course-correct targets and milestones if required and feedback into the overarching Carbon Budget Delivery Plan and Net Zero Strategy
- Undertake updates to the roadmap to include progress assessments on overall success metrics
- Where evolving conditions significantly impact on the sectoral decarbonisation pathways, the pathway (and ensuing analysis) may need to be revisited to ensure the most efficient pathway continues to be the focus of the roadmap

4. Report

- Report progress and changes in accordance with the reporting requirements set out by the UK Government
- Reporting of the individual Sectoral Investment Roadmaps should account for overall Net Zero Strategy and government priorities

Baringa

3. Investment in the Clean Power Mission

Applying the sectoral roadmap methodology to the power sector

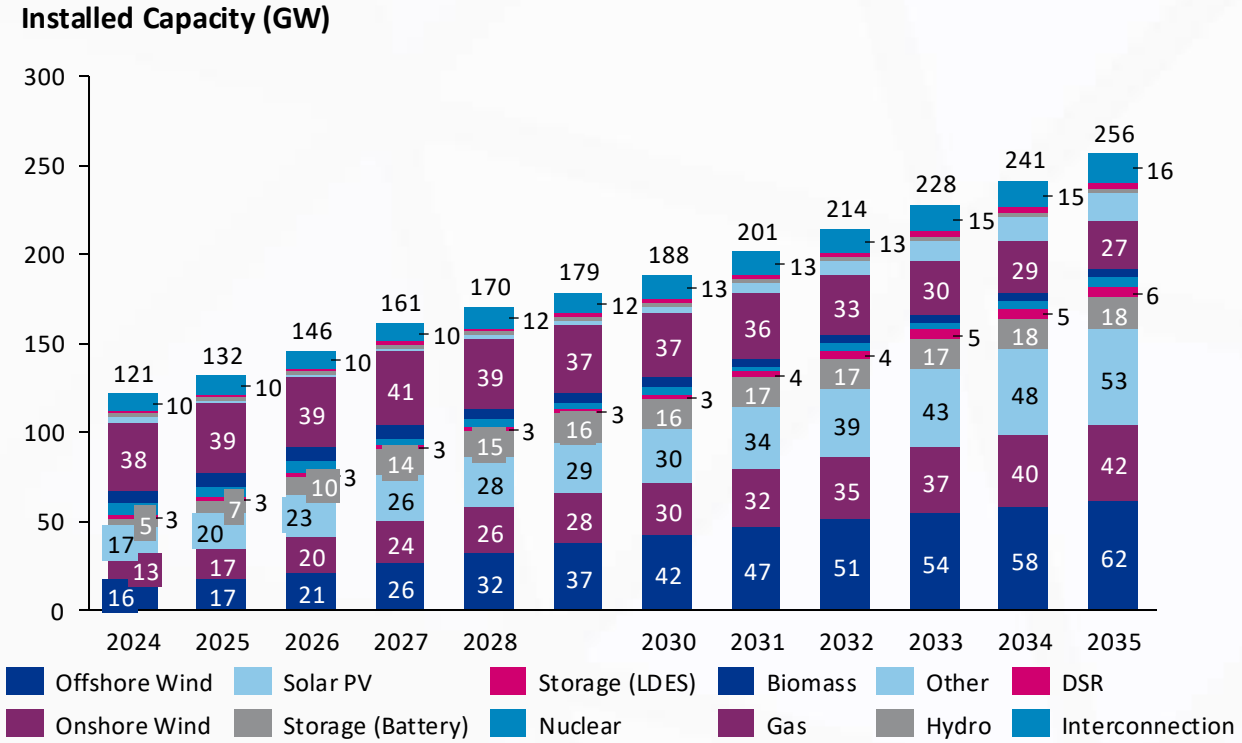
The Power Sector Investment Roadmap is based on the clean power pathway previously developed by E3G and Baringa

A Decarbonisation Pathway for the Power Sector has been modelled…

- The UK Government has set out a clear target for decarbonisation of the power sector by 2030
- E3G and Baringa have previously modelled a pathway to achieve this decarbonisation target. This pathway is based on the following:
  - Constrained Acceleration: This scenario assumed that existing delivery mechanisms are used to maximum extent within current delivery constraints. The model shows that this would achieve 94% clean power by 2030
  - The clean power pathway has been developed using a least-cost dispatch model to ensure the generating stack is developed in a cost-effective manner and at an optimal cost to the consumer

  See the following report for further details: The UK's clean power mission: Delivering the prize - E3G
- This pathway sets the objective for the Power Sector Investment Roadmap which will set out how the finance will be brought forward to deliver this goal

… this pathway will set the objective for the Power Sector Investment Roadmap

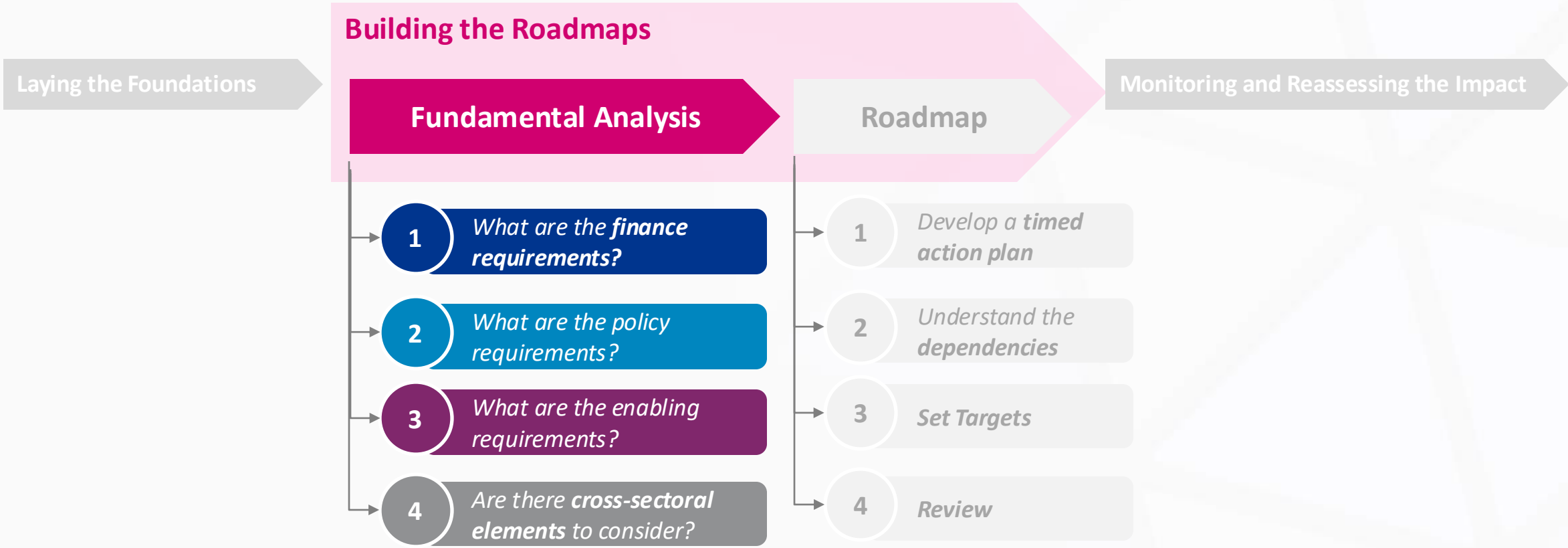


Assumptions for the 'constrained acceleration scenario' can be found in The UK's clean power mission: Delivering the prize - E3G

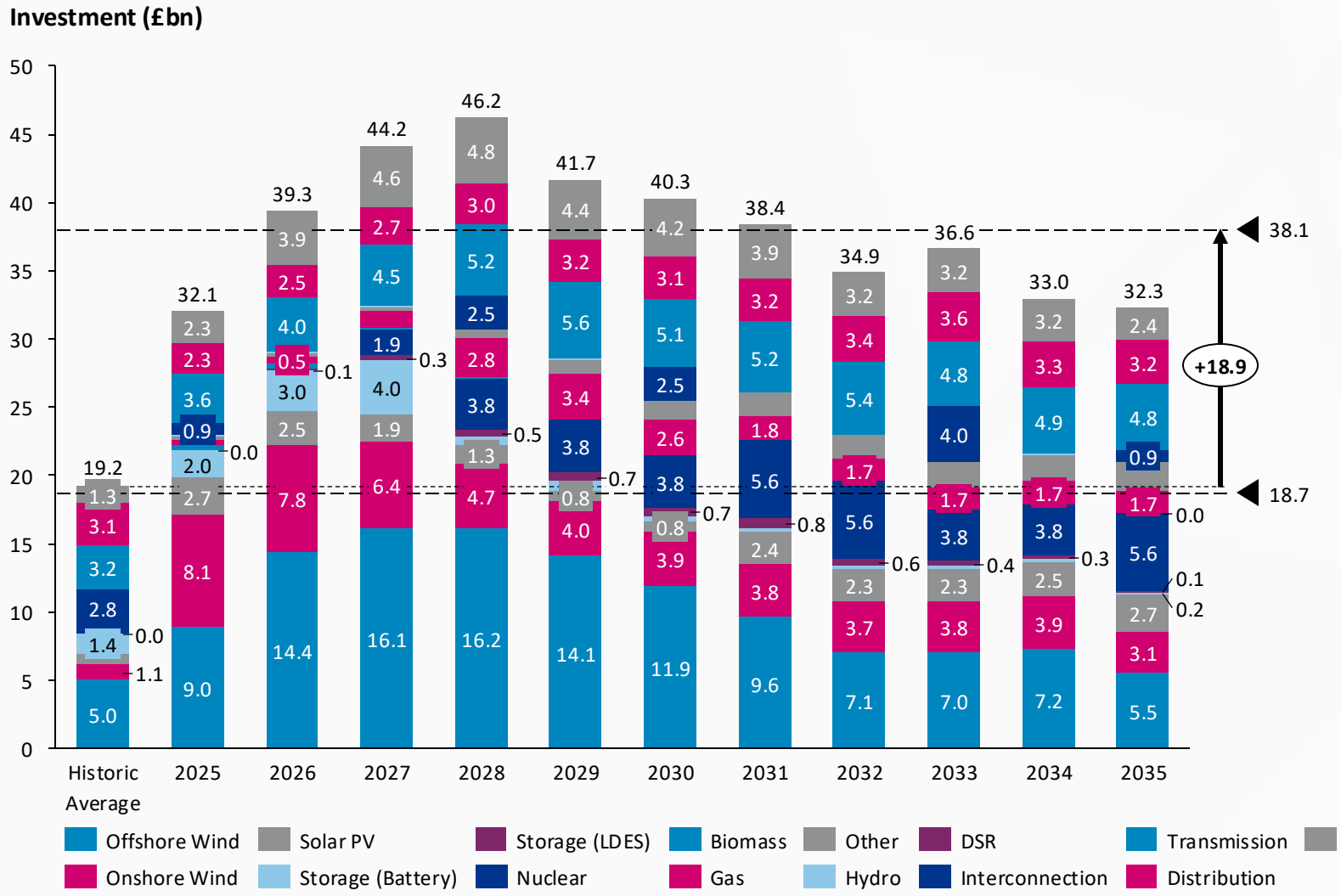
The next sections of the report sets out the Power Sector Investment Roadmap based on this pathway
*The roadmap will form a template for developing similar roadmaps for other sectors**

**Note there be nuances that will need to be addressed differently in other sectors (e.g. the levers for decarbonisation differ in other sectors and hence the methodology for deriving the investment quantum will differ)*

Following the methodology for Sectoral Investment Roadmaps means answering the four fundamental questions for the power sector



Reaching clean power by 2030 will require an investment programme averaging just under £40bn of CAPEX annually, which is double the investment spent historically



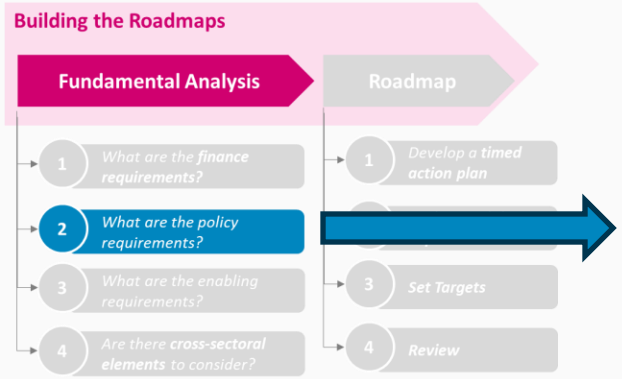
- An **average investment of £38.1bn per annum** will be required to reach clean power by 2030[1]
- Given the **average historic spend[2] of £18.7bn per annum**, there is currently a **finance gap of £19.4bn per annum**
- Within the power sector, the majority of the finance gap is **expected to be covered via private finance,** with the exception of nuclear technology

Notes:

1. Achieves clean power by NESO's definition
2. Historic spend is based on an average spend between 2021-2023 (analysis based on NESO Clean Power 2030 figures)
3. The investment quantum is derived based on the 'constrained scenario' for *The UK's clean power mission: Delivering the prize - E3G*. The efficiency of the technology stack has been accounted for as part of that analysis. CAPEX figures are based on NESO's Clean Power 2030 work (*Clean Power 2030 | National Energy System Operator*) plus Baringa internal IP and analysis

Source: *The UK's clean power mission: Delivering the prize - E3G*, *Clean Power 2030 | National Energy System Operator* and Baringa internal analysis

Policies for each decarbonisation lever are assessed under a decision tree to identify policy gaps



For each decarbonisation lever assess the following:

a Policy Direction

Is there active existing policy?

- NO → Policy Ambition
- YES → *Is the policy 'fit-for-purpose'?*

Is the policy **Necessary**?*

- NO → Policy Ambition
- YES → *i.e. will the policy result in an increase in investment to support the relevant decarbonisation lever?*

Is the policy **Affordable**?*

- NO → Policy Ambition
- YES → *i.e. is this policy going to deliver the objective at the lowest cost to customers?*

Is the policy **of minimum distortion**?*

- NO → Policy Ambition
- YES → *i.e. does this policy risk unintended consequences? (e.g. distorting competition or industry's international competitiveness)*

b Policy Ambition

Is there sufficient investment to close the finance gap and deliver the decarbonisation pathway?***

- NO → **No Implemented Policy** — *New policy needs to be implemented to bring forward investment*
- YES → *N/A – no further action required as there is no need to bring investment forward*

Is there sufficient investment to close the finance gap and deliver the decarbonisation pathway?***

- NO → **No Immediate Policy** or **Policy modifications red'q** — *Further analysis required to determine whether policy can be modified to be 'Fit for Purpose' or whether new policy is required to bring investment forward**
- YES → **Policy modifications red'q** — *Further analysis required to pinpoint if policy modifications needed**

Is there sufficient investment to close the finance gap and deliver the decarbonisation pathway?***

- NO → **Scaling req'd** — *Analysis required to pinpoint if existing policy needs scaling or whether there are delivery gaps*
- YES → **Sufficient Policy in Place** — *No action required*

Policy Rating

** Note that a policy not scoring well against 'Fit For Purpose' does not necessarily entail that it should not be implemented but instead further analysis is required to understand whether there may be areas of focus to improve the policy. For example, a policy that does not score well on affordability may require increased focus on bringing in private finance*

*** It is acknowledged that policy making is part of a wider political process and that the Government will also have to consider how this fits into its overall strategy*

****Note that the analysis should break down the finance gaps into public and private sector finance. This will have an impact on the type of policies required to bridge the finance gap*

Baringa

Although existing policies are largely fit-for-purpose, a step change in policy ambition is needed to bridge the gap between the historical and required investment

	Policy Direction				Policy Ambition		
Decarbonisation Lever: Technology	**Existing Policy**	**Fit For Purpose**			**Average req'd Investment (£bn/yr)**	**Historical Investment (£bn/yr)**	**Policy Rating**
		Necessary	Affordable	Minimum Distortion			
Offshore Wind	• Contract for Difference	✓	✓	✓	10.7	5.0	
Onshore Wind	• Contract for Difference	✓	✓	✓	4.8	1.1	
Solar PV	• Contract for Difference	✓	✓	✓	2.0	0.8	
Storage (Batteries)	• Market mechanisms to allow for revenue stacking (e.g. capacity market, ancillary services, etc.)				1.1	1.4	
Storage (LDES[1])	• Cap and Floor for LDES (aim to open 2025, with recommendations to move this forward)				0.4	<0.1	
Nuclear	• Nuclear Energy (Financing) Act – Regulated Asset Base (RAB) model for nuclear project financing. • Development support for Advanced Nuclear Technologies including Small Modular Reactors				3.4	3.4	
Gas CCS	• Confirmed funding for supporting track-1 clusters in October 2024, with up to £21.7bn of funding available over 25 years				1.8	<0.1	
Other (Hydrogen[2])	• Hydrogen Allocation Round (HAR1, 125MW, HAR2 aiming to allocate up to 875MW)				1.2	<0.1	
DSR	• Various policies driving the market requirement for demand flexibility (e.g. P415, P375, smart meter rollout, etc.) but there is no clear strategy at this stage				<0.1	<0.1	
Interconnection	• Cap and Floor regime				1.0	2.8	
Transmission	• RIIO 3 Price Controls and ASTI	✓	✓	✓	4.8	3.2	
Distribution	• RIIO 3 Price Controls	✓	✓	✓	3.0	3.0	
Offshore Network	• Holistic Network Design (HND) (facilitates connection of 23GW of offshore wind, with a further 24MW recommended in the follow up exercise)	✓	✓	✓	3.6	1.2	

FOR ILLUSTRATION ONLY

More detailed analysis on the Fit-For-Purpose is required to evaluate this section (see slide 21) and this is outside the scope of this report

1. Long Duration Energy Storage (LDES): Note that this is a complex area with multiple technologies of different maturity (e.g. LDES includes mature technologies such as pumped storage technology but also more novel technologies such as Liquid Air Energy Storage). The full policy analysis should assess the suite of different technologies noting that this decarbonisation lever may require multiple policy and investment types

2. Hydrogen use cases span multiple sectors (e.g. energy storage, decarbonisation of industrial processes, chemical production, etc.). In this instance (and for other similar examples), the overarching Net Zero plan must make clear any policy that overlaps multiple sectors to avoid miscommunication

Fit For Purpose: ✓ Meets criteria ● Further analysis required ✗ Does not meet criteria

Policy Rating: No Implemented Policy → Policy modifications red'q → Scaling req'd → Sufficient Policy in Place

Baringa

As significant scaling is required to bridge the gap, it is critical that the Government re-assesses the affordability of these schemes to ensure minimal impact to customer bills

Decarbonisation Lever: Technology	Policy Rating	Indicative Policy Recommendations
Offshore Wind		**CfD Budget scaling required to bridge the gap of £51bn** between current and required spend to 2030. Further analysis required to ensure affordability
Onshore Wind		**CfD Budget scaling required to bridge the gap of £28bn** between current and required spend to 2030. Further analysis required to ensure affordability
Solar PV		**CfD Budget scaling required to bridge the gap of £5bn** between current and required spend to 2030. Further analysis required to ensure affordability
Storage (Batteries)		Market mechanisms are currently sufficient to meet investment requirements
Storage (LDES[1])		It is recommended that the government **bring forward amendments to Ofgem's remit sooner** to ensure the policy intent is implemented
Nuclear		**Budget scaling required to bridge the gap of £10bn** between current and required spend to 2030. Further analysis required to ensure affordability
Gas CCS		**Budget scaling required to bridge the gap of £11bn** between current and required spend to 2030. Further analysis required to ensure affordability
Other (Hydrogen)		**HAR budget scaling required to bridge the gap of £0.7bn** between current and required spend to 2030. Further analysis required to ensure affordability
DSR		**Clear strategy required** to co-ordinate policies, ensure affordability and raise consumer awareness
Interconnection		Continue to maintain current policy
Transmission		This is a delivery gap (see overleaf)
Distribution		Continue to maintain current policies
Offshore Network		**Budget scaling required to bridge the gap of £17bn** between current and required spend to 2030. Further analysis required to ensure affordability

Note: Budget scaling fgures are based on the difference in absolute costs on an annual basis to 2030, against the historic average annual spend

There are key delivery gaps across supply chain capacity, grid constraint and planning processes that will need to be addressed to ensure there are no additional blockers to capital investment

Below is a summary of the Delivery Gaps and the suggested actions for mitigating these gaps. Deep-dives into the Supply Chain Capacity and Investor Appetite are presented in the following two slides to illustrate some of the analysis around these topics

Summary of Delivery Gaps

Delivery Gaps for Commercial Scale - Mature Technology

- **Supply Chain Capacity** – Although the policy framework for wind, solar and (more recently) battery technologies have historically brought investment forward, the supply chain may struggle to absorb the increased levels of investment at a sufficient rate. This is particularly given levels of access to **workforce talent.**

- **Grid Constraints** – The grid connection queue is a significant blocker to decarbonising power. There is currently a 744 GW connections queue in the UK grid. Since October 2024, the NESO's reform programme aims to provide quicker connections for viable projects, improve network design, and support Net Zero. Despite efforts, the transmission connections queue has grown by over 275 GW in the past year.
- The Government are currently working on the TMO4+ connections reform project with code modifications aimed at reducing queue congestion being treated as urgent and targeting full implementation by Q2 2025.

- **Planning Process** – Slow planning processes may limit the rate at which new plants can be developed posing a risk to clean power targets.

Delivery Gaps for Early-Stage Technology

- **Investor Appetite** – High development risks of early-stage technology may limit investment in new technology (e.g. long duration energy storage).

Mitigating Action

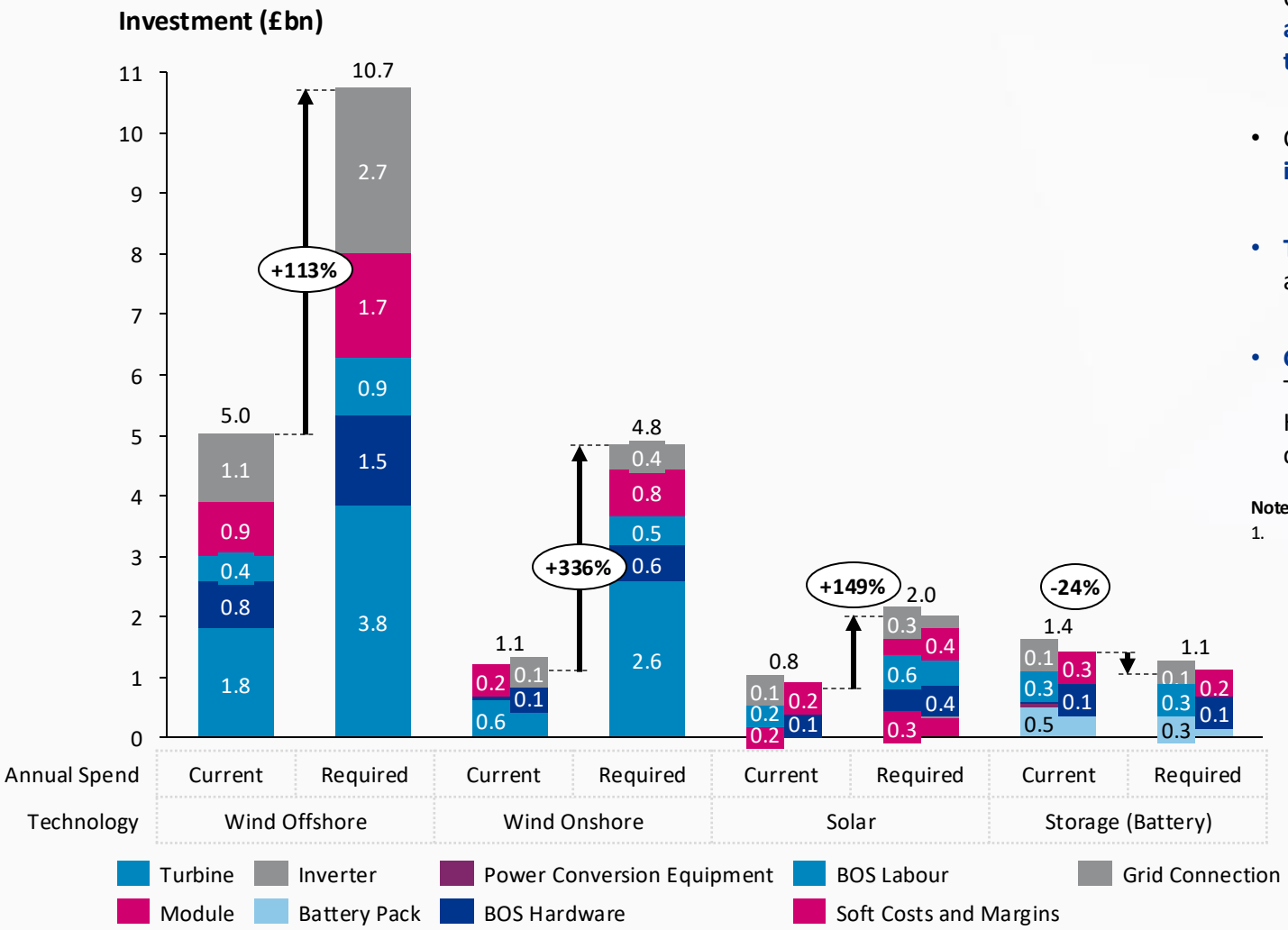
- Direct investment into critical components of the supply chain
- Implementation of Sustainable Industry Rewards in the CfD allocation
- Investment into programmes to increase engineering talent

- Continue to prioritise NESO's proposed code modifications and implement regular reviews to assess effectiveness of this approach

- Planning reform to enable infrastructure deployment

- Direct investment for specific early-stage technologies such as floating offshore wind, SMRs, hydrogen production, hydrogen transport and storage, CCUS infrastructure, including carbon storage, LDES, and one-off large-scale projects such as tidal range

Quantitative analysis of the increased levels of CAPEX spend highlights the scale of the challenge for component suppliers, especially for turbines and cables, and hence the risk of a delivery gap



- Of the average investment required of £38.1bn per annum, **£18.7bn (~50%) is accounted for by spend in offshore wind, onshore wind, solar and battery storage technologies**
- Compared to the historic annual spend across these technologies (£8.3bn) **this is an increase of £10.3bn per annum**
- **Turbine CAPEX is the greatest spend**, projected to be an average of £6.7bn per annum. This is **an additional £4.3bn per annum** compared to the historic spend[1]
- **Grid connections is another significant spend**, projected to be £3.6bn per annum. This is **an additional £1.4bn per annum** compared to the historic spend.[1] Historically grid investment has not been sufficient with over 700 GW in the connections queue across transmission and distribution.

Notes:

1. Historic spend is based on an average spend between 2021-2023 (analysis based on NESO Clean Power 2030 figures)

To absorb the additional investment into the supply chain, parts of the supply chain would need to grow at a significant rate. Key risks include:

- ***Lack of investment in grid***
- ***Lack of co-ordination and certainty for supply chain development***
- ***Insufficient training and educational pathways to grow the existing workforce***
- ***Lack of incentive to invest in the supply chain rather than to increase material prices***

Planning also forms another delivery risk as slow planning processes can also lead to bottlenecks in delivery

Source: *The UK's clean power mission: Delivering the prize - E3G*, *Clean Power 2030 | National Energy System Operator* and *Baringa internal analysis*

Baringa

Public funding is limited and should be focused on driving forward investment where high risk reduces private investor appetite (e.g. early-stage technology)

Public funding in the power sector is limited and is therefore focused on driving investment forward from the private sector

Key sources of public funding for the GB power sector:

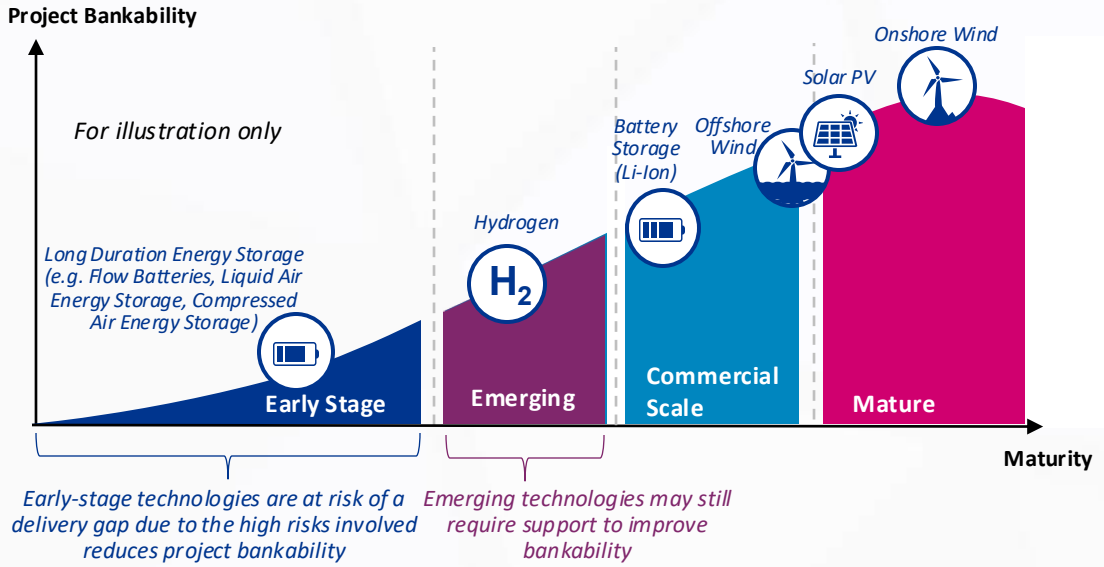
- NWF will have a total **capitalisation of £27.8 billion*** to catalyse investment that would not have otherwise taken place
- With a target portfolio mobilisation ratio of 1:3, the NWF could **mobilise at least £70 billion of private investment,** compared to the £200bn additional investment needed between 2025-2035

** Note that not all of the £27.8bn is directed towards the power sector. This will be divided across the different sectors, but proportions have not yet been confirmed*

- Great British Energy will be backed by a **capitalisation of up to £8.3 billion** of new money over this Parliament

The limited funding should be directed towards de-risking early-stage technologies to improve investor appetite

- Historically, private sector investment comes forward when there are sufficient financial returns available, hence the importance a policy framework that can make low-carbon technology sufficiently profitable
- However, investor appetite is also driven down by:
  - High-risk investment such as early-stage technologies, which can be reduced if supported by public funding
  - Lack of confidence or clarity in policy, which can be supported through clear communication (such as commitment to the investment plan)
- Note that in other regions with higher political risks, or in other sectors with lower technology readiness, there may be less certainty about attracting private capital, even with a supportive policy framework



Source: National Wealth Fund: Mobilising Private Investment, Great British Energy founding statement

Assessing the cross-cutting issues and positive spillovers presents an opportunity to add value through a cross-economy approach

Cross Cutting Issues

Focusing on a single sector may cause a loss of the broader context. Therefore, it is essential to address cross-cutting issues to ensure that all relevant implications are considered and understood

Carbon Pricing

Higher carbon pricing will incentivise power producers and users towards clean power. However, if improperly designed, the increase in cost for end-users may have a negative impact on the economy.

Electrification

Electrification of other sectors, including heat and transport, will be crucial in achieving decarbonisation and can deliver economic improvements through greater efficiency. However, the higher the rate of electrification, the greater the capacity of clean power needed.

Carbon Sequestration

The use of disused gas wells / aquifers for carbon capture and storage would support the shift to clean power, but it would reduce the availability of this limited resource for the decarbonisation of heavy industry, which will further impact the economy.

Hydrogen

Clean hydrogen can help to progress the shift to clean power. However, it will only be of limited availability in the near-term and will also be in demand for decarbonising heavy industry.

Positive Spillovers

Addressing issues in one sector may further result in positive implications in other sectors. Understanding the positive spillovers will provide a broader view of the overall impact of an action

Consumer Confidence

Increased consumer confidence in clean technology such as EVs if the grid is perceived to be clean.

Positive impact on transport sector

Air Quality and Water Consumption

Improvement in air quality and reduction in water consumption through the closure of thermal power stations.

Positive impact on overall environment

Employment

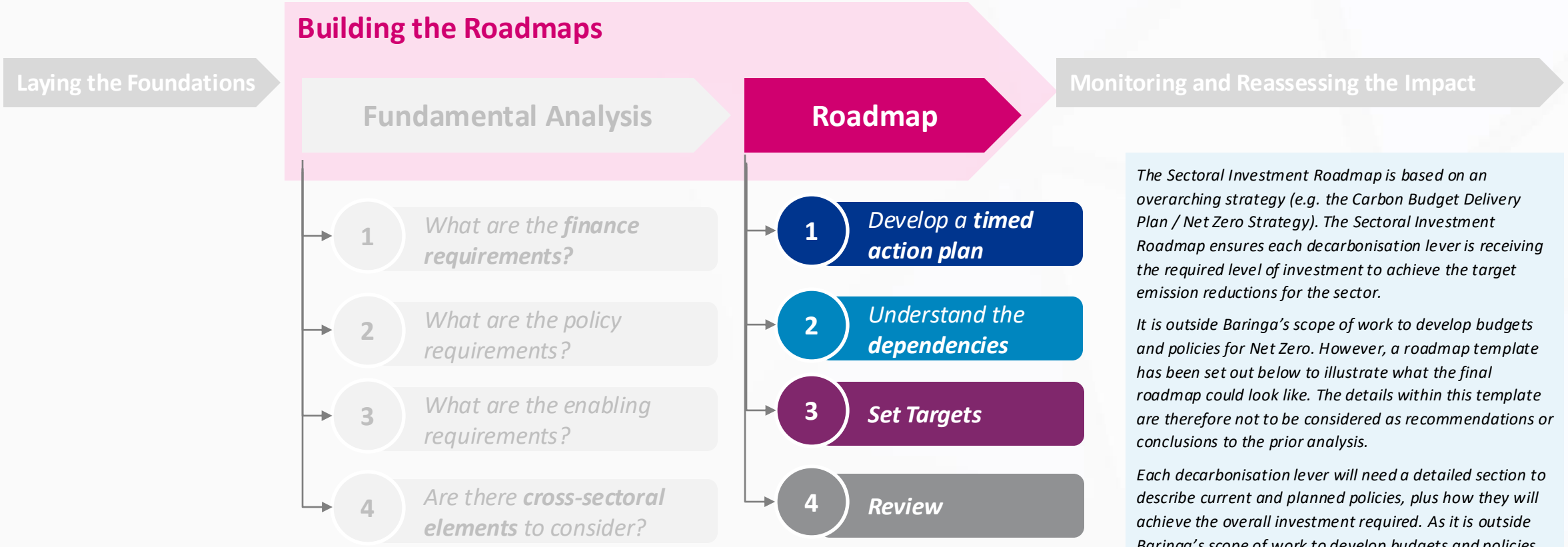
Job creation through investment in clean power which will further stimulate economic growth.

Positive social impact

Cross cutting issues and positive spillovers can be understood and addressed by completing and aggregating the individual Sectoral Investment Roadmaps into the overall Net Zero Investment Plan. This will present the opportunity to add value through a cross-economy approach rather than studying each sector piecemeal

Baringa

A template to demonstrate what the power sector roadmap could look like is set out overleaf



The Sectoral Investment Roadmap is based on an overarching strategy (e.g. the Carbon Budget Delivery Plan / Net Zero Strategy). The Sectoral Investment Roadmap ensures each decarbonisation lever is receiving the required level of investment to achieve the target emission reductions for the sector.

It is outside Baringa's scope of work to develop budgets and policies for Net Zero. However, a roadmap template has been set out below to illustrate what the final roadmap could look like. The details within this template are therefore not to be considered as recommendations or conclusions to the prior analysis.

Each decarbonisation lever will need a detailed section to describe current and planned policies, plus how they will achieve the overall investment required. As it is outside Baringa's scope of work to develop budgets and policies for Net Zero, a template has been set out below to illustrate how this can be implemented for a single decarbonisation lever (LDES in this example). The details within this template are not to be considered as recommendations or conclusions to the prior analysis.

The action plan sets out strategies to ensure each decarbonisation lever receives the required level of investment to achieve the target emission reductions for the sector

Decarbonisation Lever		2025				2026				2027				2028				2029				2030				Beyond 2030	Owner
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
Generating Technology	Offshore Wind	Budget of £XX for AR7				Budget of £XX for AR8				Budget of £XX for ARx				Budget of £XX for ARx				Budget of £XX for ARx				Budget of £XX for ARx					
	Onshore Wind	Budget of £XX for AR7				Budget of £XX for AR8				Budget of £XX for ARx				Budget of £XX for ARx				Budget of £XX for ARx				Budget of £XX for ARx					
	Solar PV	Budget of £XX for AR7				Budget of £XX for AR8				Budget of £XX for ARx				Budget of £XX for ARx				Budget of £XX for ARx				Budget of £XX for ARx					
	Storage (LDES[1])					Legislate LDES policy																					
	Nuclear									Budget of £XX for SMR investment																	
	Gas CCS													Budget of £XX for CCUS investment													
	Other (Hydrogen)									Budget of £XX for H2 investment								Budget of £XX for H2 investment								Budget of £XX for H2 investment	
	DSR					DSR Strategy Consultations								DSR Strategy Published													
Grid	Transmission																										
	Offshore Network																										
Planning						Planning Reforms				Legislate Planning Reforms																	
Supply Chain										Strategy for supply chain investment				Budget of £XX for supply chain investment													
Education										Strategy for increasing engineering talent																	
Cross-Whitehall Programme Board Actions						Assess REMA outcome				Monitor and course correct				Monitor and course correct				Update Published									

Key: Gov. Legislation | Policy/Strategy | Budget | Review

THE ABOVE IS FOR ILLUSTRATION ONLY

Baringa

For each decarbonisation lever, the roadmap must clearly set out time-bound commitments for scaling or implementing relevant policies that will unlock the investment required to deliver CO2 reductions

DECARBONISATION LEVER: Long Duration Energy Storage (LDES)

Key: Public Investment | Private Investment | Expected Impact | Existing policy/strategy | New policy/strategy | Budget

Key barriers for LDES:

- **COST:** Currently not commercially viable without government subsidy
- **Grid Connection:** Lack of grid connections, especially for less proven technologies

	2024 (Current Status)	2025 Q1	2025 Q2	2025 Q3	2025 Q4	2026 Q1	2026 Q2	2026 Q3	2026 Q4	2027 Q1	2027 Q2	2027 Q3	2027 Q4	2028 Q1	2028 Q2	2028 Q3	2028 Q4	2029 Q1	2029 Q2	2029 Q3	2029 Q4	2030 Q1	2030 Q2	2030 Q3	2030 Q4	Beyond 2030
LDES GW																										
Required Installed GW:	2.8GW	2.8GW				2.8GW				2.8GW				2.8GW				<- Projected installed capacity based on the Decarbonisation Pathway								
Required GW Additions		0GW				0GW				0GW				0GW				<- Required capacity additions to achieve the Decarbonisation Pathway								
Actual GW:		2.8GW				N/A				N/A				N/A				<- GW Tracking (actual capacity installed by the end of the year)								
Investment Profile																										
Required Investment:	<£0.1bn	£0.1bn				£0.3bn				£0.5bn				£0.7bn				<- Investment quantum								
Expected Investment:		£0bn				£0.001bn				£0.2bn				£0.03bn				<- Investment expected from implementing the roadmap below**								
Actual Investment:		£0bn				£0.001bn				N/A				N/A				<- Investment Tracking**								

Existing and New Policies

Existing Market Mechanisms

Various NESO workstreams for the balancing mechanism (e.g. Long-term Stability market, Quick Reserve, etc.)

Dependency:
Without grid connection reforms, Cap and Floor regime will have limited impact on enabling new LDES investment as projects will not be deployable if grid connections remain unavailable to new projects

LDES Cap and Floor Regime: Aims to overcome the barriers to deployment due to their high upfront costs and a lack of substantial long-term guaranteed revenue streams. A revenue cap will prevent exposing end consumers to high costs

Cap and Floor Methodology released (Q1)

Review of auction outcome

Review of auction outcome

Review of auction outcome

First window (Q3-4) (2030 – 2033 projects)
Budget (mature tech): TBC
Budget (feasible tech): TBC*
300MW expected (deployed 2030-2033)

Second window (2026) (2031 – 2034 projects)
Budget (mature tech): TBC
Budget (feasible tech): TBC*
300MW expected (deployed 2031-2034)

Third window (2027) (2032 – 2035 projects)
Budget (mature tech): TBC
Budget (feasible tech): TBC*
300MW expected (deployed 2032-2035)

Note that it is understood that the auction windows have not been typically announced until closer to the time. It is envisaged that providing this level of clarity will demonstrate commitment and help to drive investment in the sector

Key shortfall in capacity will arise for feasible* technology as these projects are not currently in development and will struggle to obtain a grid connection for 2030 – 2033 with current policies in place

Enabling Policy

TMO4+ Go-Live
Reformed connections process commences *"first ready, first connected"*

Further Grid Reforms
TM04 may ease some of the grid connection queues. However, further grid reforms is likely required to achieve targets across all decarbonisation levers including LDES

THE ABOVE IS FOR ILLUSTRATION ONLY

** Technology that is currently feasible but not commercially viable without additional support/funding*
***Shortfall (denoted in red) lies ultimately in investment for novel (feasible) technologies due to grid connection issues*

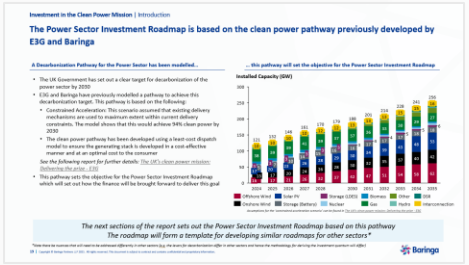
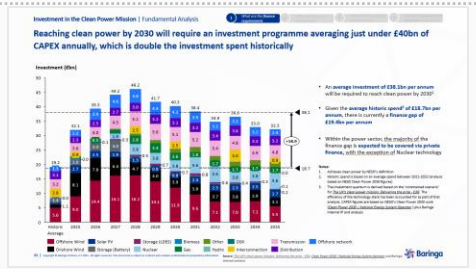
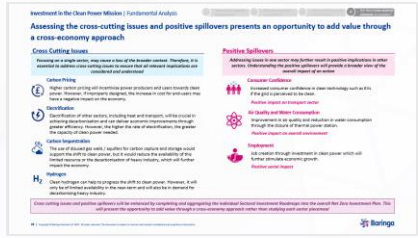
Baringa

4. Publishing the Sectoral Investment Roadmap

Publication requirements for the Sectoral Investment Roadmap

For the roadmap to be a valuable tool for attracting private finance, the published document must present sufficient clarity and detail to foster confidence within the investor community

Having conducted the fundamental analysis and roadmap development, the sectoral roadmap should be published in accordance with the requirements set out below.

No.	Topic	Reference Slide
1	**Decarbonisation Pathway** Assessment of best-value technology mix and pathway to deliver net zero for relevant sector, with clear milestones and timelines to enabled delivery tracking against investment and emissions targets.	Slide 18 
2	**Financing Requirements** Assessment of current/anticipated financing vs the financing requirements to meet the pathway.	Slide 20 
3	**Policy Requirements** Assessment of the suite of policies, including public investment, regulation, incentives, and market reform to enable sector to align with pathway to net zero.	Slides 22 23 
4	**Enabling Requirements** Assessment of specific enabling requirements to deliver the required investment and how Government will address these factors.	Slides 24 25 26 
5	**Cross Sectoral Elements** Assessment of cross-sectoral barriers and interdependencies and identification of policies to overcome them.	Slides 27 
6	**Sectoral Investment Roadmap** A comprehensive overview with: • Targets / milestones to align the sector with the net zero pathway. • Granular breakdowns of investment need and policy interventions for each decarbonisation lever, including expected impact of each policy on investment and emissions reductions.	Slides 29 30 

This work was undertaken by Baringa for E3G and WWF-UK

For a future where people and nature thrive | wwf.org.uk