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Electricity Network Expansion

Delivery Challenges and Opportunities from a Design and Build Perspective

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The scale of the challenge

Clean Power 2030 and beyond

- The Clean Power 2030 mission will see c. 5x more electricity infrastructure constructed in the next 6 years than in the past 30.
- Beyond 2030, further substantial T&D infrastructure will be needed to decarbonise demand and reach Net Zero by 2050.
- Globally, electricity utilities are embarking on similar grid upgrades.
- An Arup AECOM joint venture (JV) has been appointed as design and consenting service partner for National Grid's GGU Partnership.
- Initial focus on network design and construction work required by the end of the decade on 9 major projects across England and Wales.

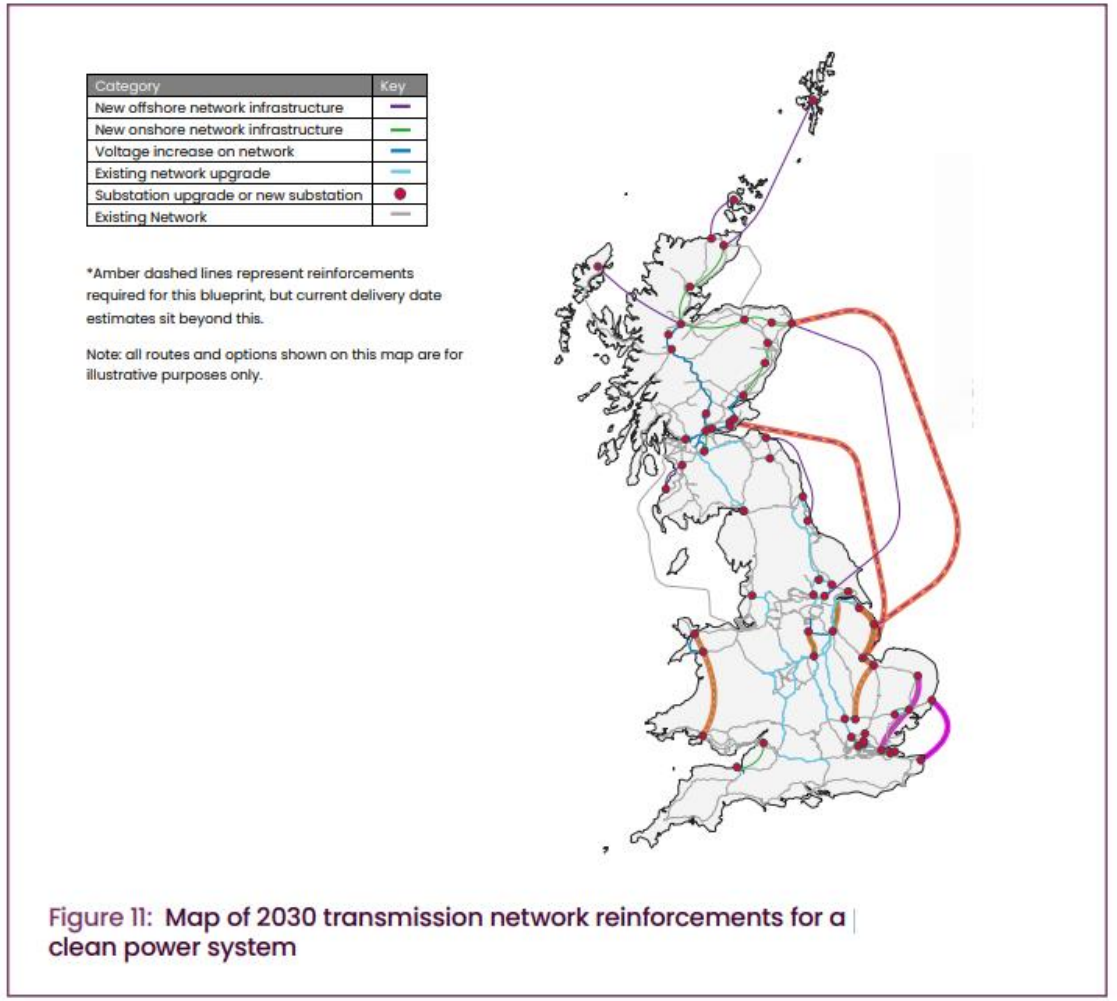

Figure 11: Map of 2030 transmission network reinforcements for a clean power system

Source: Clean Power 2030

How do we build an electricity grid fit for the future? - Arup

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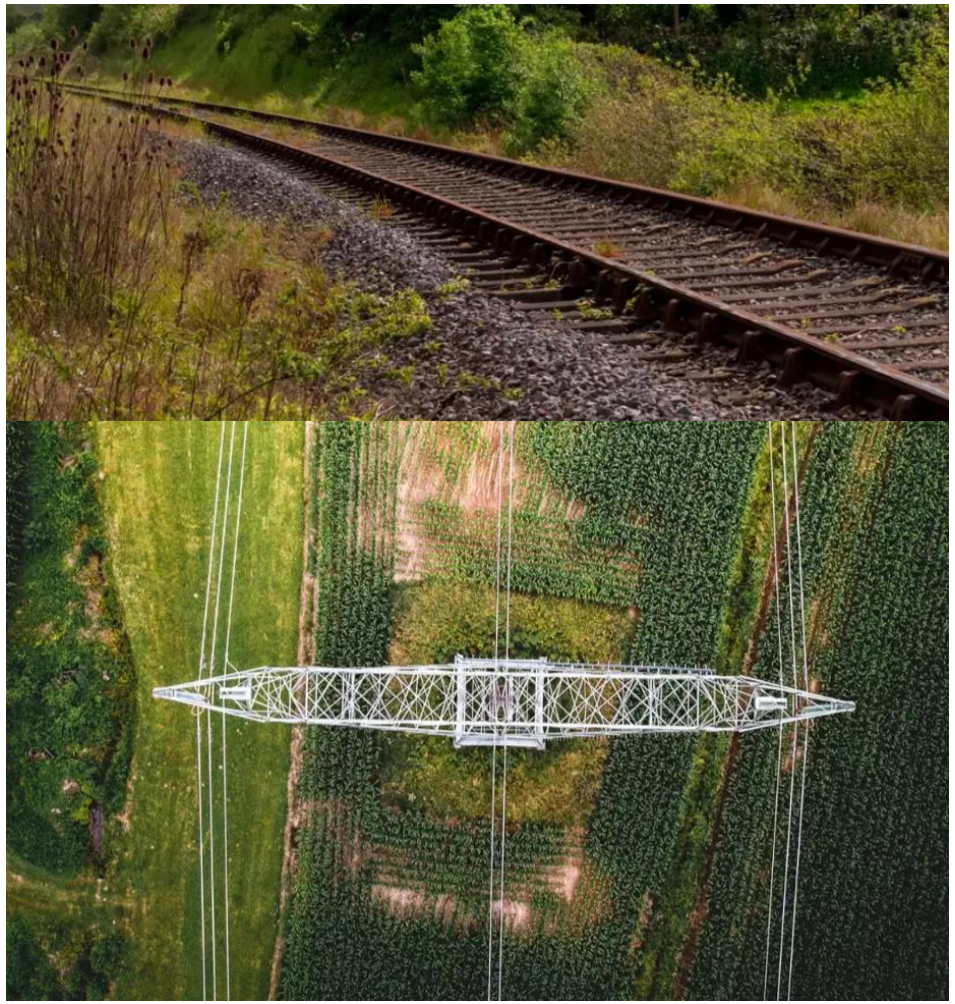
Global skills shortages – trends and solutions

Growth of specialist skills and multi-disc teams

- Embedding and fostering core, specialist skills: Electrical design (substations, cable, OHL, C&P), power system studies, HVDC
- Collaborating with Universities to grow pipeline
- Halo effect: Attraction of engineering and other infra project disciplines e.g. civils, geotech, planning and consenting, project management
    - Rail → Electricity networks (both linear infrastructure)
- Consider conversion: Circa 9-18 months into specific project roles then broaden experience over time
- Deployment strategy to ensure quality is not impacted

Understanding the sensitivities around planning and consenting is important



Global skills shortages – trends and solutions

Addressing constraints in skills globally

- We are seeing skills constraints for electricity network expansion across all our regions – US, Asia Pacific, Europe
- Use of offshore (low) cost centres by declining as other countries go through their own energy transformation
- Arup is growing our regional T&D teams to deliver regional projects, also provides some level of global skills base e.g. electrical design, power systems studies and software
  - Long term and short-term assignments
  - Global sharing of specialist expertise
  - We're used to working in multi-region teams

At least $21.4 trillion needs to be invested in the electricity grid by 2050 to support a net-zero trajectory for the world, according to the 2023 BloombergNEF New Energy Outlook: Grids report.

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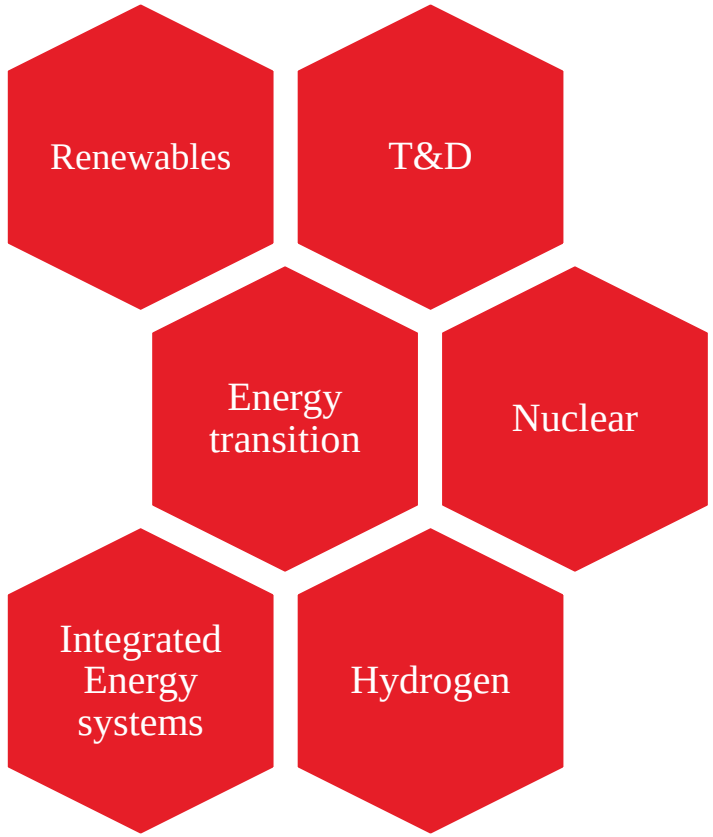
Pivoting business to an energy transition

Adapting our business and partnerships to deliver net zero

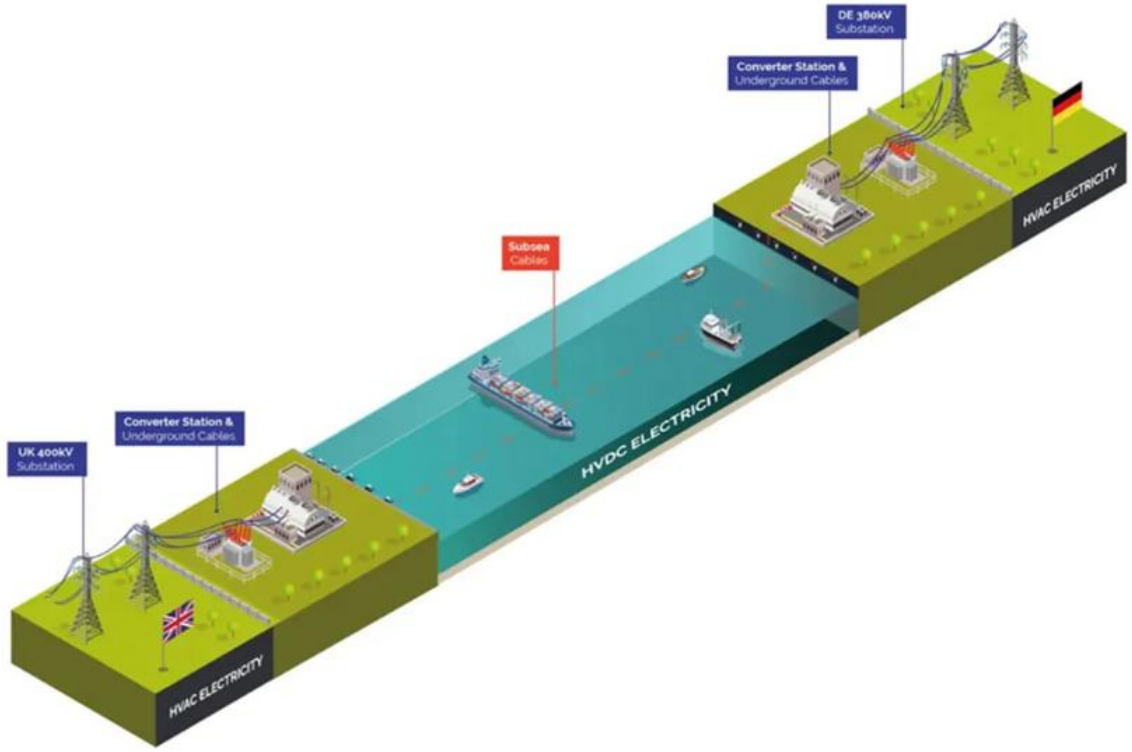
- For a global consultancy, pivoting from sectors that are stabilising or declining to sectors that are growing…rapidly
  - Organisational change
  - Opportunity but a short-term challenge
- Deployment of our supply chain on projects
  - Specialist sub-consultants, partners (JV)
  - Relationship management and pipeline visibility (some level of certainty)
  - Consistency of approach and style



Electricity sector clients are changing

Different clients require different approaches

- Traditional clients: Transmission network owners, Distribution network owners
  - Large resourcing demands, procurement approaches are evolving
  - Increasing use of broad and specific frameworks and secondments
  - Partnerships for large infra programmes
- Other clients going through transformation
  - Interconnectors: SPV driven, technical expertise is bought in externally. Key driver is time to market.
  - OFTO build, CATO - future
- Projects are becoming more complex



Adapting to Constraints in the Supply Chain

Manufacturing constraints are leading to new procurement approaches

- OEM supply chain bottlenecks at present – transformers, switchgear, HVDC converters, cables, designers, specialists. Capacity reservation to hold factory slots.
- Understanding these constraints and evolving procurement strategies is important to manage commercial risk and move at pace
  - Use of frameworks rather than project specific procurement
  - T3 advanced procurement mechanism
  - Reference designs
  - Move away from turnkey approach
- Managing more interfaces can increase complexity

Conclusions

- We recognise the scale of the challenge, we are responding and adapting.
- Electrical skills are very important for electricity expansion, other disciplines are also key. These can be transitioned from other sectors.
- There are some positive signs with increasing elec grads.
- Broader changes and challenges in the energy sector also require some consideration for infrastructure construction.

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