

Solving the UK's Cabling Challenge:

A blueprint for the new government



Foreword

Delivering a net zero economy by 2050 requires a significant increase in electrification to transform the way we travel to work and school, heat our homes and power our economy; every aspect of our daily lives will be shaped by our obligation to decarbonise.

Specifically for the UK, National Grid ESO's latest release for its Future Energy Scenarios estimates that annual electricity demand could be between 194% and 268% higher by the middle of this century.¹

In order to manage this, as well as the integration of renewable energy, the capacity, efficiency and resilience of the grid needs to increase substantially. This challenge isn't new, and over the last 12 months we've seen significant – and welcome – political interest in resolving grid challenges. This has focused on the planning reforms and system changes needed to prioritise grid connections.

But to date, industry and policymakers have paid less attention to one of the fundamentals required to genuinely transform the UK's electricity grid: the cabling systems we need to transmit and distribute power.

The cabling which makes up the UK's system is little changed from the cables installed by the Victorians, built for a bygone era where electricity travelled one way and to fewer end points. These cables are inefficient with high levels of resistance. We believe there's an opportunity to do things differently – benefitting from emerging research and innovation to develop cables that are fit for the future.

As the grid grows, we'll need significantly more cable. So, we need a conversation about how we manufacture and procure that, ensuring that the UK has the critical content it needs and can also establish an international leadership and export position.

At Enertechnos, we are leading the way in developing innovative cable solutions, having invented the 'Capacitive Transfer System' (CTS) which reimagines cable design. As a UK-based clean tech innovator, we're working with cable manufacturers, electricity networks and power users around the world to pioneer a different way of delivering power.

We want the UK to be a leader in developing and manufacturing the cable solutions of the future. As leaders in cabling solutions, driving innovation and new thinking, we're well placed to shape the approach that policymakers take to address this issue. Earlier this year, we brought together experts from across the cabling industry, the energy sector, think tanks and academia to explore the challenges we face in relation to producing the cable solutions we need, and how we might overcome these. This conversation has informed the production of this report, and we extend warm thanks to all who participated.

With a new government in power, we have a fresh opportunity to address this challenge, and an even greater impetus with Labour's ambition to decarbonise the power system by 2030. This report acts as an ambitious but deliverable blueprint for the new government, informing their thinking on this topic and setting out a practical pathway to solving a critical challenge that will impact how effectively the government can deliver its Clean Power Mission. While this report is focused on the UK – as our home market – almost every country around the world is facing this common challenge, and the learnings and recommendations are universal.

Dominic Quennell

Chief Executive Officer & Co-Founder

Introduction

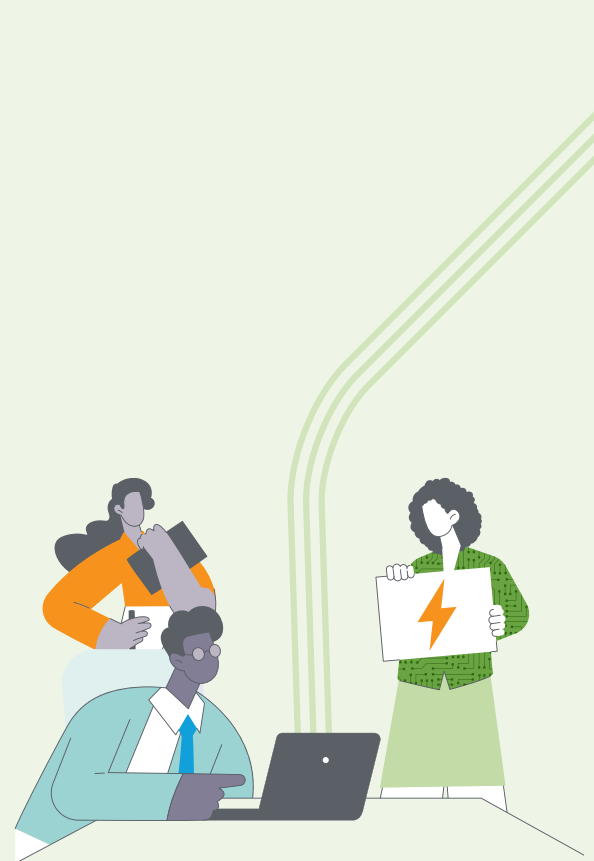
Upgrading the UK’s grid on the scale that’s required to deliver net zero will require a significant increase in cabling. A report by the International Energy Agency (IEA) has estimated that 80 million kilometres of distribution or transmission grids will need to be added or replaced worldwide by 2040.²

Increasing demand for cables on a global scale, partnered with the necessary frontloading of this to achieve a decarbonised power system by 2035, has resulted in a near-term risk that the UK won’t have access to the cabling it needs. Moreover, there is a need to be more innovative in our approach. Instead of upgrading the grid with cables that are struggling to meet today’s demand, we must start looking towards cleaner, smarter and more modern technology, particularly if it can be developed in the UK. Building a more resilient grid runs parallel to building a more resilient supply chain.

Addressing these challenges presents significant opportunities for the UK, such as boosting the economy, enhancing our national security and accelerating the transition to net zero. However, there is no time to wait. Swift and decisive action from government and regulators is needed now to futureproof the grid so that it can serve as the backbone of a decarbonised electricity network.

This report begins by exploring factors which limit the capacity, efficiency and resilience of the grid and argues that energy losses must be taken more seriously by policymakers. It then goes on to examine the considerable challenge of securing the equipment to bolster the grid when we have limited manufacturing capacity and supply chains are unusually volatile. Next, it addresses the role of innovation and technology in delivering net zero before rounding off with several concrete recommendations for policymakers seeking to rewire Britain.

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Chapter One: Capacity, Efficiency and Resilience of the Grid

The Challenge

With the increasing electrification of transport and home heating, the inefficient copper cabling we currently use will struggle to meet demand. This will be particularly true in periods of high demand, such as in winter, leaving consumers vulnerable to increased costs and potentially even blackouts.

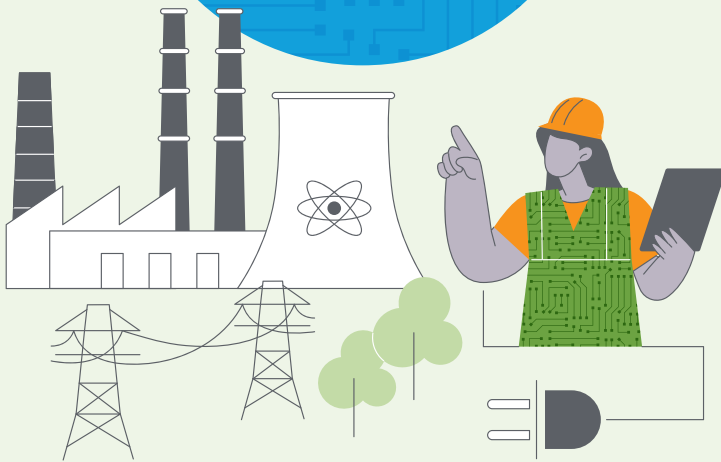
Our current cabling solutions don't have the capacity and efficiency that they could, and don't take advantage of recent innovation and emerging technologies.

The current cabling that makes up our system was predominantly installed in the postwar era when electricity travelled to fewer end points and there was significantly less demand for electricity. These cabling solutions are currently losing significant power.

Energy losses are a significant but rarely discussed problem with legacy copper cabling. This means that a relatively high proportion of the power going into our grid doesn't reach its intended end point. Most losses occur on distribution networks as electricity is being transported from the high voltage transmission grid to end users – domestic, commercial and industrial. These are the costliest losses, but also the easiest to address through more efficient infrastructure. This is the equivalent to leakages in the water sector, which are easier to see and understand.



At 26TWh per year, losses currently equate to the expected annual electricity production of Hinkley Point C



Wastage on the network has been a longstanding concern, but it will be felt more acutely as electricity demand increases and more renewables are integrated into the grid. Tackling this issue requires a more innovative approach using modern technology.

Clearly, legacy cabling is not suitable for the rapid growth in renewable energy the grid will see, particularly from wind and solar power. These weather-dependent resources are highly intermittent, putting further strain on the grid. The more strain put on the asset, the more losses will occur. A grid that is resilient, with the ability to increase capacity over time, will underpin the entire transition.

	Losses TWh	Net Imports TWh
2021	26	25
2020	26	18
2019	26	21
2018	27	19
2017	27	15

The above graph displays five years of losses compared to electricity the UK imported from abroad, a solution that is often used to stave off the threat of blackouts. At 26TWh per year, losses currently equate to the expected annual electricity production of Hinkley Point C.⁴

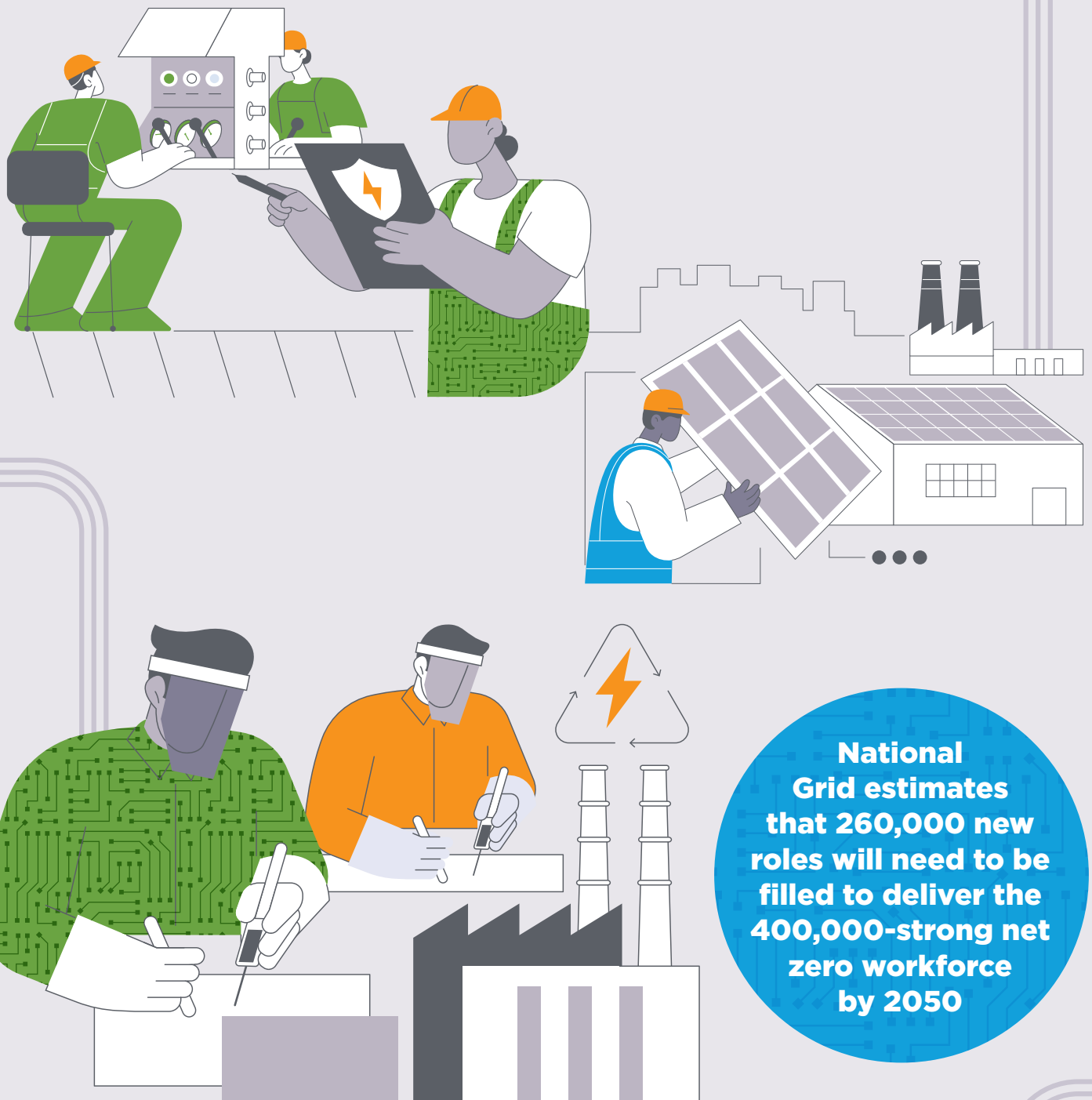
“There is an outdated view that network losses are inevitable, but that is not the case with modern technology. Addressing this challenge will boost our energy security, sustainability and affordability, three elements that are at the top of our agenda.”

Maxine Frerk, Sustainability First

Chapter Two: Manufacturing, Skills and Supply Chain

The Challenge

In 2021, the UK consumed a total of 241 kiloton conductors of wire and cable, making it the fifth largest market in Europe.⁵ Despite this, the UK is not currently a leader in the manufacturing of cabling systems, with significant dependence on other international markets.⁶



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This poses questions over our supply chain resilience at a time of geopolitical volatility and limits the economic opportunity that developing a strong manufacturing base can bring. As the world moves to decarbonise, demand for vital grid components – including cables – is set to skyrocket. For the UK, the demand for these critical grid systems and components threatens to outstrip our limited domestic manufacturing capacity. While a global market is essential, there is a need for the UK to consider strategically its own supply chain resilience as part of a future industrial strategy, providing the confidence that we have reliable cable system supplies.

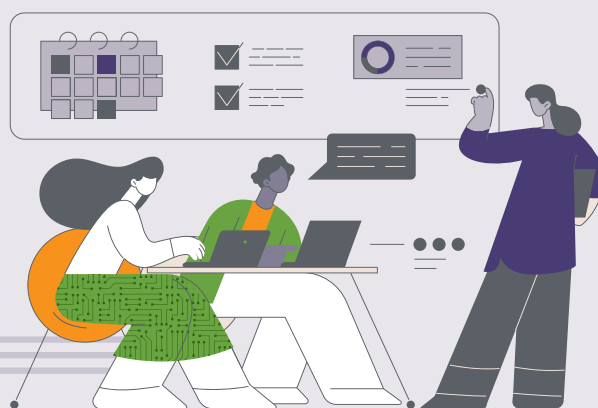
The previous UK government looked at the readiness of our supply chain to deliver net zero and identified HVDC cables, export cables and cable vessels for offshore wind as “high risk”. Other transmission and distribution cables, pylons and poles are identified as “medium risk”.⁷ For offshore wind alone, there is a need for vast quantities of cabling that must be laid underwater. Nonetheless, with an ambition to deploy up to 50GW of offshore wind capacity by 2030, increasing from approximately 15GW today, supply chain barriers must be urgently addressed to position the UK as a world-leader in this market.

As the new Chancellor, Rachel Reeves has acknowledged the importance of considering the supply chains we need for the future and the potential risks to the UK economy in an increasingly uncertain world.⁸ The Labour Party has also set out proposals for centralised procurement of electricity cables. This provides an opportunity to take a more strategic view on how the industry works, and how the benefits from UK innovation and manufacturing can best be secured.

Meeting these challenges requires more UK-based manufacturing. There are considerable economic benefits to this. Expertise required to develop a successful net zero economy often sits outside of urban areas, such as JDR Cable Systems’ facility in Hartlepool. Increased manufacturing could drive forward regional prosperity and create a more balanced economy.

However, building up manufacturing capability in this space will require a UK skills upgrade. There are skills gaps and shortages across the breadth of the decarbonisation agenda. National Grid estimates that 260,000 new roles will need to be filled to deliver the 400,000-strong net zero workforce by 2050.⁹ For cabling, there are particular shortages for electrical design, test and commissioning engineers, despite the UK having excellent engineering universities, and being home to 3 of the top 10 engineering schools worldwide.¹⁰ Much of the pressure comes from international competition for these skillsets and the UK is heavily reliant on overseas workers.

With global competition for equipment and skills unlikely to wane in the short to medium-term, it is crucial that the UK starts to capitalise on opportunities to bolster its manufacturing capabilities and build a more resilient supply chain. The current picture is stark, with recent analysis by the Bennett Institute for Public Policy showing that the UK has had the steepest decline in manufacturing’s share of GDP within the G7.¹¹



Chapter Three: Protecting Against a Shortage of Critical Minerals

The Challenge

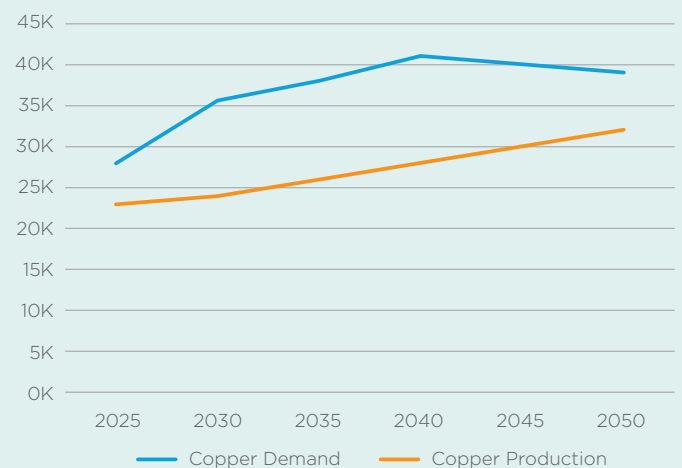
Critical materials that are needed for cabling systems, specifically copper, are in increasingly high demand from other carbon reduction measures.

The world's demand for copper could outstrip supply by 50 million tonnes annually by 2035 as countries around the world move to electrify their economies. Analysts say this will lead to a copper price boom, with prices having spiked towards the end of 2023 and now having surged over 20% to almost \$10,000 per tonne since February 2024.¹² This poses a significant risk to the net zero transition, with copper and other scarce resources playing a critical role in the production of technologies, including cables and electric vehicles.

Chile, which contributes 27% of global copper supply, is facing a production decline. Meanwhile, Peru, which accounts for 11%, is experiencing disruption due to protests.

This means that we will need to become increasingly reliant on newer technologies entering the market that reduce reliance on materials such as copper. Although there are likely to be higher upfront costs, this will provide greater resilience against volatility in global supply chains.

World mine production and demand for copper in metric tonnes



Chile, which contributes 27% of global copper supply, is facing a production decline. Meanwhile, Peru, which accounts for 11%, is experiencing disruption due to protests



Chapter Four: Championing Innovation

The Challenge

The UK has a world-leading R&D sector, but we can do more to make the most of this. The UK has been successful at incubating new cabling solution innovators, developing different technologies that will address the challenges set out in this report.

However, to date, we haven't been quick enough to move from innovation to commercialisation and deployment, with significant opportunity for policy and regulation to be less risk adverse in pursuit of more homegrown innovation and export opportunities.

Embracing innovation is critical to the energy transition. The deployment of cleaner and smarter cabling will help to reinforce the grid and ensure it is ready for a significant increase in renewable resources.

The Distribution Network Operators' (DNOs) ability to invest in new technologies is hamstrung by inconsistencies within the regulatory regime, which mean they do not have long-term visibility over funding or incentives to invest.

A prominent example of this is the withdrawal of the "Losses Discretionary Reward" that was introduced in RIIO-ED1. This scheme sought to incentivise DNOs to focus on activities that manage losses on their network and lower them as much as possible. However, this mechanism was withdrawn by Ofgem in RIIO-ED2 on the basis of "significant challenges in accurate measurement" and "administrative burdens" which drew them to the conclusion that the incentive was not matched by the benefits it had brought.

Although it can be argued that the Losses Discretionary Reward did not have the full desired effect of incentivising DNOs to reduce network losses, its withdrawal for RIIO-ED2, without a concrete replacement, is demonstrative of Ofgem's piecemeal approach to strategic funding. Meanwhile, all DNOs have indicated in their losses strategies that total losses on the network will increase throughout RIIO-ED2 as a result of growth in distributed generation. This means that the issue will only be felt more acutely as we move towards greater electrification and a decarbonised economy.



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Chapter Five: Our Blueprint for the Future

As we have set out in this report, we need to see an ambitious and consolidated approach from the government and the regulator to ensure we are embracing innovation, and smarter, cleaner and more resilient cabling technology.

To achieve this, we would recommend that policymakers and industry collectively take forward the following recommendations:

A clearer strategic direction for the UK's cabling industry

- 1. The Departments for Energy Security and Net Zero and for Business and Trade should work together – in partnership with industry – to establish a clear plan for the UK cabling industry, as part of the next Industrial Strategy. This should leave sufficient space for industry innovation but should specifically consider:**
 - What the UK's future electricity cable demand is likely to be, and how this can best be met
 - How new innovation can be fostered and encouraged, with policy and regulation creating the right incentives for DNOs to deploy innovative new cabling solutions
 - How the UK can establish a resilient supply chain, securing the jobs and economic benefits from a homegrown manufacturing sector
- 2. GB Energy's proposed role to procure cabling solutions through a 'super tender' should be aligned to this plan, with a clear mandate to choose the most innovative and efficient solutions available.**
- 3. Ofgem's strategic priorities should also be aligned with this plan.**

A regulatory framework that incentivises innovation

- 4. Ofgem's price control period must provide stronger incentives to enable the DNOs to be less risk-averse in their approach towards innovation and invest in new technologies through greater long-term visibility over strategic funding.**
- 5. Ofgem should provide effective incentives to use the most efficient cabling technologies, including through the reintroduction of the Losses Discretionary Reward or an equivalent scheme as part of the upcoming RIIO-ED3 price control process.**
- 6. Ofgem should introduce an obligation for DNOs to provide two models as part of their cost benefit analysis – one looking at business-as-usual technology and another providing an alternative plan that uses innovative equipment. This would create a more forward-looking approach to grid upgrades, whereby the DNO can show the regulator the cost versus benefit analysis and help to justify upfront spend by demonstrating return on investment.**



References

- ¹ National Grid ESO, Future Energy Scenarios, July 2024, <https://www.nationalgrideso.com/document/322316/download>
- ² IEA, Electricity Grids and Secure Energy Transitions, October 2023, <https://iea.blob.core.windows.net/assets/ea2ff609-8180-4312-8de9-494bcf21696d/ElectricityGridsandSecureEnergyTransitions.pdf>
- ³ Department for Business, Energy and Industrial Strategy, Digest of UK Energy Statistics, July 2022, <https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2022>
- ⁴ Power Technology, Hinkley Point C nuclear power station, May 2023, <https://www.power-technology.com/projects/hinkley-point-c-nuclear-power-station/?cf-view>
- ⁵ CRU Group, Construction and electrification drive UK cable demand growth, May 2022, <https://www.events.crugroup.com/wireandcable/Uploads/CRU%20Wire%20and%20Cable%20Market%20Outlook%20-%20UK%20Country%20Profile%20-%20May%202022.pdf>
- ⁶ Fortune Business Insights, Wires and Cables Market Size, Share & Industry Analysis, June 2024, <https://www.fortunebusinessinsights.com/wires-and-cables-market-103322>
- ⁷ Department for Energy Security and Net Zero, UK Renewables Deployment Supply Chain Readiness Study, April 2024, UK renewables deployment supply chain readiness study - Executive summary for industry and policymakers <https://www.gov.uk/government/publications/uk-renewables-deployment-supply-chain-readiness>
- ⁸ Rachel Reeves MP, 'Securonomics', May 2023, <https://labour.org.uk/updates/press-releases/rachel-reeves-securonomics/>
- ⁹ National Grid, Building the Net Zero Energy Workforce, January 2020, <https://www.nationalgrid.com/stories/journey-to-net-zero/net-zero-energy-workforce>
- ¹⁰ Times Higher Education, World University Rankings 2024 by subject: Engineering, <https://www.timeshighereducation.com/world-university-rankings/2024/subject-ranking/engineering-and-it>
- ¹¹ Bennett Institute for Public Policy Cambridge, Investment in the UK: Longer term trends, November 2023, <https://www.bennettinstitute.cam.ac.uk/publications/investment-in-the-uk-longer-term-trends/>
- ¹² Credendo, Copper Sector: Record-Breaking Copper Prices Amid Speculation of Supply Shortages, 27 May 2024, <https://credendo.com/en/knowledge-hub/copper-sector-record-breaking-copper-prices-amid-speculations-supply-shortages>
- ¹³ UN Trade and Development, Critical Minerals Boom: Global Energy Shift Brings Opportunities and Risks for Developing Countries, April 2024, <https://unctad.org/news/critical-minerals-boom-global-energy-shift-brings-opportunities-and-risks-developing-countries>

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About Enertechnos

Enertechnos is a UK clean-tech company, developing innovative solutions to enable better electricity and support the transition to net zero. Our innovative cable technology – the Capacitive Transfer System, ‘CTS’ – reduces energy losses throughout the power network, cutting carbon emissions from wasted energy.

We have received backing from several government programmes and are currently working with Innovate UK to revolutionise electric vehicle charging. We’re also working with industry to help tackle the problem of losses.