



What next for financing network innovation?

December 2024

Supported by



With special thanks to...

Thank you to our supporters, Breakthrough Energy

Alberto Toril, Breakthrough Energy

Julia Reinaud, Breakthrough Energy

Jon Fuller, Breakthrough Energy

Tom Rollason, Breakthrough Energy

Green Finance Institute and Regen would also like to thank the numerous key stakeholders from the networks and investment community who participated in interviews and workshops to support our research. The conclusions in this report have been decided by Green Finance Institute and Regen authors and are therefore not necessarily shared by those who engaged with the research.

Lily Cairns Haylor, Advanced Infrastructure

Karim Palant, BVCA

Christopher Tchen, CLT

Layla Sawyer, Current Europe

Tom Williams, Downing

Jo-Jo Hubbard, Electron

Denise Massey, Energy Innovation Centre

Nathaniel Bottrell, Energy Systems Catapult

Tom Elliot, Energy Systems Catapult

Luke Bettesworth, HSBC

Randolph Brazier, HSBC

Paul Padaruth, Innovate UK

Jodie Giles, Innovate UK

Matt Hastings, Ideconomy AI

Bill Thompson, KPMG

Gerard Kelly, National Grid Ventures

Luke Wainwright, National Grid Ventures

April Chen, National Grid Ventures

Philippe Bazin, Novuna

Marzia Zafar, Ofgem

Luke Ames Blackaby, Ofgem

Manu Ravishankar, PA Consulting

Alberto Mendez, Plexigrid

Lovisa Urheim, Plexigrid

Matthew Billson, Piclo

Rosalind Smith-Maxwell, Quinbrook Infrastructure Partners

Ryan Lim, Quinbrook Infrastructure Partners

Duncan Burt, Reactive Technologies

Marc Borrett, Reactive Technologies

Gareth Miller, Regen

Graham Ault, Smarter Grid Solutions

Flo Silver, Smarter Grid Solutions

Andrew Roper, SSEN Distribution

Stewart Reid, SSEN Distribution

Monika Paplaczkyk, Thrive Renewables

Jason Huang, TS Conductors

Tim Heidel, VEIR

Tom Palmer, Zenobe

Contents

Executive Summary	4
Chapter 1: Context and methodology	7
Chapter 2: Mapping the UK’s network innovation ecosystem	13
Chapter 3: Barriers to accessing and providing private finance for network innovation	17
Chapter 4: Solutions: enabling private investors to grow their role within the UK energy network innovation ecosystem	24
Appendix 1: Overview of archetypes	40
Appendix 2: Case studies	43
Appendix 3: Bibliography	47
About the authors	49

Executive summary

The UK's energy networks are amongst the oldest in the world. Its power and gas transmission networks were first built in the early 1900s. Grids and networks are critical infrastructure underpinning the whole energy system. As the UK aims to reach net zero emissions by 2050, networks will play a pivotal role in integrating renewable energy sources, managing more flexible generation and storage systems, and ensuring a resilient and affordable energy supply for households and businesses alike.

Delivering net zero means networks must grow and modernise faster than ever before. Going forward, networks will need to accommodate the electrification of transport and heat. Innovation in both physical and digital solutions is key to achieving this.

Financing network upgrades and innovation is also more challenging than ever. The UK's public balance sheet is under pressure and private financing is also falling short of what is needed to deliver the transition. Many have highlighted the 'missing middle' for climate tech companies that have successfully demonstrated their potential in pilot stages but have not yet commercially deployed their technologies.

This study maps the key players in the network innovation ecosystem in the UK; identifies the key barriers to the deployment of private capital in innovative companies; and suggests avenues for solutions spanning policy, regulation and financial interventions – so that the UK's financial sector can capture the opportunities offered by network innovators while the networks can decarbonise at pace.

Regen and the Green Finance Institute, supported by Breakthrough Energy, conducted an extensive literature review, interviewed 11 stakeholders from companies involved in network innovation and investment and held a closed-door workshop with 24 more participants to source and organise the findings presented in this 'greenprint', illustrating a way forward for network innovation in the UK. Greenprints reflect the expert thinking coming out of the UK - the global green finance leader - as we focus on a pathway to action through industry and public collaboration.

What is in this 'greenprint'?

1. Context and methodology (page 7)

This section outlines why grids and networks are so critical to the UK's overall energy transition and the role private finance should play to support the sector. We also describe the approach and methodology for the research.

2. Mapping the network innovation ecosystem (page 13)

The network innovation ecosystem is made up of different types of organisations, or 'archetypes', each having a role in the journey from research and development (R&D) to commercialisation. This section describes the various archetypes we identified, which in turn is used in the third section mapping which types of businesses are most impacted by barriers.

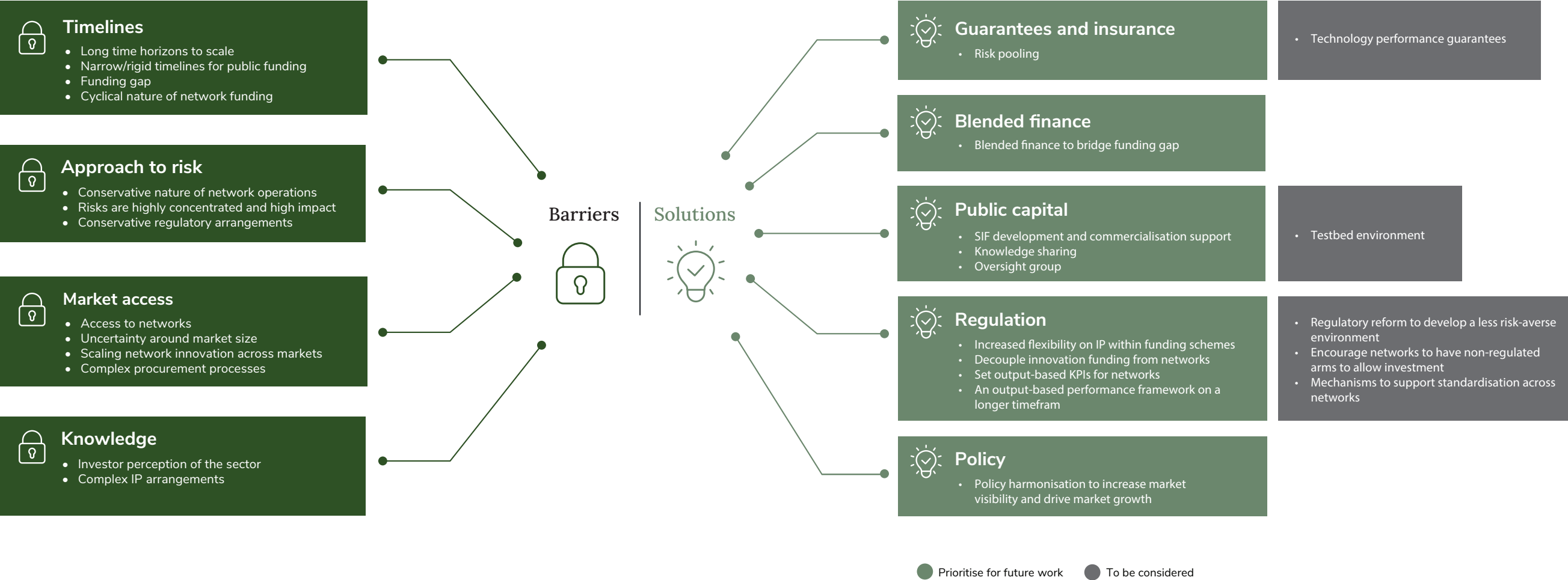
3. Barriers to accessing and providing private finance for network innovation (page 17)

Overall, we identified multiple barriers, grouped into 4 broad themes: timelines, approach to risk, market access and knowledge.

4. Solutions (page 24)

Through stakeholder engagement, we identified a range of possible solutions, each with the potential to address different barriers and benefit different archetypes. These span from regulation, policy and finance levers. It is likely that multiple solutions will be required, as no single solution can address all barriers. These solutions were assessed against the ease and speed to delivery and their potential impact on the market, which identified seven key areas to be explored further: regulatory reforms; policy harmonisation across key organisations; structuring a new public-private blended equity fund; scaling insurance products like technology performance guarantees and risk pools; further changes to the Strategic Innovation Fund; and decoupling innovation funding from networks. These solutions attracted broad consensus across stakeholders from different sectors.

Summary of barriers and potential solutions



Taking this work forward

Looking at the suite of proposed solutions in the greenprint, both the public sector and the finance community can do more to support network innovation, with a range of incremental and more disruptive changes.

There was strong consensus among stakeholders on the importance of the regulatory framework for incentivising innovation across the networks.

While some interviewees mentioned regulatory change, the need for this came across more strongly during the workshop. Representatives from across the innovation and investor communities, as well as supporting organisations, highlighted the need for a culture change across the regulator and the networks to support greater levels of innovation.

However, regulatory reform must be aligned with wider policy, to define success and set the direction of change.

Stakeholders highlighted that policy levers could address barriers around market access, with clearly defined sectoral pathways and outcomes making it easier for investors to understand the potential market size and to invest in the solutions that would best meet desired outcomes. Signals from policy and regulation should be harmonised for consistency and should focus on developing growing markets rather than picking individual winners.

Several potential financial mechanisms could be developed or scaled to allow investors to support network innovation and encourage the investment community to play their part in tackling the challenge.

These include the creation of a new fund to run alongside the SIF to support innovators or a blended finance model to work as an equity escalator and bridge the funding on the road to commercialisation. Existing products such as technology performance guarantees, green bonds, or insurance products to pool risk could also be better leveraged to support innovators in attracting private capital to commercialisation and scaling.

Public capital could also support innovators to reach the commercialisation stage faster.

Other solutions identified include using public capital to support knowledge sharing across the network innovation ecosystem or developing mechanisms to shrink the timelines associated with the innovation journey.

More work is required to fully develop and take forward these solutions along with continued cross-sector collaboration.



Chapter 1: Context and Methodology

Context: delivering clean power by 2030

Following the 2024 election, the new Labour government made it clear that clean energy and climate change are at the heart of the government's economic policy, and that the target to deliver a cheaper, clean electricity system by 2030, is a core mission¹. This will mean a move away from traditional fossil fuel-based energy generation, such as natural gas and coal-fired power stations, to more renewables, such as onshore and offshore wind, and solar. Reliance on fossil fuels has had a significant effect on the UK's energy independence and will continue to expose customers to rising energy bills when the price of energy rises in the international markets.

However, while energy demand is expected to fall overall, along with the demand for gas, electricity demand is expected to increase significantly as key sectors begin to electrify. According to the National Energy System Operator's Clean Power 2030 report, consumer electricity demand will almost double from 258TWh today to 488TWh by 2050². This transition will put immense pressure on the grid and network system.

The gas and electricity grids will therefore need to play an essential role in delivering this ambition and meeting this change in demand. Upgrading the grid and energy sector is a key priority for government, and there have been several regulatory, policy, and funding initiatives focussed on decarbonising the network and boosting innovation in recent years.

Policy updates

The passing of 'The Energy Act' in October 2023 called for the creation of a Future Systems Operator to provide a whole system view to energy system planning and operations with the aim of accelerating the energy transition. This has now been launched as the National Energy Systems Operator (NESO).

In July 2024, the UK Government also announced the planned formation of GB Energy, a publicly-owned company that will work alongside the private sector to scale the innovation and investment required to decarbonise the grid by 2030³. In the same month, a new Mission Control was announced that will bring government and industry experts together to remove barriers and deliver clean energy by 2030⁴.

In 2022, the then UK Government launched the Review of Electricity Market Arrangements (REMA) to address long-standing inefficiencies within the energy market. The Review focuses on mechanisms that can enable the development of assets that will need to connect to the grid⁵. The outcome of this review will influence the amount of investment required in the grid.

Regulatory and funding initiatives

Through the RIIO-2 framework⁶, innovation is currently incentivised via two funding streams – the Network Innovation Fund, its successor, the Strategic Innovation Fund (SIF), and the Network Innovation Allowance (NIA) have awarded almost £1 billion in funding to over 2,000 innovation projects since 2013.

The SIF funds projects that could speed up the transition to net zero at the lowest cost to the consumer and was recently updated to include a more accessible and flexible application process for innovators⁷. The NIA provides limited funding to RIIO network licensees to enable them to take forward innovation projects that have the potential to address consumer vulnerability and/or deliver longer-term financial and environmental benefits for consumers⁷.

To deliver clean power by 2030, Great Britain will need to mobilise and deploy an average of over £40 billion of investment annually in energy infrastructure over the next five years², and innovation will be a key component of this. With constrained public balance sheets, there is an urgent need to catalyse more private capital into grid modernisation and innovation if the UK Government targets are to be met. The National Energy System Operator, which started operating as a public corporation in October 2024, has already highlighted the critical role of private capital in achieving clean power and how well-targeted and carefully designed investment support mechanisms can help mobilise this finance. NESO recent report Clean Power 2030 also identifies how 'transformative innovation' will be key to achieving clean power by 2030, calling for 'prioritised and coordinated action' across public and private organisations to speed the pace and scale of innovation.

¹ [Labour.org.uk - Make Britain a Clean Energy Superpower](#)

² [Clean Power 2030 - Advice on achieving clean power for Great Britain by 2030](#)

³ [Gov.uk: Introducing GB Energy](#)

⁴ [Gov.uk: Mission Control to deliver clean energy by 2030](#)

⁵ <https://www.whatisrema.com/>

⁶ [Ofgem.co.uk: RIIO-2](#)

⁷ [Ofgem.co.uk: SIF](#)

⁸ [Ofgem.co.uk: NIA](#)

Context: delivering clean power by 2030

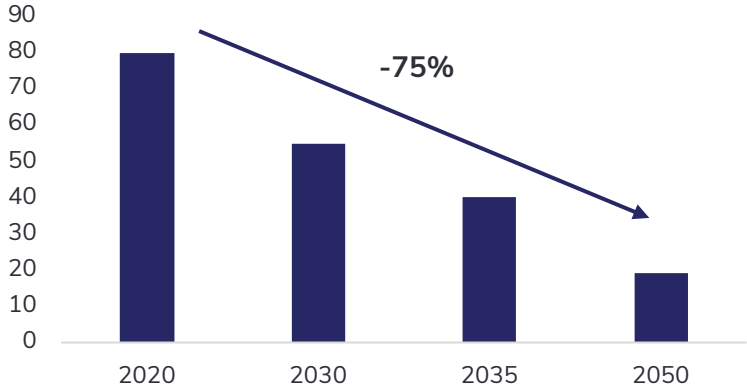


Electricity demand is expected to increase significantly as key sectors move from fossil fuels to electricity. The electrification of the economy will almost double consumer electricity demand for electricity from 258TWh today to 488TWh by 2050⁵.



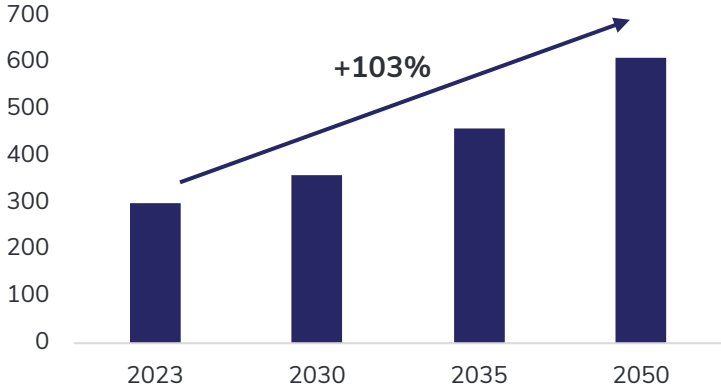
The challenge of **transmitting and distributing energy from utility-scale, intermittent renewable sources over long distances** is unprecedented and will require significant investment and modernisation in electricity infrastructure.

Forecast gas demand (Mtoe)¹



¹ Under the Balanced Pathway in the [Sixth Carbon Budget, Climate Change Committee, December 2020](#)

Forecast UK Electricity Demand (TWh)²



² Adapted from OGUK: [Energy Demand Scenarios: A window into the future. 2021](#)



£16bn

Investment planned for **upgrades** to the transmission system by 2026 as part of National Grid's Great Grid Upgrade project³.



£58bn

Investment required for distribution and transmission network transformation to meet UK climate commitments on reducing emissions⁴.

⁵ [Clean Power 2030 – Advice on achieving clean power for Great Britain by 2030](#)

³ [National Grid - Great Grid Upgrade](#)

⁴ [NESO – Beyond 2030](#)

The role of networks in the UK's transition

As the transition to a more electrified system occurs, there is an urgent need for the UK's networks to expand while improving and modernising existing network infrastructure.

Energy flows will become more 'bi-directional', with generation and consumption happening at every level and consumers participating in a smarter, more flexible energy system. There will be an increase in the number of network connection requests for distributed energy resources (DERs), including solar photovoltaics (PVs), wind and storage.

Improved grid visibility to monitor DERs and greater flexibility within the grid will also be required to manage the intermittent nature of renewable energy sources, address grid constraints and increase resilience.

Financing for innovation required is falling short

Challenges are not only in relation to the grid itself but also to the financing of the innovation required to enable the grid to manage and deliver the transition. The level of financing for the technology required for this transition is currently falling short of what is required.

In particular, there is a marked financing gap for firms that have completed the development phase and require funding to progress high-potential technologies into commercial deployment². This is known as Series B funding, and the gap for all climate tech financing at this stage was calculated to be £1.5bn between 2018 and 2022³.



50GW

UK Government target for offshore wind connection by 2030¹.



£1.5bn

Financing gap for climate tech at Series B stage. (Cleantech for UK)³

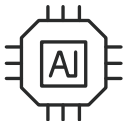
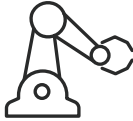
¹ Under the Balanced Pathway in the [Sixth Carbon Budget, Climate Change Committee, December 2020](#)

² [Scaling growth-stage climate tech companies. Barclays. July 2024](#)

³ [Clean Tech for UK, Building the next generation of cleantech champions. UK landscape overview](#)

Where are the innovation opportunities?

The energy transition will require far greater innovation and create potential new roles for different network, technology, policy and finance actors. To guide this innovation, through collaboration with industry actors, the Energy Networks Association (ENA) has suggested shared network innovation themes – priority innovation areas for all networks to ensure a shared strategic direction. The ENA recommend that network innovation projects must fit under one of these themes to ensure they are focused on solving the biggest challenges going forward. These themes are data and digitalisation; Flexibility and market evolution; Net zero and the energy system transition; Optimised assets and practices; Supporting consumers in vulnerable situations; and Whole energy system.

Potential areas for grid innovation ¹ : Digital solutions 	Technology	Description
	AI tools for networks	Artificial intelligence tools can help deliver better efficiencies and integration of new technologies into the network. For example, cloud-based AI models that can process data and images to detect defects and produce real-time asset condition reports ² ; forecasting using digital twins, improved fault detection, improved power flow, the use of new performance measures and increased stability ⁷ .
	Advanced Power Flow Control (APFC)	Unlock capacity by dynamically controlling power flows across the grid.
	Dynamic Line Rating	Improve utilisation by providing greater visibility to system operators and allowing them to react to actual temperature and sag of a power line.
	Flexibility Management Systems	Flexibility management solutions allow grid operators to manage and control the flow of electricity efficiently by actively managing the supply and demand of grid connected assets.
Physical solutions 	Grid inertia measurements	One grid constraint is, that a sufficient amount of inertia (rotating turbines stabilising the grid) must be present. Measuring inertia in real time allows a) higher renewables operation on the grid / less redispatch for inertia reasons, and b) more targeted inertia procurement.
	Technology	Description
	EHVDC mass impregnated (MI) subsea cables	MI cables are composed of a very high viscosity impregnating compound, which does not cause leakage in the event of cable damage or failure ⁴ .
	High Temperature Super Conductors	Allows transmission of very high amounts of line capacity.
	HVDC converter hubs	HVDC systems utilise power electronics technology to convert AC and DC voltage and enable the efficient integration of renewable energy sources ⁵ .
	Storage as A Transmission Asset (SATA)	SATA uses storage facilities to inject or absorb energy to facilitate power flows on transmission lines. Used this way, SATA can provide reliable services and serve as an alternative to new transmission projects ³ .
	Superconductor cables	Due to their high efficiency, small volume and high capacity, superconducting cables are a possible solution for connecting new equipment to the physically remote networks that will require additional capacity ⁶ .

¹ Developed with Innovate UK, Ofgem, and Carbon Trust, and based on technologies identified by [Compass Lexecon, CurrENT and Breakthrough Energy. Prospects for innovative power grid technologies, Final report, June 2024](#)

² [National Grid, April 2024](#)
³ [NARUC](#)

⁴ [www.gevernova.com](#)
⁵ [Entso-E](#)

⁶ [Nationalgrid.co.uk](#)
⁷ <https://es.catapult.org.uk/report/ai-in-energy/>

Greenprint context and methodology

Given the significance of the opportunities and challenges in network innovation, this project set out to use targeted stakeholder engagement to review the opportunities for leveraging private finance to support UK network innovation, in order to increase the scale and pace of network transformation. This work was commissioned by Breakthrough Energy and has been led by the Green Finance Institute and Regen over a three-month period.

Our research aimed to surface three main categories of insight:

1. Mapping the network innovation ecosystem and across the innovation journey, using archetypes to more precisely link the types of organisations to types of barriers.

> See findings in Chapter 2

2. Identifying barriers:

- for innovators seeking to access private capital, and
- for private finance seeking to deploy more capital.

> See findings in Chapter 3

3. Identifying solutions, ranging from policy and regulatory changes to new investment models; from incremental reform to more disruptive solutions.

> See findings in Chapter 4

The assessment and greenprint development has been taken over three stages:



Initial research

To analyse past funding models and current barriers to enhancing network innovation financing

1. **Literature review:** Understanding the existing innovation landscape, identifying key barriers and reviewing success case studies.
2. **11 semi-structured interviews:** Engaging with active stakeholders in the network innovation ecosystem to understand their experiences of barriers and opportunities.



Invite-only workshop

To gain wider industry feedback from 24 participants on potential options and/or reforms to network innovation financing

1. What are the challenges or barriers faced by investors in participating in the existing ecosystem?
2. What are the opportunities for leveraging greater private capital into network innovation, and how to enable these in practice?



Greenprint

Summary of the current challenges faced by innovation investors, and industry feedback and appetite for potential reforms

1. Summary of challenges
2. Review and prioritisation of potential solutions
3. Final greenprint and recommendations

A large-scale solar farm with rows of solar panels stretching towards a bright sunset over a horizon with trees. The image is split diagonally, with the solar farm on the left and a white background on the right.

Chapter 2:

Mapping the UK's network innovation ecosystem

Mapping archetypes on the innovation journey

The network innovation ecosystem is made up of different types of organisations, or 'archetypes', each having a role in the journey from research and development (R&D) to commercialisation.

While this list of archetypes is not fully comprehensive, this approach helps to map the barriers and solutions alongside the types of stakeholders impacted and with agency to deliver change.

18 archetypes have been identified and grouped into the following categories:

- Innovators
- End users
- Private finance
- Public capital
- Enablers.

See [Appendix 1](#) for a summary description of each archetype.

The next page provides a high-level overview of the current network innovation investment ecosystem. It maps each archetype on the innovation journey and shows where private finance already plays a role.

“Private finance can help fund, build and profit from the vast new ecosystem of products and services that will underpin a zero-carbon grid. Network utilities are not going to do this on their own. They need an ecosystem of services and products to enable it.”

The map also highlights a ‘valley of death’ resulting from a lack of connectivity between public and private funding. The literature review and stakeholder engagement emphasised the need to bridge the transition of companies from post-feasibility and pre-revenue into commercialisation.

“Public funding is great when you're first starting. There is a lot of support at the innovation stage; the challenge is at the commercialisation stage and getting into BAU [business as usual]. This took us years to overcome.”

Innovators

End users

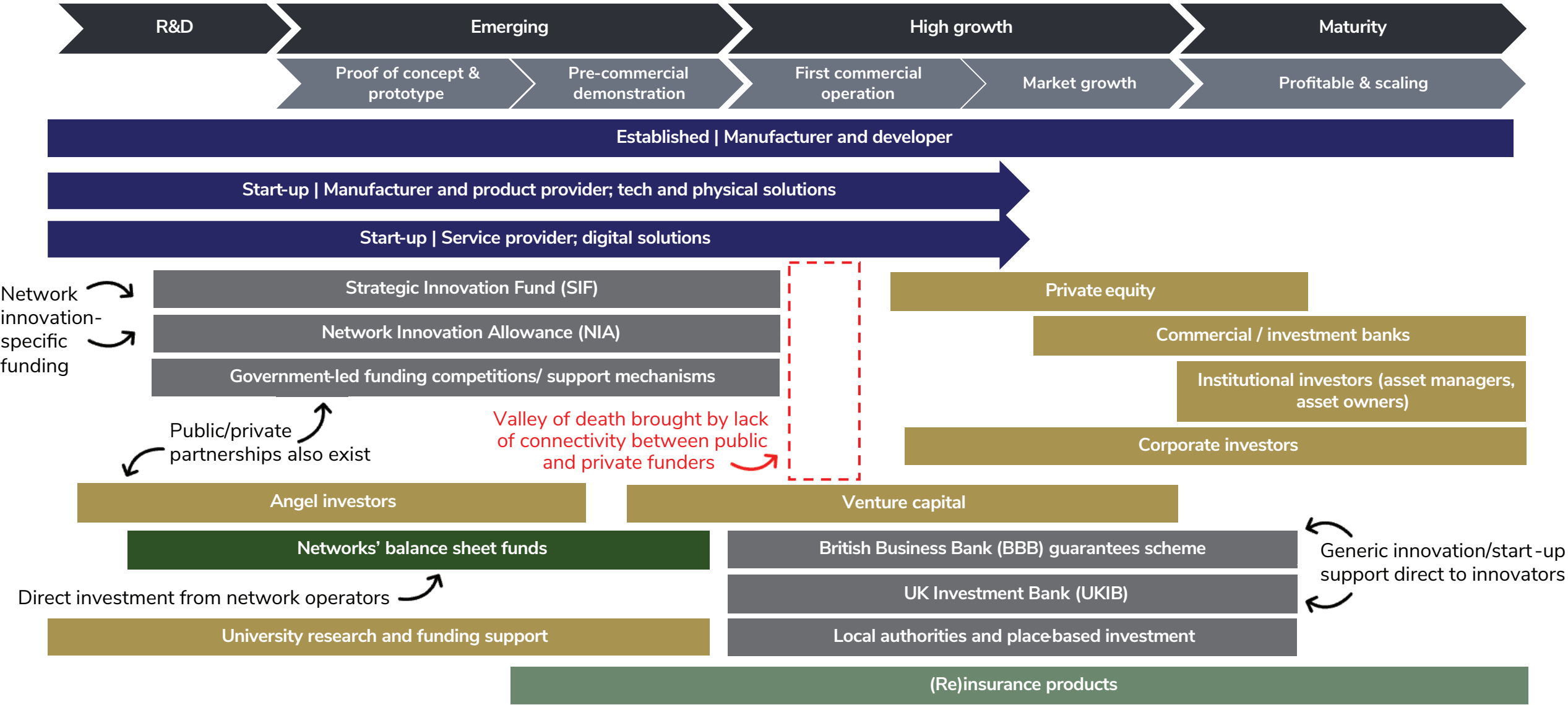
Private finance

Public capital

Enablers

Mapping archetypes on the innovation journey

One organisation can correspond to several archetypes, with different arms focusing on different stages of the innovation journey or different investment teams working to different risk/return appetites.



Summary of flows of investment in network innovation

A few illustrative examples are provided in italics; based on public information only.

Already in market
Nascent
Gap
Not applicable

	Start-up Manufacturer and product provider; tech and physical solutions	Start-up Service provider; digital solutions	Established Manufacturer and developer
Commercial/ investment banks			Banks largely arranging M&As, with established firms acquiring start-ups.
Corporate investors	Some corporates have dedicated VC/PE functions that support innovators aligned with their priorities. While many invest in net zero technologies, most will focus on 'simpler' cleantech rather than network innovation. National Grid Ventures has so far only invested in network innovation in the US.		Some larger firms acquiring start-ups. Smarter Grid Solutions recently acquired by Mitsubishi Electric Corporation.
Institutional investors			Many established firms are listed and have deep relationships with institutional investors. Many investors are decarbonising their portfolios and looking to align their portfolio companies with net zero.
Private Equity (PE)	Physical solutions innovators struggling to capture PE capital in the UK	PE capital typically more available for digital innovation with lower capex. More examples of UK firms being supported by international or foreign firms rather than UK funds. M&G recently invested in Reactive Technologies	
Venture Capital (VC)	Physical solutions innovators struggling to capture VC capital in the UK	VC capital typically more available for digital innovation with lower capex. More examples of UK firms being supported by international or foreign firms rather than UK funds. Plexigrid secured VC capital in 2023 from Swedish and American VC firms	
Angels	UK angel activities more prominent though still largely focusing on digital solutions.	UK angel investment space is active in cleantech. Some start-ups found success with UK angels. UK angel syndicate Veridian Ventures recently invested in GridDuck.	
Public capital	Significant public capital being invested into start-ups via the NIA, SIF, BBB, National Wealth Fund (NWF) and UK Govt. Admin burden of applying for public funding remains challenging.		
Networks	Some innovation project finance available from network balance sheet funds to test and trial products and services. Projects tend to focus on optimising assets and practices, as these are harder to fund through NIA or SIF.		
Insurance	Dedicated insurance products for cleantech, including long duration storage, have emerged recently (e.g. technology performance guarantees provided by MunichRe) whilst traditional insurance products continue to apply (e.g. business interruption, non-payment etc). Costs of premiums remain unaffordable for most businesses		



Chapter 3:

Barriers to accessing and providing private finance for network innovation

Barriers identified to accessing or providing private finance

13 barriers were identified, which can be grouped into four main themes: timelines, approach to risk, market access and knowledge. All barriers are described in more detail overleaf.

We first explored barriers to accessing or providing private finance to network innovators through a literature review and stakeholder interviews. We then grouped the barriers into four main themes, which were used to map solutions in the following chapter:

1. Timelines

The way that both the networks and their innovation activities are funded creates timeline challenges: gaps in funding for innovators, long time horizons to scale and a more piecemeal approach to innovation. This is even more challenging for physical technologies which require bigger investment rounds compared to digital solutions.

2. Approach to risk

Network companies tend to be risk-averse. This is in part due to the regulatory environment and their primary function of keeping the lights on, as well as networks operating as fully regulated businesses. This affects their appetite to support more disruptive or radical innovation.

3. Market access

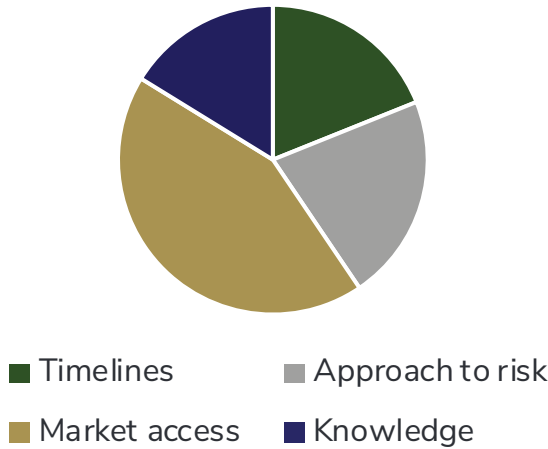
Innovators have difficulty accessing network operators in the early stages and then selling and scaling their services post-pilot. Investors face challenges when assessing the market size and potential risks and returns.

4. Knowledge

Investor perception of the energy networks sector tends to be negative compared to other types of cleantech as the fully regulated models and network operators are more challenging to navigate and understand. Plus, complexities around IP arrangements in publicly funded projects create additional challenges for investors.

We presented the barriers to workshop participants to test their significance and whether any were missing. Of the four themes, market access presented the greatest challenge area.

Most significant barriers by theme



Thematic barriers: Timelines

The way that both the networks and their innovation activities are funded results in challenges related to timelines: gaps in funding for innovators, long time horizons to scale and a more piecemeal approach to innovation.

Challenges & Barriers		Description
Timelines	1. Long time horizons to scale	Early-stage investors, such as VCs, can expect a return on investment in 12-18 months (3-5 years at most) ¹ . Network innovation can take 5-8 years to be implemented, including running several multi-year pilots; then the first commercial contract may need to run for several more years before the innovator can secure a second contract – all before any returns can be realised. Other research, supported by evidence from stakeholder engagement, has identified this characteristic as a reason for investor reluctance to enter the market ² .
	2. Narrow/rigid timelines for public innovation funding	Public innovation funding often happens in timed rounds and requires match funding, which can push innovators to seek private co-investors only based on innovation funding timings rather than strategic needs.
	3. Funding gap	There is a gap between Pre-seed and Series A funding, not covered by public financing models. This comes with broader lack of connectivity between public funding, network funding and private investment opportunities, making it difficult for innovators to secure capital smoothly from one source to another. A number of other reports have pointed to the range of contributing factors to the so-called “Valley of Death” funding gap ^{1,2,3} .
	4. Cyclical nature of network funding	The existing price control mechanism, being cyclical in nature, tends to incentivise short term, incremental innovation from the networks. Networks may pause the rollout of the innovation until they can plan for it in the next price control period.

“SIF and NIA... takes too long. If you’re a startup, you’ve got 18 months maximum burn time of cash and... you do not have time to write a six-month paper, which is what NIA requires.”

“Early stage and demonstration are fairly well supported. However, within commercialisation, there is nothing here in support. Banks won't invest unless other people are.”

“There's an awful lot of pilots that happen and then they don't go anywhere. Encouraging balance sheet investment in innovation from the utilities in whatever form, whether it's CVC or something else, is key.”

¹ NREL, [Accelerating Clean Energy Commercialization: A Strategic Partnership Approach](#);

² Design of Early-Stage Growth Finance to enhance Ofgem SIF;

³ Energy innovation funding and institutions in major economies

Thematic barriers: Approach to risk

Network companies tend to be risk-averse. This is in part due to the regulatory environment and their primary function of keeping the lights on. This affects their appetite to support more disruptive or radical innovation.

Challenges & Barriers		Description
Approach to risk	5. Conservative nature of network operations	Innovation is driven by the networks that are risk averse and tend to focus on ‘edge’ innovations rather than support transformative change that might be riskier to implement. The regulatory environment also doesn’t incentivise networks to support growth and commercialisation of the innovation to business-as-usual.
	6. Risks are highly concentrated and high impact	Network innovation involves performance risks. When included in network operations, any issues can cause serious disruptions to numerous customers, and there are no clear ‘bearers’ of these risks other than consumers (e.g. insurers, investors, networks).
	7. Conservative regulatory arrangements	The regulatory framework doesn't sufficiently incentivise innovation or efficient use of existing grid capacity. Instead, it continues to incentivise traditional grid reinforcement.

“Innovation is hard, and you have to be prepared to fail. The temptation with projects of scale is to err towards commercialisation for technologies that are already there.”

“If DSOs [Distribution System Operators] became more efficient and were able to distribute more electricity with less infrastructure, they would be "rewarded" with a lower remuneration and lower operating profit. Why would they want to become more efficient? The regulation has to change so that the more efficiently they run their grids, the more EBITDA they make.”

“Who will cover the exposure if the technology fails or if there is disruption? The scale of warranties needed to cover that risk is multiples of the value of the equipment to fill in the broader impact of business interruption (e.g. lost profits as well as consumer protection). Fears of various types of risks are the biggest issue preventing investments.”

Thematic barriers: Market access

Innovators have difficulty accessing the networks in the early stages and then selling and scaling their services post-pilot. Investors face challenges when assessing the market size and potential risks and returns.

Challenges & Barriers		Description
Market access	8. Access to networks	The technical challenges faced by network operators are not clearly understood, making it difficult for innovators to meet their needs and priorities; as networks operate as monopolies, working with them can be complex; some perceive that networks can ‘gatekeep’ access to innovation funding and projects.
	9. Uncertainty around market size	There is a lack of clarity around the potential market size for network innovation that makes it harder for investors to assess both the risks and the potential returns on investment. There is a need for more consistent policy to set market direction and increase market visibility, which other studies have highlighted has a track record of successfully unleashing private capital in other markets ¹ .
	10. Scaling network innovation across markets	Transitioning a product/service within the network organisation from the innovation team to the operational team can be challenging. Network innovation might also not scale across multiple networks in the UK or international markets, with bespoke or specific requirements making it difficult to assess growth opportunities.
	11. Complex procurement processes	Rigid, protracted and complex procurement processes make it difficult for innovators to gain commercial contracts with network operators, even if they have worked together on publicly funded innovation projects. This process often favours large organisations with strong credit ratings and guarantees, etc., and innovators can lose out on delivering commercial projects for/with the networks.

“Investors need to know that what they're investing in is something that the market wants to buy.”

“The UK market opportunity is probably enough for your first couple of funding rounds as a company. But [investors] like to see you breaking through into multiple geographic areas.”

“The procurement process favours larger suppliers, not small innovators. This means that that investors don't have certainty on returns post-project end, which makes them less likely to invest.”

¹ Clean Innovation | Why it Matters & How to Accelerate it Across the Canadian Economy

Thematic barriers: Knowledge

Investor perception of the energy networks sector tends to be negative. Plus, complexities around IP arrangements in publicly funded projects creates additional challenges for investors.

Challenges & Barriers		Description
Knowledge	12. Investor perception of the sector	Investors perceive the energy networks as having short investment horizons, long innovation commercialisation timelines, regulatory risks, and unpredictable procurement opportunities.
	13. Complex IP arrangements	The current public funding rules around Intellectual Property (IP) can lead to multiple entities sharing IP, making for a complex environment that is challenging for investors to understand. It can also mean it is challenging for innovators to scale their solution outside of the consortium partners, if, for example, they want to branch into other markets. Other research found that some innovators would not apply for Beta-stage funding due to the current IP arrangements under SIF ¹ .

“The SIF and NIA process is more than "complex" for IP; it is punitive.”

“Getting VC funding is really hard in asset-light/knowledge-heavy energy services like flexibility markets. They need to know about the technologies, policies, regulatory risks, and market risks. They also have to bet on the company and successful delivery of services.”

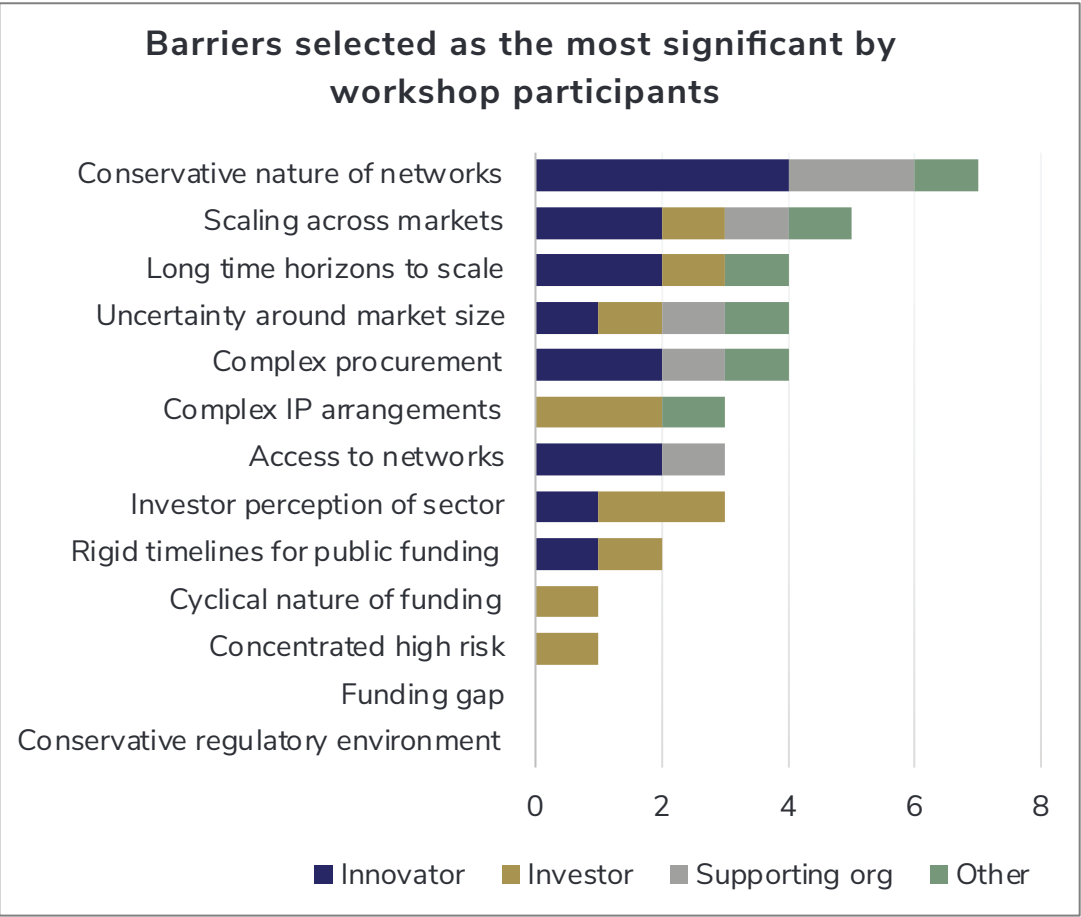
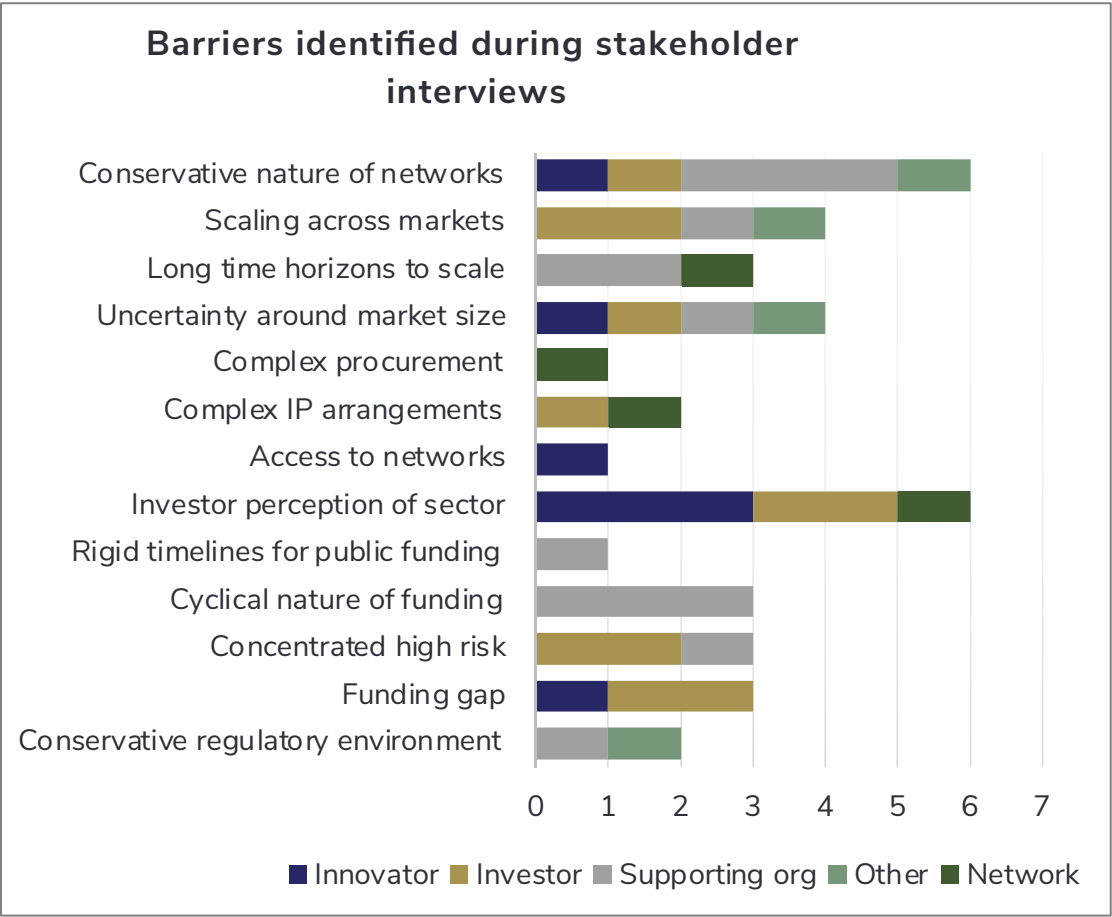
“Who will cover the exposure if the technology fails or if there is disruption? The scale of warranties needed to cover that risk is multiples of the value of the equipment to fill in the broader impact of business interruption (e.g. lost profits as well as consumer protection). Fears of various types of risks are the biggest issue preventing investments.”


¹ Design of Early-Stage Growth Finance to enhance Ofgem SIF;

Most significant barriers

During the interview and workshop engagements, participants were asked about their views on the barriers to private capital funding network innovation. We surfaced the 13 barriers during the literature review and interviews. During the workshop, these barriers were presented to participants, who were asked to select the three barriers they felt were the most significant out of the list of 13.

Overall, we found that access to finance was not seen as the top barrier but rather the conservative and monopolistic nature of networks present barriers to scaling and commercialising new solutions.



A photograph of a wind farm at sunset. In the foreground, a worker wearing a white hard hat and an orange safety vest is looking down at a tablet computer. In the background, another worker is visible, and several wind turbines are silhouetted against the bright orange and yellow sky. The scene is partially obscured by a large white diagonal shape that contains the chapter title.

Chapter 4:

Solutions: enabling private investors to grow their role within the UK energy network innovation ecosystem

Identifying solutions

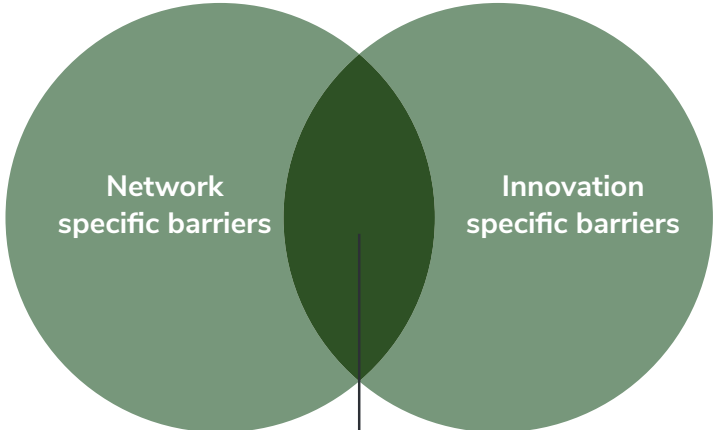
In the previous section we identified numerous barriers preventing private finance from being scaled into innovation for the network sector.



Some barriers identified are specific to the financing of networks. For example, the conservative nature of network operations and the specific regulatory arrangements within the network space. Other barriers apply to the financing of innovation more broadly and can be seen across other sectors looking to innovate. For example, investor concerns about the performance risk for new and innovative technologies. As discussed previously, there are several interventions from the UK Government and Ofgem that look to scale financing for innovation in networks and a policy environment that is considered leading in comparison to other countries. However, with the scale of the challenge, there is much more that needs to be done.



In the following section, we showcase several solutions identified and developed through stakeholder interviews, workshops, and desktop research. In total, 16 solutions were identified. Eight were explored in more detail, highlighting the key benefits that the solution would bring to scaling private finance into innovation, and suggestions for how the solution may be implemented. Each solution idea was assessed based on its ability to address one or multiple barriers from the list identified in the previous section. [Page 26](#) sets out in more detail, the methodology by which solutions were identified.



Barriers to private finance scaling network innovation



Solutions ideation and methodology

Following the initial project phase, a set of solutions was drafted, which were then further developed and added to during the workshop.



Initial research

Six indicative solutions were shared with workshop participants in advance. These had come through strongly in the literature and interviews and were:

- SIF development and commercialisation support
- Blended finance to bridge funding gap
- Risk pooling
- Policies to increase market visibility and drive market growth
- Knowledge sharing within sector
- A mechanism to decouple innovation funding from networks.



Invite-only workshop

Participants were told that the types of interventions in scope were:

- Policy
- Regulation
- Public finance
- Guarantee and insurance
- Debt
- Equity
- Other blended finance

They identified 16 potential solutions, which are set out on [pages 27-30](#).

Each breakout room was encouraged to select their two top solutions, which were fed back to the room and then voted on.

The top solutions identified by workshop stakeholders, in order of priority, were:

- An output-based performance framework on a longer timeframe
- Setting KPIs that are outcome-based and drive the correct behaviours
- Blended funding to provide seamless transition
- Encourage networks to have regulated and non-regulated arms
- A policy mechanism to define market size
- Insurance products to de-risk early-stage technologies (joint 5th)
- Define sector pathways to provide clarity on technologies.

See the next page for further detail on the workshop findings.



Greenprint

The project team then reviewed all 16 solutions and expanded on eight areas that have the greatest potential to deliver a step change based on findings from both the workshop and interviews (see [pages 32-39](#)).

Some specific suggestions were combined under one theme, e.g. 'regulatory reform'.

Summary of solutions (1/4)

	Solution ideas	Description of the solution	Key barriers addressed	Intervention theme	Organisation to deliver	Beneficiaries
1.	Technology performance guarantees	Provision of guarantees rather than capital – a 'first fail' protection to encourage other investors to crowd in. While guarantees are a relatively novel insurance product, they have the potential to support emerging and first of a kind (FOAK) technologies.	7. Risks are high impact; 12. Investor perception of the sector	Guarantees & insurance	Insurance companies, with public sector-led coordination	Innovators, network companies, private capital
2.	Risk pooling	Coordinate risk pool among several insurers to improve de-risking for network innovation tech. Capital from several insurers and public bodies can be 'pooled' into a fund and used as insurance capital for innovators. Several innovators can then 'pool' their risks to secure insurance at lower rates by acting as a consortium.	7. Risks are high impact; 10. Uncertainty around market size	Guarantees & insurance Public capital	Insurance companies, with public sector-led coordination	Innovators, network companies private capital
3.	Blended finance to bridge funding gap	A blended fund could combine public and different types of private capital, allowing innovators to transition more smoothly through the stages of innovation to commercialisation.	1. Long time horizons to scale; 2. Narrow/rigid timelines for public innovation funding; 3. Funding gap	Other blended finance	Private capital, with public sector-led coordination	Private capital, innovators
4.	Green bonds	Often innovations are not green in themselves but are enablers for green technology to reach the grid. This would be a mechanism to label something as a 'green enabler' to allow it to receive 'green investment'. This may make it easier for investors with sustainability commitments to invest in network decarbonisation/innovation. Bondholders would expect a return, so it may be better suited to support successful innovations to scale.	3. Funding gap; 10. Uncertainty around market size	Debt	Innovators, Network companies, with Public sector-led coordination (e.g. NWF or GB Energy)	Innovators

Summary of solutions (2/4)

	Solution ideas	Description of the solution	Key barriers addressed	Intervention theme	Organisation to deliver	Beneficiaries
5.	Knowledge sharing	A mechanism to support greater sharing of knowledge between innovators, investors and networks, to improve investors' understanding of the sector, help innovators to access and solve network issues, and support the transition of innovations to BAU within the networks. This could be coordinated by Ofgem.	9. Access to networks; 12. Investor perception of the sector	Public capital	Ofgem, InnovateUK, Network companies	Network companies, innovators, private capital
6.	Testbed environment	Create 'low stakes' environment for innovators to demonstrate track record outside of the networks, to make it easier to shrink the demonstration phase timeline and allow innovators to move to commercialisation with greater speed. This could be a digital-twin type environment, or an incubator to provide support in kind to early-stage innovators. This would need to be managed by Ofgem, with collaboration from the networks to buy in.	1. Long time horizons to scale; 11. Scaling network innovation across markets	Public capital	Ofgem, Innovators	Innovators, network companies
7.	SIF development and commercialisation support	The creation of a continuous support mechanism providing funding alongside the SIF, supporting pre-discovery innovators to engage with networks, and running in parallel with the SIF to support commercialisation. This could also include funding to support the development of a SIF application, 'post-pilot' planning, or to build a business case to attract additional investment from private finance.	3. Funding gap; 4. Cyclical nature of network funding	Public capital	Ofgem, Innovate UK, GB Energy	Innovators
8.	Oversight group	A dedicated organisation that can oversee the creation and delivery of several of the solutions identified, such as the blended finance escalator, and convene the sector to support greater rollout of technology guarantees and support knowledge sharing. This could be a new body, such as GB Energy, or an arm of existing institutions such as Ofgem or UK Research and innovation (UKRI), with a specific remit to deliver or support the delivery of other solutions.	3. Funding gap; 4. Cyclical nature of network funding	Public capital	Ofgem and with involvement with Innovate UK, GB Energy and NESO	Network companies, Ofgem

Summary of solutions (3/4)

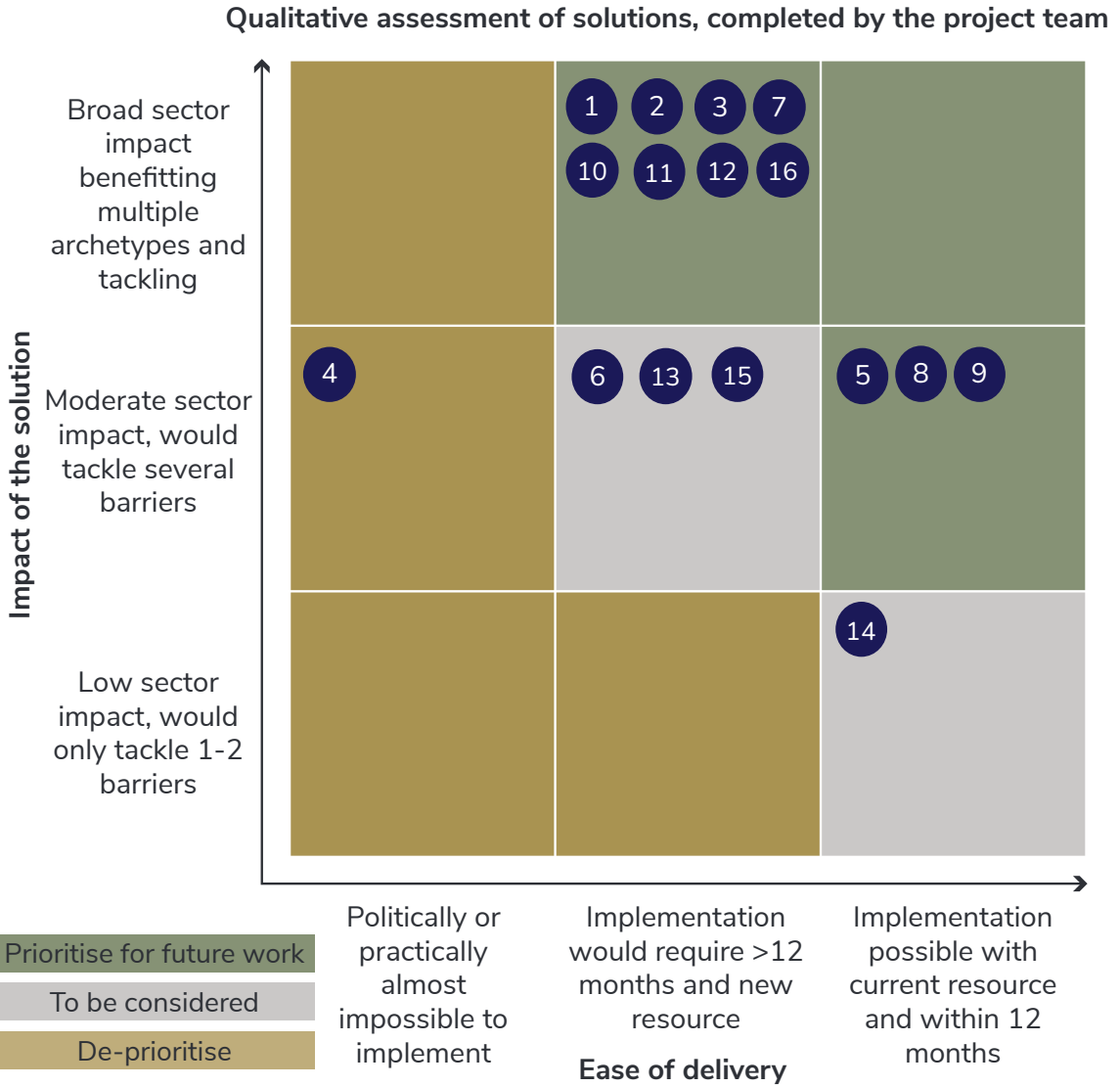
	Solution ideas	Description of the solution	Key barriers addressed	Intervention theme	Organisation to deliver	Beneficiaries
9.	Increased flexibility on IP within innovation funding schemes	Changes could be made to the IP arrangements under the current publicly-funded innovation schemes, so they are less rigid and complex. Changes to the consortium-led approach might make it easier for innovators to scale their innovations across markets and networks.	8. Complex IP arrangements	Regulation	Ofgem, Innovate UK	Innovators, Private capital
10.	A mechanism to decouple innovation funding from networks	This would require a regulatory change to remove the need to have networks as a partner/decouple networks from the innovation process and focus their role more as the customer/implementor of the innovation. This could be a new licence condition given to a different regulatory body to dispense innovation funding separate from the networks.	3. Funding gap; 4. Cyclical nature of network funding; 5. Conservative nature of network operators	Regulation	Ofgem, DESNZ	Innovators
11.	Setting KPIs that are output based and drive the correct behaviours from networks	Alongside the creation of policy to set the direction of transformation or define outcomes that the industry needs to deliver, KPIs would be created within the regulatory framework to incentivise the network operators to deliver these outcomes. This could also mandate networks to procure the innovation once it has been proven if it aligns with the targeted outcomes.	5. Conservative nature of network operators; 10. Uncertainty around market size	Regulation	Ofgem, DESNZ	Innovators
12.	An output-based performance framework on a longer timeframe	A longer-term, outcomes-based performance framework for network innovation would enable greater investment in proven innovations. Innovation investment could be separated from Totex in the price control and Cost-Benefit Analysis (CBA) allowed to extend over multiple price control periods.	4. Cyclical nature of network funding; 5. Conservative nature of network operators	Regulation	Ofgem, DESNZ	Innovators

Summary of solutions (4/4)

	Solution ideas	Description of the solution	Key barriers addressed	Intervention theme	Organisation to deliver	Beneficiaries
13.	Regulatory reform to develop a less risk-averse environment	A change in both the regulatory framework and the culture within Ofgem and the networks to increase the acceptance of failure within innovation in a style more akin to the US approach to innovation.	5. Conservative nature of network operators; 6. Conservative regulatory environment	Regulation	Ofgem	Innovators, Private capital
14.	Encourage networks to have regulated and non-regulated arms to allow for investment	While this exists in the energy industry, it is more common in other sectors such as water, where the non-regulated arms of the business can generate profit to support operations in the regulated arm. Increased adoption of this by energy networks could lead to an increase in innovation funding.	3. Funding gap; 4. Cyclical nature of network funding; 5. Conservative nature of network operators	Regulation	Network companies, Ofgem	Innovators
15.	Mechanisms to support standardisation across networks	Regulatory change could mandate for the adoption of shared standards, encouraging networks to collaborate to deliver these. This may then allow for faster and more efficient rollout of innovations and allow innovators to scale across networks.	9. Access to networks; 11. Scaling network innovation across markets 12. Investor perception of the sector	Regulation	Ofgem	Networks, Innovators
16.	Policy harmonisation to increase market visibility and drive market growth	Creation of policy that picks outcomes and sets market direction, to empower investors to support solutions that will best achieve the desired outcome. This would also improve market visibility and make it easier for investors to understand the potential returns/size of the market.	10. Uncertainty around market size	Policy	DESNZ, Ofgem	Innovators, Private capital

Qualitative assessment of solutions

Following the identification of possible solutions, GFI and Regen undertook a qualitative assessment of the ease of delivery and potential impact of solutions to map the recommended prioritization for further investigation.



Solutions	Rationale
1) Tech performance guarantees	Product already in market but needs scaling. Affordability is also a barrier to scale.
2) Risk pooling	Coordinating and establishing new pool would take more than 12 months, while delivering broad impact for innovators and insurers.
3) Blended finance to bridge funding gap	High impact potential by attracting a wider range of investors. Establishing fund would take more than 12 months.
4) Green bonds	No track record for green bonds for innovation and unclear who would be the issuing party, makes delivery extremely challenging.
5) Knowledge sharing	Easy to deliver but impact would only complement wider package of measures to increase private finance.
6) Testbed environment	Easy to deliver by building on existing testbed models but would be limited to the moderate impact of increasing investment.
7) SIF development	Requires additional funding and a timeline exceeding 12 months, but offers broad impact by bridging an important funding gap pre-discovery phase.
8) Oversight group	Delivery can be achieved over 12+ months, but it is unlikely to have a sector-wide impact. It could complement another solution, such as a blended fund.
9) Increased flexibility on IP	Simplifying IP can be easily delivered within a short timeframe and can provide innovators with moderate commercial benefits.
10) Decoupling innovation funding from networks	Delivery would require additional resources and a 12+ timescale, but has the potential to deliver significant benefits, especially for whole system innovations.
11) Output based KPIs for networks	Delivery possible in around a 12 month timescale. Additional resource required to identify the right KPIs and rewards for networks, which if done effectively would deliver broad sector impacts.
12) Network performance framework on a longer timeframe	Could enable networks to invest in transformative change and support market creation. Necessary regulatory change would add complexity to the price control framework, which would take over 12 months and additional resource to implement.
13) Develop a less risk-averse environment	Regulatory changes could encourage cultural change but unclear how such a transformation can be achieved. Requires significant time and resources to deliver.
14) Non-regulated arms of networks to allow for investment	Already in practice, but only one network has taken this approach due to competition risks. Easy delivery is possible, but it may only deliver incremental benefits.
15) Standardisation across networks	Standardisation would require more than 12 months and additional resources but could enable a faster rollout of network innovation and, in turn, encourage greater investment.
16) Policy harmonisation to increase market visibility and growth	Unclear how best to deliver this, and implementation would take more than 12 months and additional resources. Impact for this step is significant, as it delivers important market signals to investors and is a prerequisite for the success of other solutions.

Solution #1: Technology performance guarantees

Intervention theme	Guarantees & insurance
Archetypes to implement	Enablers

Technology performance guarantees can create a 'first fail' protection to encourage other investors to crowd in.

While technology performance guarantees are a relatively novel insurance product, they have already begun to show positive outcomes in supporting emerging and FOAK technologies. They are currently only offered by a few companies, due to the high level of technical expertise required, but there is interest from the sector to grow the availability of such products.

Key benefits

Insurance-provided technology guarantees can help reduce the need for public capital investment by providing revenue certainty for innovators while passing the risks onto insurers. Technology performance guarantees can also help to improve access to debt, as both lenders and innovators are guaranteed minimum cashflow, decoupled from the performance of the technology. This is particularly helpful for new technologies installed in complex facilities/systems which may need adjustments in early years of operation to maximise performance (see Figure 4).

Typical coverage can insure a minimum output of an asset or a technology. The innovator (or lender) will be compensated for any output shortfalls, providing liquidity for the business. In many cases the policy would also insure unscheduled major repairs needed for operational performance. A small number of insurers such as New Energy Risk have offered this type of product for emerging technologies such as hydrogen.

Options for implementation

Because new network technologies have limited performance history, these products remain unaffordable and, so far, such products have only been deployed to support debt investments rather than equity. Public finance could support insurers to offer more attractive rates on technologies that would otherwise be associated with large risk premiums. However, it is questionable whether guarantees would create any cost saving for the consumer, especially for higher risk innovations.

To grow this market and make such products more commonly available for emerging technologies in network innovation, greater links need to be made between brokers and insurers, and innovators. There could be a role for a convening organisation, such as the oversight group (solution #8), to facilitate this.

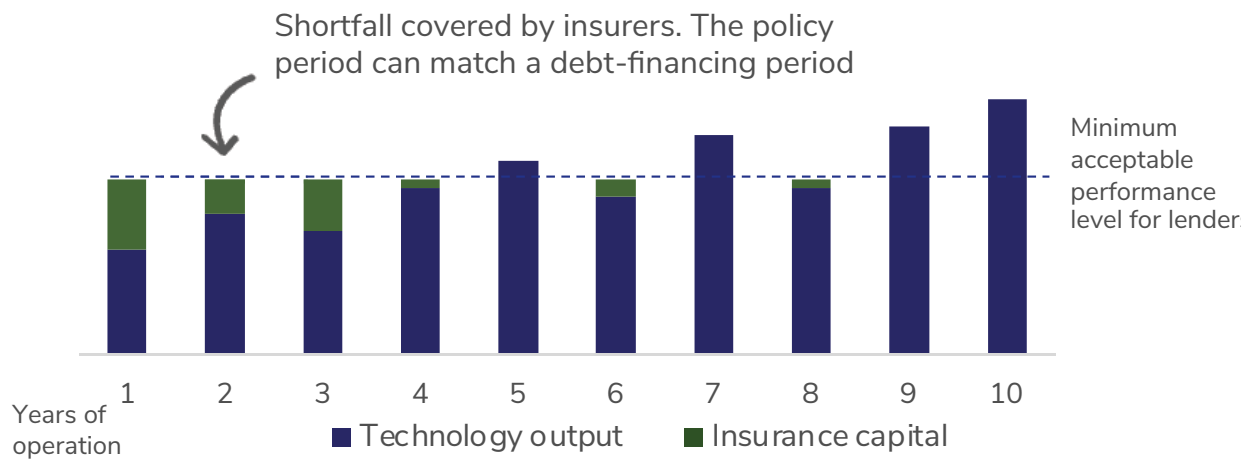


Figure 4: Example of how technology performance guarantees operate. Any shortfall in output under an agreed minimum performance level is provided by the insurer.

Solution #2: Risk pooling

Risk pooling sees capital from a number of insurers ‘pooled’ into a fund and used as insurance capital for innovators.

While risk pools are a well-tested mechanism in the insurance sector, they have not been trialled in the context of innovation funding. This model would help spread risk across multiple insurers, reducing the cost of insurance for innovators. Innovators and/or insurers can pool their assets; this could include innovators coming together to jointly negotiate insurance terms for technology performance or other key risks, and/or insurers pooling risk capital in order to cover innovators, who are typically higher-risk clients.

Key benefits

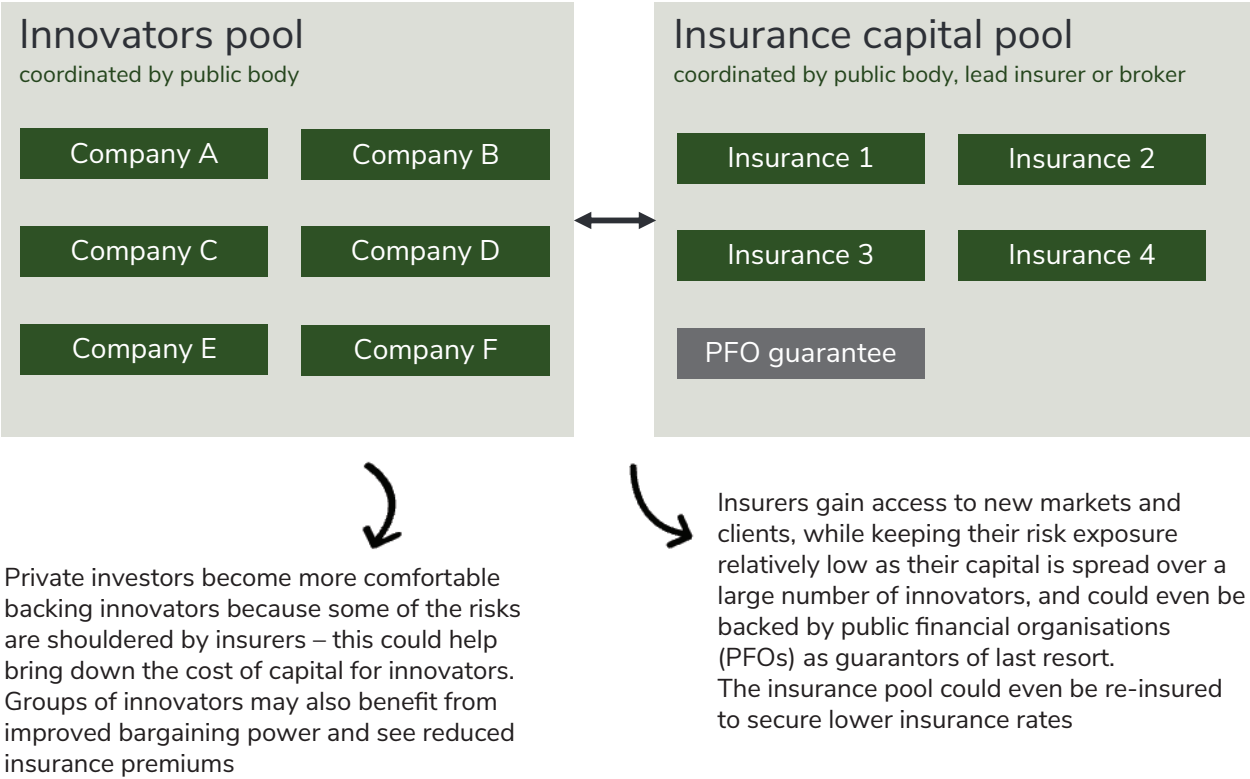
This model allows innovators to increase their purchasing power when buying insurance as a group; reduces investment risks for private investors as some of the potential downsides are shouldered by insurers; and allows insurers to gain access to new markets, clients, and types of exposure. Risk pools can also be reinsured which can help bring down the cost of premiums and further spread the risk across financial institutions.

Options for implementation

Risk pools are typically coordinated by a lead insurer or a broker. In this case, the model could also be spearheaded by a public body which could help identify suitable innovators and create pipeline for the innovators pool.

“Figuring out how to wrap risk, taking some risk so projects are more financeable might be more efficient [than providing capital].
[This is] also not a new concept.”

Intervention theme	Public capital	Guarantees & insurance
Archetypes to implement	Enablers	
	Public sector	



Solution #3: Blended finance to bridge funding gap

A blended fund would combine public and different types of private capital to allow innovators to more smoothly transition through the early stages of innovation to commercialisation.

Key benefits

Innovators could seamlessly access capital as they grow their business and rely on a single fund for their innovation journey. It could provide non-dilutive funding when it's most suitable, e.g. risk capital where there is an upside opportunity and patient debt where there is an extended route to commercialisation. Meanwhile, individual investors would be able to limit their exposure to innovators across one or two stages of innovation, in line with their own investment strategy.

Options for implementation

A blended fund should be spearheaded by a public body (UKIB, the National Wealth Fund, Department for Energy Security and Net Zero or Ofgem/Innovate UK). This body would determine the investment mandate and remit of the fund. An external and experienced fund manager would be appointed to raise private capital, structure and manage different capital tranches and disburse the fund.

Private investors with different levels of risk appetite can provide capital to the fund, along with their stipulations on what their capital can be invested towards – e.g. an institutional investor might have a ‘minimum investment size’ requirement, while venture capital may only be interested in having their capital put towards ‘emerging’ technologies. The fund manager blends the capital allocating funds to investments in line with investors’ expectations.

Although the blending model can be complex, the disbursement of funds to companies receiving the investment would be straightforward. The company would still receive e.g. a simple debt or equity investment. However, the blending of capital may mean they get a better rate than they would otherwise (e.g. if the fund contains concessional public capital) or they can access finance from investors who would not normally invest in them at this stage in their development due to being uncomfortable with risk exposure.

Intervention theme	Other blended finance
Archetypes to implement	Public sector
	Private finance

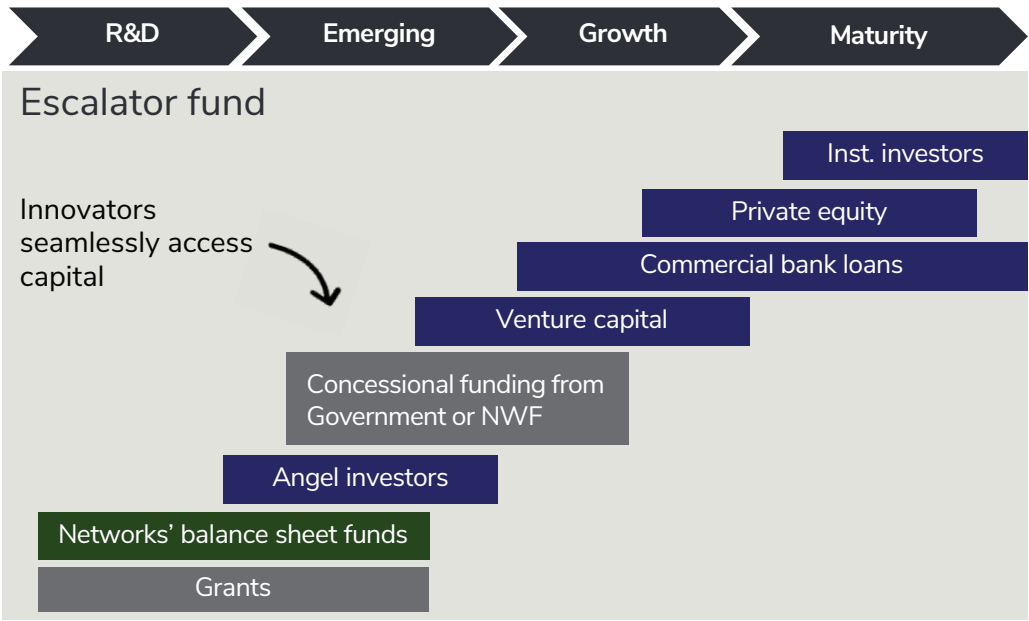


Figure 5: A theoretical ‘escalator fund’ structure, which could involve capital from various types of investors (illustrated with individual boxes). This structure would allow investors to maintain exposure only to the risk-return profiles they are interested in an escalator fund, these types of capital would be combined in different ways depending on the type of investment, taking into account the investor preferences.

Solutions #5/8: Knowledge sharing and oversight group

Intervention
theme

Public
capital

Archetypes
to implement

Public
sector

The creation of a body or function to enable greater coordination and oversight of mechanisms could support the commercialisation of innovations.

There is no single solution to overcome all the barriers to increasing private investment in network innovation. A range of solutions will be required, including regulatory change, the creation of new funds and products, and greater knowledge sharing. An oversight group could oversee the creation and delivery of these solutions in a coordinated way and lead the knowledge-sharing function.

Key benefits

An oversight group could add visibility and alignment to the activities taking place. It could provide clarity on the direction of travel for the sector and support the sharing of knowledge. This would support investors to understand the sector better and where the opportunities lie. Furthermore, the innovators would benefit from help to understand, access and solve network issues.

It could also convene multiple parties to create new funds or products, for example, a blended fund or technology performance guarantee products. In addition, it could convene the relevant parties to ensure there is alignment in policy direction, regulations and public innovation funding. It could provide a ‘technical authority’ role that sets the direction of travel for the market.

Options for implementation

This function could be provided by a dedicated team in a new body, such as GB Energy or NESO, or an arm of existing institutions such as Ofgem or UKRI, with a specific remit to deliver or support in the delivery of other solutions. All of these organisations should be represented in such a group.

The Transition Finance Market Review¹, published in October 2024, also recommended the set-up of a Transition Finance Lab, which could be based in the Green Finance Institute (GFI), ‘to work with finance, policy and industry, to design, develop and test finance structures to accelerate sector-specific transition pathways’. While not limited to network innovation, this model could help the design and piloting of structured finance solutions, in partnership with private sector actors.

“We would benefit from having a technical authority that decides when it’s time for diversion and exploration and when it’s time to select an option that should be applied at a system level. This would stop investment in the dead ends, like peer-to-peer trading for example, and send a clear signal to both innovators and investors.”

¹ [Scaling Transition Finance Report](#)

Solution #7: SIF development and commercialisation support

Intervention
theme

Public
capital

Archetypes
to implement

Public
sector

Public capital could be used to create an additional fund to provide innovators with a continuous roadmap of support alongside the SIF. This recommendation was developed by Carbon Limiting Technologies following a review of how to enhance the impact of the SIF.

The fund could run from early product development, supporting pre-Discovery innovators to engage with networks, through testing and demonstration to commercialisation and scale up. It could also include funding to support the development of a SIF application or ‘post-pilot’ planning, to build a business case and attract additional investment from private finance. This would be an alternative option from the blended fund (solution #3) rather than in addition to it, as it would provide the same function.

Key benefits

Establishing a new support fund to run alongside existing mechanisms, such as the SIF and the NIA, would provide innovators with access to capital to support them in overcoming many of the barriers identified. For example, grants could be provided to encourage innovators to develop business plans detailing their route to market, commercial market analysis for the innovation, further development/demonstration, financing, etc., which would make it easier for them to attract private investment that would fund scaling of the innovation/product. This could also allow innovators to ringfence resources to focus on commercialisation beyond the deliverables required for innovation-funded projects.

Options for implementation

This would be delivered by a public body such as Ofgem or UKRI and would provide cashflow and in-kind support for innovators throughout the early innovation journey, as well as helping them to commercialise the resulting innovations to successful deployment. This could be delivered through a combination of grants, innovation loans and commercialisation support modelled on successful schemes such as the Energy Entrepreneurs Fund (EEF).

“While SIF might test the tech, it doesn’t build the training programmes or the SME’s organisational capability.”

Solutions #9/11/12: Regulatory reform

Intervention
theme

Regulation

Archetypes
to implement

Public
sector

Regulatory reform was the most frequently cited solution by stakeholders, with a longer-term performance framework for network innovation being the most significant. Other regulatory reform solutions are also included here.

Two mechanisms exist within the regulatory framework for driving network behaviour: the RIIO framework (the price control mechanism that sets incentives for the networks) and the innovation funding mechanisms, such as the SIF and the NIA.

Key benefits

A longer-term, outcomes-based performance framework for network innovation would enable greater investment in proven innovations. This framework would allow network companies a longer payback period and incentivise them to invest in innovative solutions. Clear output-based KPIs could be set and linked to incentives. This would allow for faster and more efficient rollout of proven innovations and support innovators to scale across networks.

Changes to the innovation funding governance could reduce complexities around IP, making it easier for innovators to attract investment.

Options for implementation within RIIO-3:

- Separate innovation investment from Totex in the price control and allow CBAs to extend over multiple price control periods.
- Set clear outcome-based KPIs, such as achieved network capacity and level of zero carbon supply, and link incentives to them. This doesn't require a fundamental change for Ofgem to deliver. The challenge is identifying the right KPIs and how networks are rewarded.

Options for changes within innovation funding governance:

- Changes could be made to the IP arrangements under the current publicly-funded innovation schemes, so they are less rigid and complex. Changes to the consortium-led approach might make it easier for innovators to scale their innovations across markets and networks.

“We need regulatory incentives, mandates and expectations on network companies for pace, scale, breadth and value from a dynamic portfolio of their own and the adoption of others’ innovations.”

Solution #10: Decoupling innovation funding from networks

Intervention theme

Regulation

Archetypes to implement

Public sector

Reform that enables more whole systems innovation by decoupling network innovation cycles from the incumbent priorities of network operators.

The current public sector innovation regime requires network operators to act as both primary project partners and end customers for innovation projects with network-centric objectives limiting pace and scale of innovation. Decoupling public sector innovation funding from network companies can empower innovation to be more transformative and evolve to scale more quickly.

Key benefits

Removing the requirement for innovators to work in partnership with network companies could empower innovation from third parties that deliver more transformative, whole systems change. This could increase the pipeline of ideas coming forward, increase the amount of innovation activity, as well as increase its visibility. This in turn could generate interest from private investors who could provide the finance to scale solutions. When paired with reformed price controls that encourage bolder innovation strategies, network operators, which can act solely as end customers have a healthier innovation marketplace to select from.

Options for implementation:

1. Provide a licence condition to a different regulatory body to dispense innovation funding separate from the networks. This could be an existing public body such as NESO or Innovate UK.
2. Reform the existing SIF funding regime to enable third party companies to lead projects with the option to include a network partner.

Both options would require changes to primary legislation, which takes time and resources.

“We need to find a way for consumer money to be better represented by supporting third party innovators or innovations directly. By removing the network gatekeeper and allowing innovation the chance to prove something potentially outside of the network setting, until such point as it's ready. But it would also help to address some of those more whole system challenges that, if we're being frank about it, networks just don't care about because it's not their problem.”

Solution #16: Policy harmonisation

Intervention
theme

Policy

Archetypes
to implement

Public
sector

The creation of policy that drives market growth and increases market visibility can help to provide investor confidence.

A clear, detailed vision is required from government to increase market visibility and investor confidence in both the transition and specific technologies.

Key benefits

Providing network companies with clarity on what kind of grid to design would give them confidence in the types of innovations to support. Likewise, giving investors and innovators visibility of market size would increase confidence in investments, by making it easier to assess both the risks and potential returns on investment, with learnings from the [Energy Entrepreneurs Fund](#) demonstrating the importance of this approach.

NESO's latest report Clean Power 2030 also highlights the importance of stable and joined-up policy environment being key to attracting investors. The report highlights upcoming cap and floor decisions, future CfD allocation round designs and the REMA programme as key opportunities to harmonise policies and public sector support for the sector.'

Options for implementation

The [Clean Innovation Canada report](#) highlights four areas where governments can be most effective at unleashing private enterprise to accelerate clean innovation: push; pull; grow; strengthen. To provide consistent signals within network innovation, the UK government should focus on pull policies that help spur demand and strengthen policies that make the system more effective, connected and resilient. This could include:

- The creation of specific sectoral pathways to set out the target deployment for key technologies, setting outcomes for investors and innovators to deliver. Targeted delivery programmes, like the [Offshore Wind Accelerator](#), could then be founded around these technologies.
- The introduction of mechanisms to provide revenue certainty for new technologies, in a similar manner to the Feed in Tariff (FiT).
- Wider policy reform, delivered in conjunction with Ofgem and NESO, to harmonise revenue signals and define market size. For example, the Review of Electricity Market Arrangements (REMA) process is exploring how to best create effective and consistent signals for flexibility.

"The need for investor certainty is common to all models. For example, market risk is often cited as a key issue from an investor standpoint. Policies related to a clear carbon price signal, market carve outs (or targets), and/or public procurement of cleantech innovation can provide useful signals to investors."



Appendix 1: Overview of archetypes

Overview of archetypes

	Archetype	Overview	Key objectives
Demand for finance	Established Manufacturer and developer	Companies that have an established history of innovating and selling products to the energy networks sector.	<ul style="list-style-type: none"> • Maintain revenue streams from existing product base • Prove new technology or data solution for customers • Sign first commercial contract
	Start-up Manufacturer and product provider	Emerging companies seeking to scale in the energy networks sector by developing innovative products.	<ul style="list-style-type: none"> • Prove new technology for customers • Sign first commercial contract
	Start-up Service provider	Emerging companies seeking to scale in the energy networks sector by developing innovative services and solutions.	<ul style="list-style-type: none"> • Prove new process or data solution for customers • Sign first commercial contract
Supply of finance	Public Ofgem	The energy regulator in the UK. It runs the SIF and designs the regulatory framework governing networks.	<ul style="list-style-type: none"> • Foster a thriving innovation ecosystem in the UK energy networks sector • Ensure the consumer's needs are met by the networks industry
	Public DESNZ	The department responsible for delivering energy and net zero objectives, including the security of supply, ensuring properly functioning markets, and seizing net zero opportunities to lead the world in green industries.	<ul style="list-style-type: none"> • Deliver the government's strategic objectives on energy and net zero, including the commitment to revolutionise the country's energy networks • Elevate the UK's position in green industries globally
	Public Local authorities	Local bodies responsible for local government. They have a key stake in ensuring local energy networks are reliable and transitioning towards net zero, but no statutory role for energy.	<ul style="list-style-type: none"> • Ensuring energy is accessible and affordable for households and businesses • Ensure that local energy networks support the economic and net zero ambitions of the local authority
	Public UK Infrastructure Bank	A state-owned development bank with the objective of supporting the UK to meet its net zero targets and support regional economic growth.	<ul style="list-style-type: none"> • Supporting the growth of net zero infrastructure in the UK • Identifying companies with local-term growth potential for the most efficient use of public finance
	Private Private equity	Financers seeking long-term opportunities to invest in emerging companies and support their journey to become established in the market supplying energy networks.	<ul style="list-style-type: none"> • High risk/high reward appetite, comfortable with varying track record and cash flow • Investment losses part of the business model; looking for high-potential firms • Many firms looking for companies that have secured 1-2 significant contracts
	Private Venture Capital	Financers that support start-ups that have long-term growth potential. Corporate Venture Capital also exists, where an investment division of a company provides finance to emerging companies.	<ul style="list-style-type: none"> • High risk/high reward appetite, comfortable with varying track record and cash flow • Investment losses part of the business model; looking for high-potential firms • Many firms looking for companies that have secured 1-2 significant contracts

Overview of archetypes

	Archetype	Overview	Key objectives
Supply of finance	Private Angel Investors	Financers that provide early-stage seed capital to emerging companies in exchange for equity. Often individuals rather than organisations, choosing investments based on their appetite.	<ul style="list-style-type: none"> Supporting innovators through the early-stages of its growth journey to maximise opportunity Investing in companies where the investor has a specific area of interest
	Private Commercial /investment banks	Large financiers that provide capital through loans or investments to companies. Often interested in a diverse portfolio of investments that include infrastructure and net zero assets.	<ul style="list-style-type: none"> Increase exposure to large projects (hundreds of millions ticket size) Appetite for innovative finance structures and co-investing alongside PFOs Require strong track records and steady cash flow; less appetite for first of a kind technologies
	Private Institutional investors (asset managers, asset owners)	Financers seeking to invest in companies and bring them into their portfolio to deliver growth, diversify asset base and decarbonise their portfolio.	<ul style="list-style-type: none"> Support portfolio companies with achieving growth Decarbonise portfolio and making clear progress in transition; meeting TCFD and transition reporting requirements
	Private Corporate investors	Finance provided by the investment arm of a corporation that seeks to support the growth of companies that align with its strategic objectives.	<ul style="list-style-type: none"> Make investments that align with the strategic objectives of the corporation
	Private University research and funding support	Research finance provided by public bodies, educational institutions or philanthropic organisations to innovators which has the potential to deliver transformative new products or services.	<ul style="list-style-type: none"> Support innovations that elevate the awarding organisations' reputation as a research institution and/or financer of innovation.
Enablers	End users (networks)	The UK companies that hold licenses from Ofgem to own, maintain and develop gas and electricity transmission and distribution infrastructure.	<ul style="list-style-type: none"> Maintaining reliable and resilient networks while developing infrastructure to meet future net zero need Embed operational efficiencies that ensure profitability of the business model
	(Re)insurers	Insurance companies that insure part of the risk of another insurance company, allowing the spreading of risk across multiple parties.	<ul style="list-style-type: none"> Support companies with a technically promising product or service



Appendix 2: Case studies

Case studies

Technology performance insurance: New Energy Risk

Finance suppliers



Clients include:



Investment products

Technology performance insurance

Overview of product:

To stimulate the deployment of clean technologies, New Energy Risk offers performance insurance products that support innovators seeking to scale their breakthrough technologies. New Energy Risk partners with re/insurance companies to transfer technological and financial risk to insurance markets¹.

Providing backstops and allowing suppliers and manufacturers to give reliable, comprehensive, and long-term warranties for their products helps their customers and investors manage technology and warranty risks².

Sector archetypes:

Financing demand

Startup manufacturer and developer

Start-up | Developer; digital solutions

Financing supply

Reinsurers

Case study learning

- There is appetite among insurers to offer enabling products for innovators in the energy sector.
- Derisking innovation can help to raise ambition and increase the speed of scaling.
- Security provided by products can help companies to attract more private investment.

Sources (1) [New Energy Risk](#) (2) [Bloom Energy Case Study](#); (3) [Carbon Trust: 10 years of accelerating innovation](#)

Pooled corporate VC: Offshore Wind Accelerator (OWA)

Programme facilitator



Finance suppliers



Investment recipient

150+ projects

Investment products

Grant funding for R&D

Overview of product:

The OWA was established as a partnership between Carbon Trust and major offshore wind developers in response to the 2008 Climate Change Act, identifying the vital role of offshore wind and the need for technical innovation to drive cost reduction at scale to ensure it was a competitive renewable energy source. The OWA model placed offshore wind developers at the heart of project partnerships as both funders of the programme and end users of the innovations. Nine offshore wind developers pooled capital into an innovation to share risk and returns, while seeking to identify scalable innovations across five key research areas; cables, electrical systems, foundations, logistics and yield. In the first ten years of operation, the OWA supported 150 research projects delivering £34bn of energy cost savings for offshore wind through a 15 per cent reduction in the levelised cost of energy³.

Sector archetypes:

Financing demand

Established manufacturer and developer

Startup manufacturer and developer

Start-up | Developer; digital solutions

Financing supply

End user balance sheet

Research

Corporate investors

Case study learning

- Harmonising policy is essential for increasing private capital into energy markets e.g. technical delivery and market reform must go hand in hand.
- Technical delivery programmes that focus on cost efficiencies can help increase investor appetite.

Case studies

Blended fund: EU – Breakthrough Energy Catalyst Partnership

Finance suppliers



Investment recipients

Hydrogen, long duration energy storage, sustainable aviation fuel, direct air capture, industrial decarbonisation.

Investment products

Venture capital
Equity

Overview of product:

Breakthrough Energy Catalyst, the European Investment Bank and the European Commission provide a variety of funding products to help support emerging climate technology projects through the Energy Catalyst Partnership. The EU will align capital with Catalyst funding from Horizon Europe and the Innovation Fund through the InvestEU Program. Two types of projects will be funded under the partnership:

- Demonstration Projects – Venture Debt from the EIB and Capex Grant from Catalyst.
- Large FOAK Projects – Equity from Catalyst combined with Quasi-Equity from EIB both intended for project capex.

Sector archetypes:

Financing demand

Established manufacturer
and developer

Financing supply

Public capital

Venture capital

Case study learning

- Identify and support innovations with high impact and cost-down trajectories.
- De-risking early-stage projects with high levels of potential impact.
- Supporting FOAK technologies to scale up and create markets for long-term commercial viability.

Blended fund: European Angels Fund (EAF)

Programme facilitator



Investment recipient

120+ business angels
800 SME co-investments

Investment products

Public finance provision of
co-investment capital to
Business Angels

Overview of product:

EAF is an initiative advised by the European Investment Fund (EIF) which provides equity to Business Angels and other non-institutional investors for the financing of innovative companies in the form of co-investments. EAF works hand in hand with Business Angels and helps them to increase their investment capacity by co-investing into innovative companies in the seed, early or growth stage, with €330m committed so far, with a target volume of €800m.

Sector archetypes:

Financing demand

Startup manufacturer
and developer

Start-up | Developer;
digital solutions

Financing supply

Public capital


Angel investors

Case study learning

- Public co-investment offers a blended finance model that empowers angel investment experts with additional capital to support seed, early and growth-stage companies.
- Long-term contractual relationships with Angels, instead of deal-by-deal agreements, enable investor freedom and expedite investment

Case studies

Public grant funding: Energy Entrepreneurs Fund (EEF)

Finance suppliers	Investment recipient	Investment products
 Department for Energy Security & Net Zero	156 innovators	Public grant funding

Overview of product:

The EEF was a publicly funded programme provided grant funding and incubation support to SMEs to help develop and commercialise low carbon technologies and processes. The programme supported 156 projects with proposed innovation projects, awarding £72mn in grant finance. EEF funded projects made higher levels of commercial progress than projects declined for funding, however, DESNZ evaluation reports have identified the need for greater focus on market validation in future programmes to deliver longer-term commercial success for innovations.

Sector archetypes:

Financing demand

Manufacturer and developer

Startup manufacturer and developer

Start-up | Developer; digital solutions


Financing supply

Public capital

Case study learning

- Provision of public seed funding to innovators helps companies to accelerate their early innovation journey.
- Most recipients of EEF have not fully commercialised their projects or services, demonstrating greater need for market validation exercises in public grant models to target key areas of opportunity.

Bonds: Custom bond solutions

Programme facilitator	Investment recipient	Investment products
	Multiple Canadian businesses exporting to foreign markets	Green bonds Surety bonds Export finance

Overview of product:

Export Development Canada (EDC), Canada's export credit agency, offers a selection of sustainable bond solutions for Canadian businesses seeking to expand their presence in international markets. Within the guiding framework, EDC focuses on funding green, transition and social innovations.

The EDC also offers Surety Bonds to Canadian export businesses, improving the finance options available to innovators and their ability to seek ambitious international growth opportunities needed to scale.

Sector archetypes:

Financing demand

Manufacturer and developer

Startup manufacturer and developer

Start-up | Developer; digital solutions

Financing supply

Public capital

Institutional investors

Investment bank

Corporate investors

Case study learning

- Export finance agencies have the levers to deliver significant financial support to early-stage companies.
- Guiding frameworks can underpin an ambitious approach to support green and transition projects.
- International markets are critical for early-stage companies to secure investment; Surety Bonds offer greater assurance to businesses.



Appendix 3: Bibliography

Bibliography

- [Accelerating Clean Energy Commercialization: A Strategic Partnership Approach](#), NREL
- Design of Early-Stage Growth Finance to enhance Ofgem SIF, **Ofgem**
- [Energy innovation funding and institutions in major economies](#), **Nature Energy**
- [Mission Innovation Public-Private Breakfast: “Investing in Transformative Change”](#), **Mission Innovation**
- [Clean Innovation | Why it Matters & How to Accelerate it Across the Canadian Economy](#), **Smart Prosperity**
- [Roadmap to RESP: Unlocking regional ambition](#), **Regen**
- [Scaling growth-stage climate tech companies](#), **Barclays**
- [Innovation Strategy](#), **NESO**
- [Blended finance as a catalyst for accelerating the European heat transition?](#) **Smart Energy**
- [Prospects for innovative power grid technologies](#), **CurrENT, Breakthrough Energy**
- [Delivering a reliable decarbonised power system](#), **Climate Change Committee**
- [Strategy and Policy Statement for Energy Policy in Great Britain](#), **DESNZ**
- [Energy Networks Innovation Strategy](#), **ENA**
- [Understanding equity access and use in early-stage ventures](#), **Enterprise Research Centre**
- [Power Plant 2.0](#), **Eurelectric**
- [Grids for speed](#), **EY**
- [Planning for energy decarbonisation at a local level](#), **Regen**
- [Playbook for Network Innovation: Building on patterns of success](#), **Regen**



The **Green Finance Institute** is an independent, non-partisan organisation and advisor to governments. We test, demonstrate, and scale the financial solutions needed to accelerate the transition to a net-zero and nature positive economy. We partner with financial organisations, corporates, policymakers and others to create and scale innovative solutions that deliver practical outcomes for communities and economies.



Regen is an independent centre of energy expertise with a mission to accelerate the transition to a zero-carbon energy system. We have more than 20 years of experience delivering expert advice on the challenges of decarbonising power, heat and transport

Disclaimer

This greenprint has been made available to you for information purposes only. Nothing in this greenprint is to be construed as legal, tax, investment, financial or any other advice by Green Finance Institute Limited (“GFI”) and Regen SW (“Regen”). This greenprint does not constitute, and is not intended to constitute, an invitation, solicitation, recommendation, endorsement by GFI, Regen or any third party to take any particular course of action (including, but not limited to, entering into any financial arrangements) in the United Kingdom or in any other jurisdiction. It is not intended to be relied upon by users in making (or refraining from making) decisions of any nature (including financial or investment decisions).

The information contained in this greenprint is of a general nature and does not address the circumstances of any particular individual or entity. Certain information contained in this greenprint has been obtained from or is based on sources that GFI and Regen believe to be accurate and complete. This greenprint is not, and does not purport to be, a comprehensive or complete statement or reflection of the matters set out herein. Although reasonable care has been taken to check the accuracy of the information contained in this greenprint, GFI and Regen cannot guarantee and does not take responsibility for the accuracy or completeness of the information contained in this greenprint. Any opinions set out in this greenprint may be incorrect and may change at any time.

In reading and accessing this greenprint, you alone assume the responsibility of evaluating the merits and risks associated with the use of any information contained herein before making any decisions on the basis of such information or content. GFI and Regen accept no liability for any losses or damages (whether direct, indirect, special, consequential or otherwise) arising out of opinions, errors or omissions contained in this greenprint, and it excludes all liability arising from this greenprint to the fullest extent permitted by law. You should not base any investment or financial decision solely on the basis of the information contained in this greenprint. Where relevant, you should seek appropriate legal, tax, investment, financial or other professional advice. GFI and Regen are not registered investment advisers and are not regulated by the Financial Conduct Authority.