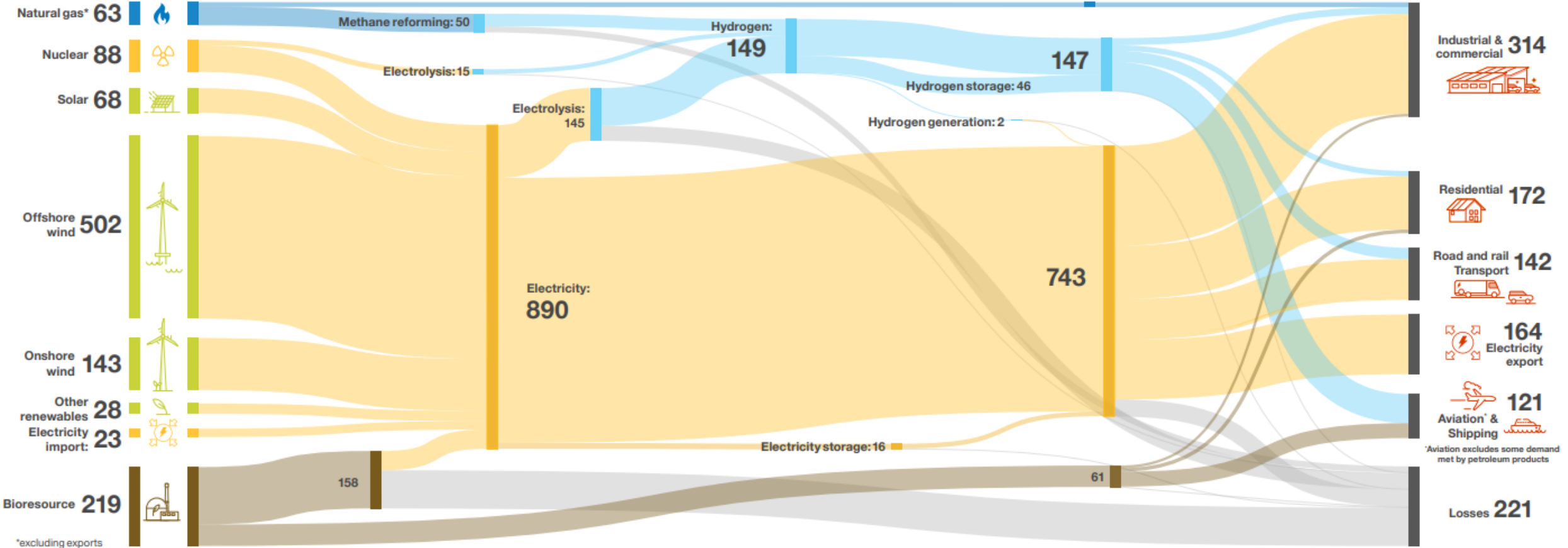




Equipment Challenges in Future High Voltage Power Systems

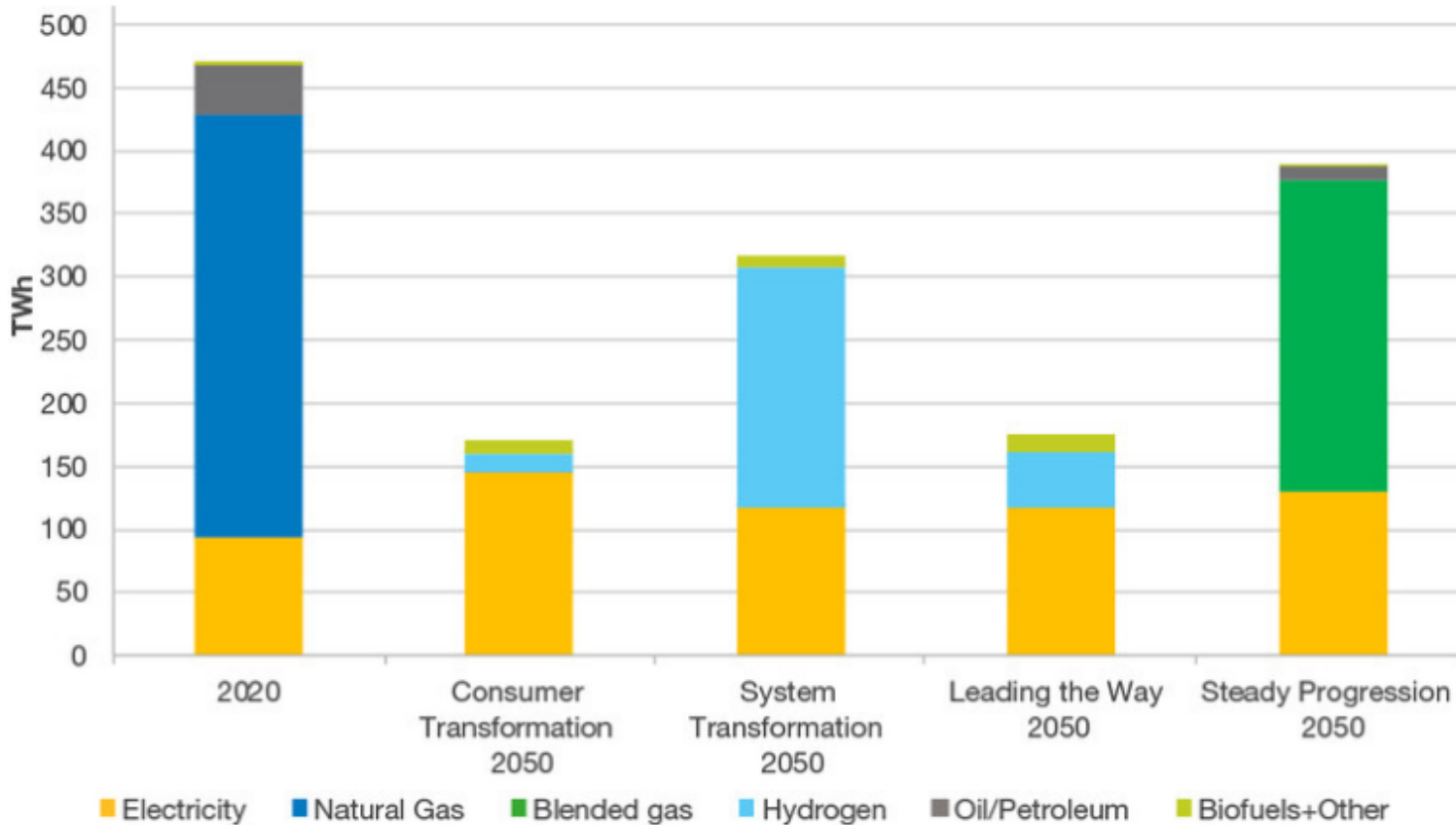
Ian Cotton, Joint Head of Research, School of Engineering

The Electrification Opportunity



- <https://www.nationalgrideso.com/future-energy/future-energy-scenarios>

The Electrification Opportunity

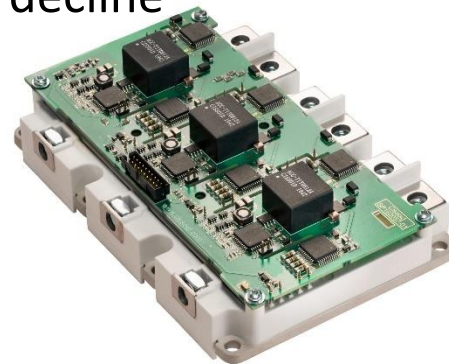


- In 2050 it's likely we will no longer use natural gas in a residential setting
- In one scenario, our energy demand for heat and appliances will result in a 50% increase in electricity consumption
- This is before a further 100TWh requirement for transport

- <https://www.nationalgrideso.com/future-energy/future-energy-scenarios>

The Electrification Challenges

- Increased levels of load
 - Higher numbers of circuits needed
 - Increasing equipment running at high temperature and increased levels of ageing
 - If equipment has only been running at 0.4pu, this is just 0.16pu of the load loss
 - We assume insulation degradation doubles for every 10°C increase in temperature
- Increased levels of intermittency
 - Ramping load leads to increased thermal cycling
- Challenges obtaining outages
 - Increased utilisation of equipment means it's difficult to obtain an outage
 - Lack of maintenance opportunity leads to spiral of decline

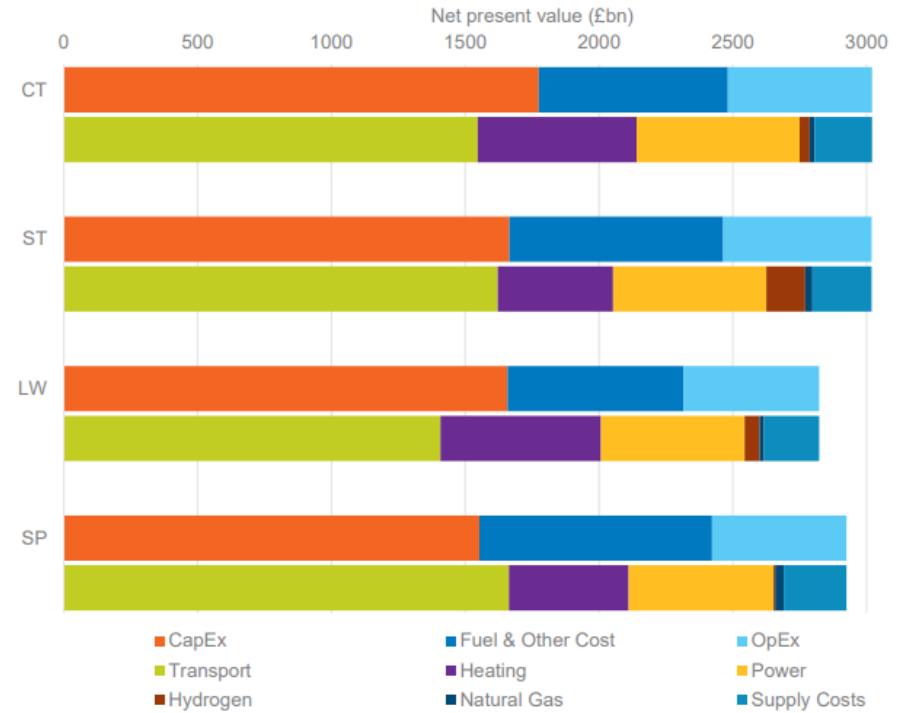


The Electrification Challenges

The University of Manchester



Planning



Cost



Skills shortage could undo UK government's net zero plans

October 28, 2021 2:41pm BST

lidlko Grant/Shutterstock

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The UK government has set out its plans for reaching net zero emissions. This target, which Prime Minister Boris Johnson says will be met by 2050, is a crucial test of whether countries can move to a carbon-free economy.

Skills Shortages

Is the end coming for sulfur hexafluoride, the most powerful greenhouse gas?

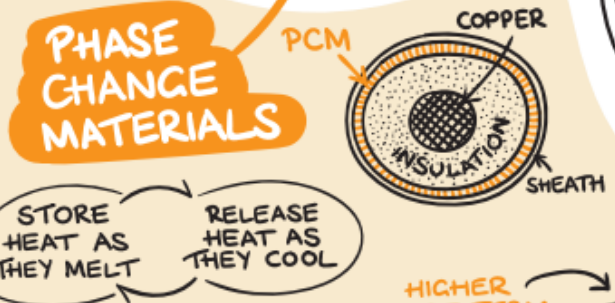
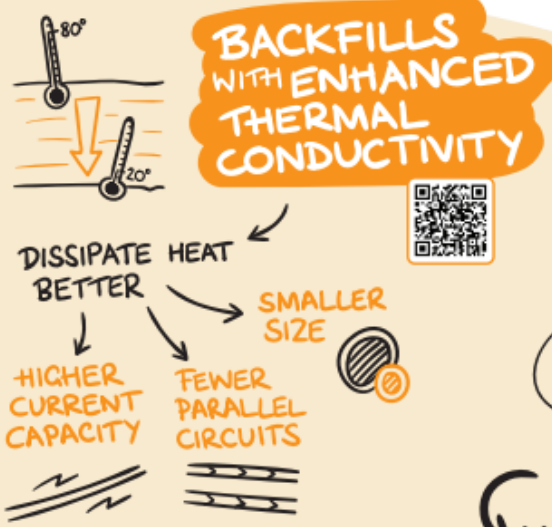
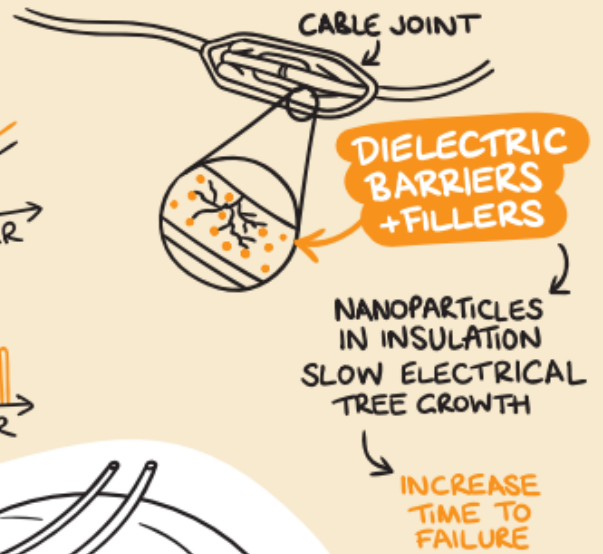
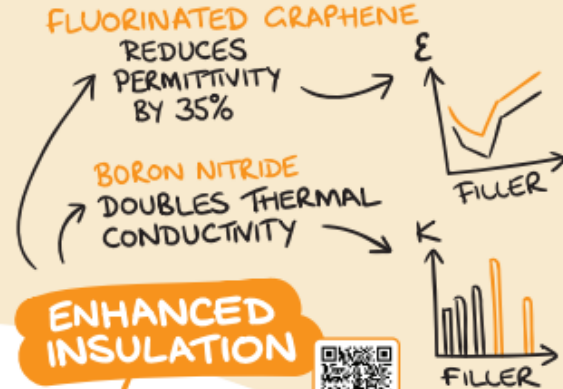
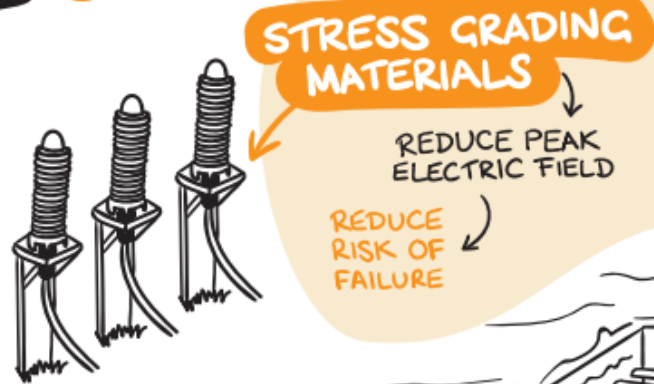
by Marie-Charlotte Guetlein and Carine Sebi, The Conversation



Environmental

OPPORTUNITIES FOR ADVANCED MATERIALS IN CABLES

Underground cables enable the transmission of power over long distances. In this poster, we explore the potential opportunities in advanced materials to improve the performance of cable systems through better thermal management, using improved insulation systems and through the use of low temperature systems.

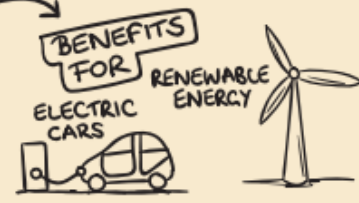
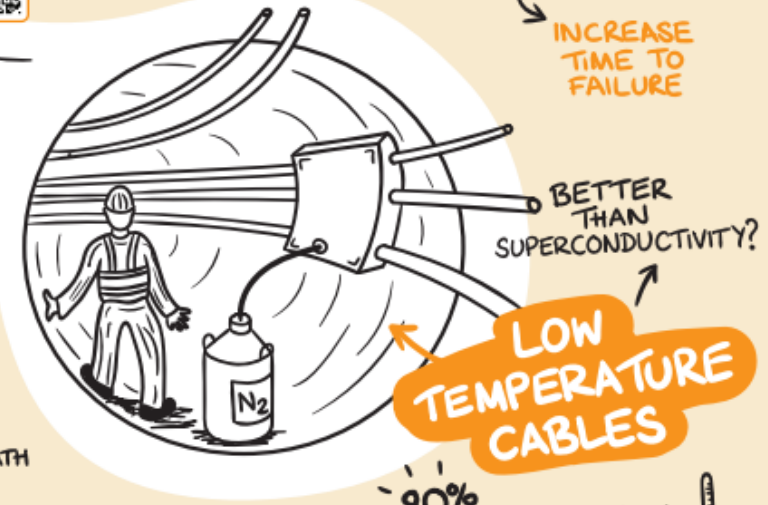


1% WEIGHT OF CARBON NANOTUBES

113% INCREASE IN THERMAL CONDUCTIVITY

COULD RESULT IN

HIGHER SHORT TERM CURRENT CAPACITY



The Henry Royce Institute

- £250m investment into advanced materials research and commercialisation.
- Located at the heart of the University of Manchester's Engineering Campus, the 16,000 square metre building houses world-leading materials scientists, state-of-the-art equipment and collaborative space for industrial and academic engagement.



MECD HV Laboratory

- New HV laboratory opening in early 2022
 - 800kV 2A AC test set
 - 600kV 200mA test set
 - 2MV impulse generator
- Provides the capability to test 400kV equipment at full-scale

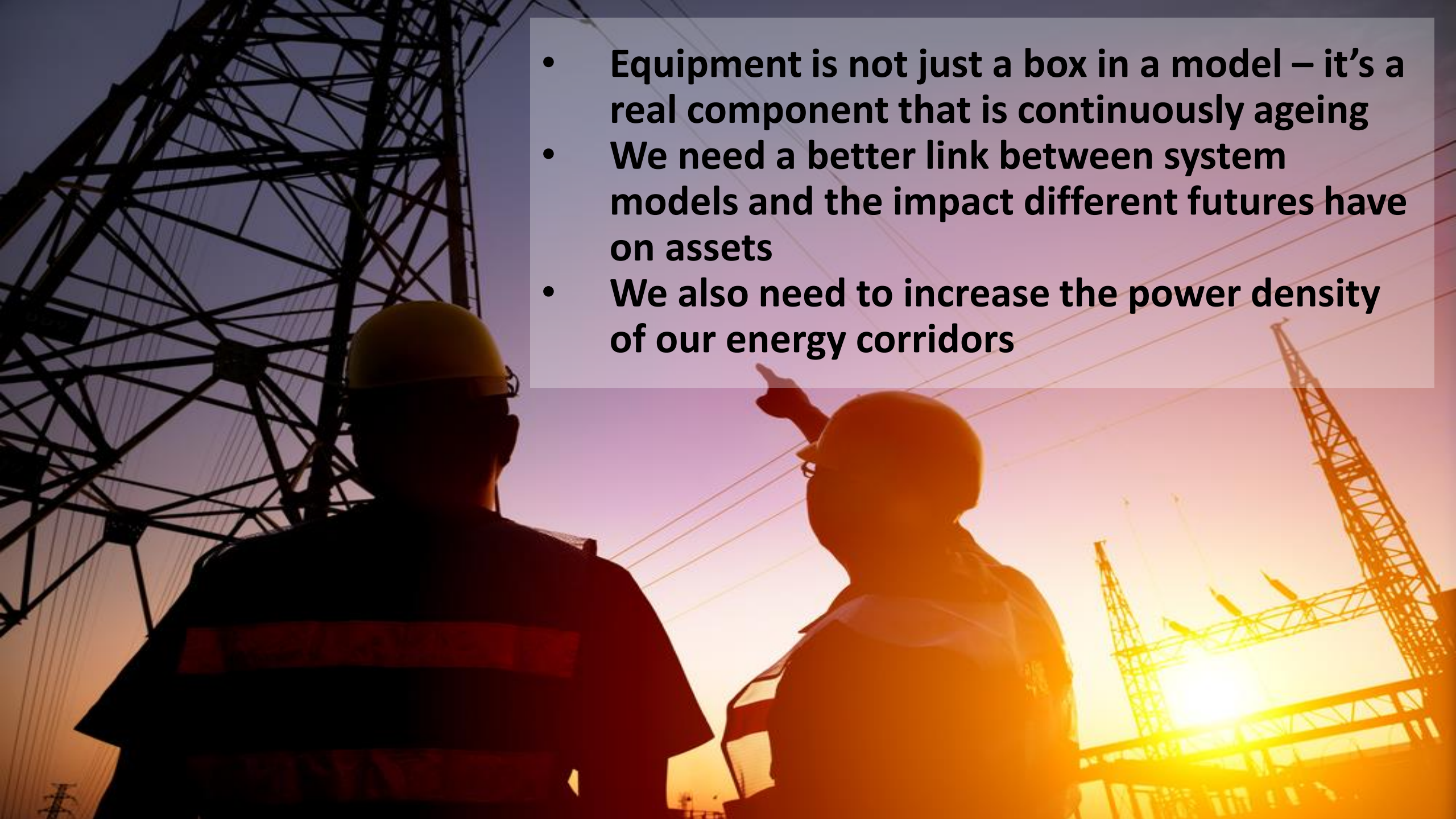


The Deeside Project

The Deeside Project will be the first facility in Europe where assets associated with electricity networks, can be tested off-grid, 24 hours a day, seven days a week.



- A 400kV substation converted into a test environment in which new technologies can be demonstrated and evaluated
- The University of Manchester has supported the design of the test site and the overhead line test area will go live shortly

- 
- The background image shows two workers in silhouette, wearing hard hats and safety vests, standing in front of a large electrical transmission tower. The scene is set against a bright sunset or sunrise, with the sun low on the horizon, creating a strong orange and yellow glow. The worker on the right is pointing towards the sky. The overall atmosphere is industrial and focused.
- **Equipment is not just a box in a model – it's a real component that is continuously ageing**
 - **We need a better link between system models and the impact different futures have on assets**
 - **We also need to increase the power density of our energy corridors**