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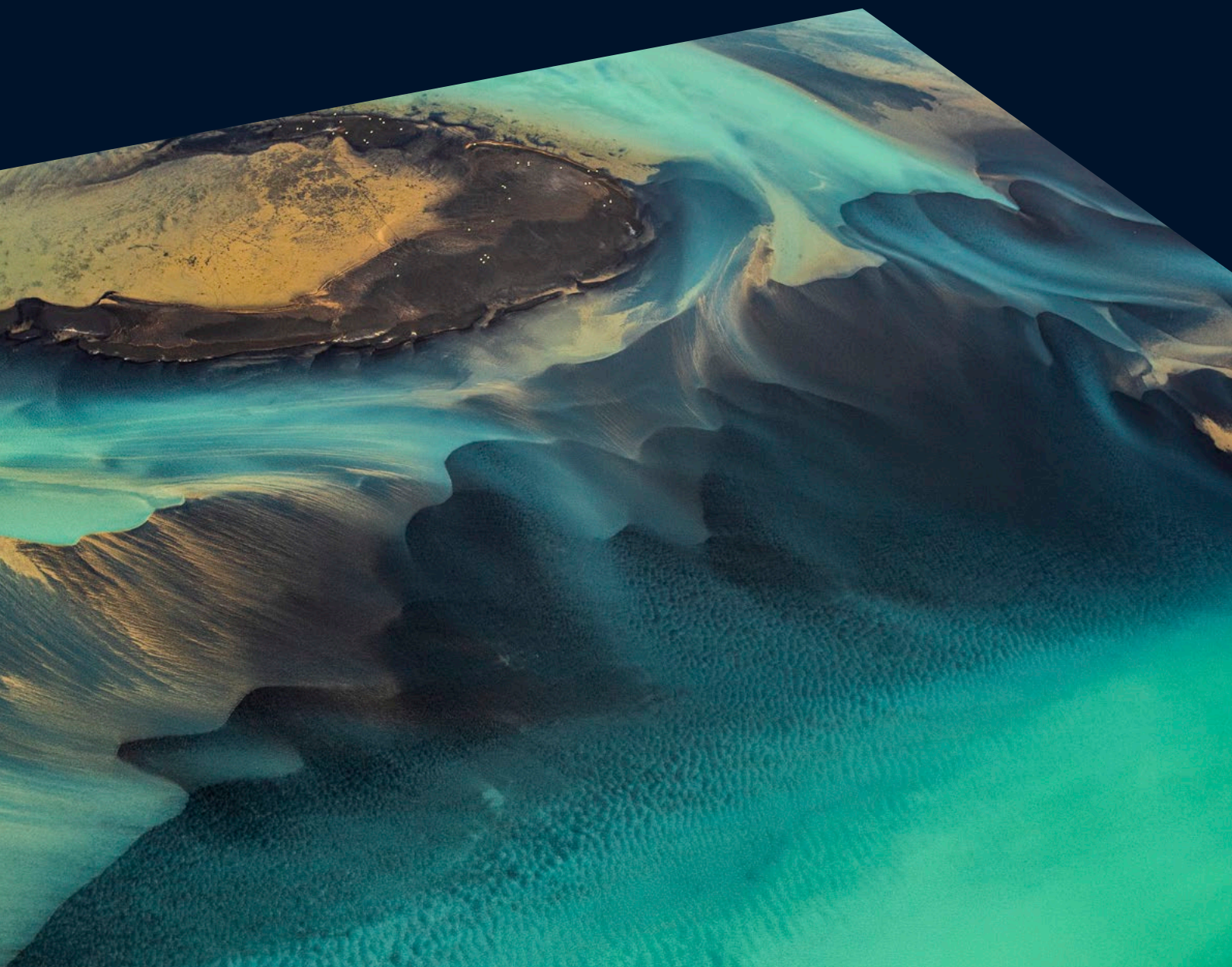
Climate Tech SuperCluster

Target net zero: Enabling mass participation in the energy system

A Cambridge Consultants and Cambridge Cleantech report



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1 Introduction

The energy system is in a period of significant change, led by various macro-level drivers across supply, infrastructure and demand. Central to these critical issues is the energy grid – and the pressing need to bring the benefits of distributed energy resources (DERs) to all segments of society, while mitigating the impact on the grid.

The key to unlocking and accelerating progress in this area is fostering mass participation in the energy system. With this in mind, we recently invited a select group of influential stakeholders from the energy industry to a Grid Tech Roundtable, hosted by Cambridge Cleantech, to delve into the topic.

This report draws together the key challenges and solutions from the roundtable discussions and prioritises those into actionable recommendations in terms of impact against development risk.

The recommendations aim to ensure that every individual and community can actively participate in and benefit from the energy transition. Through collective effort and innovative thinking, we can work towards a net zero energy system that is equitable, resilient and sustainable.

2 Key challenges

Policy and regulation

The first issue under the roundtable's spotlight was the roles that government incentives and regulatory frameworks have in supporting renewable energy adoption and decentralised energy production. It was clear to participants that government policy could help address the economic issues hindering the roll-out of DERs to homes and businesses.

There was a strong feeling that there's a significant opportunity for the government to embrace a broader range of views within policies. It's not enough to only listen to the louder voices of the best-funded, best-organised and best-connected advocacy groups. All segments of society should be engaged and included in these discussions and government at national and local levels should focus on making it easier for these holistic discussions to take place.

Economic models

Clearly, distributed energy resources should be made accessible to all, including those in low-income households. This fundamental point provided the context for a debate on appropriate financing mechanisms and economic incentives.

Stakeholders expressed the need for a new electricity pricing mechanism to support the electrification of domestic heating, vehicles and energy storage.

It was felt that improving the design and installation of electric heating systems, not solely heat pumps, should be prioritised to make operating costs less than those of gas boilers. Furthermore, fresh business models need to be found to incentivise well designed and well installed DERs in buildings.

Societal issues

Participants discussed the push and pull factors influencing society at the current stage of the energy transition. Among the strongest negative factors is the perceived high cost and poor performance of electric heating and vehicles.

Technological innovation

Turning to technology, the roundtable highlighted advancements in smart grids, energy storage solutions and other technologies that can facilitate widespread participation. The consensus was:

- The need for mass participation is driven by the necessity to reduce peak loading from 4:00–8:00pm.
- It's unclear how current domestic electrical loads (such as lighting, washing, refrigeration and cooking) are high enough and capable of making a useful contribution to operation of the energy system. This suggests that a significant switch to electric heating, vehicles and energy storage is necessary before mass participation of consumers in the energy system will be effective.
- Smart meter data quality can be poor. For example, incorrect tariff information and meter reading gaps were cited by some participants as common smart meter data issues. This lack of quality incentivises energy service providers to collect their own meter data.
- Locking down smart meter hardware prevents innovators building upon the platform.

3 Recommendations

As discussions moved towards potential solutions, attendees paused to consider the crucial question of consumer mindsets. During this phase of the roundtable – and to provide valuable context – a matrix was developed to assess expected levels of consumer engagement against their willingness to relinquish control of their energy assets.

The matrix reveals the desirability of moving the many consumers in the 'disinterested consumer' quadrant to the 'active prosumer' quadrant. This would be via the passive prosumer route or – where DER installation is not immediately possible – through the controlling consumer route.

The logical conclusion was that immediate focus should be placed on enabling the mass rollout of DERs to domestic consumers though three key avenues: incentivising vehicle electrification; incentivising home energy efficiency; and gaining consumer engagement. Solutions within each area were examined by stakeholders with the help of PEST (political, economic, social, technological) analysis.

In Figure 2 (page 03), we have plotted each solution on an impact vs development risk matrix to highlight which solutions should be prioritised.

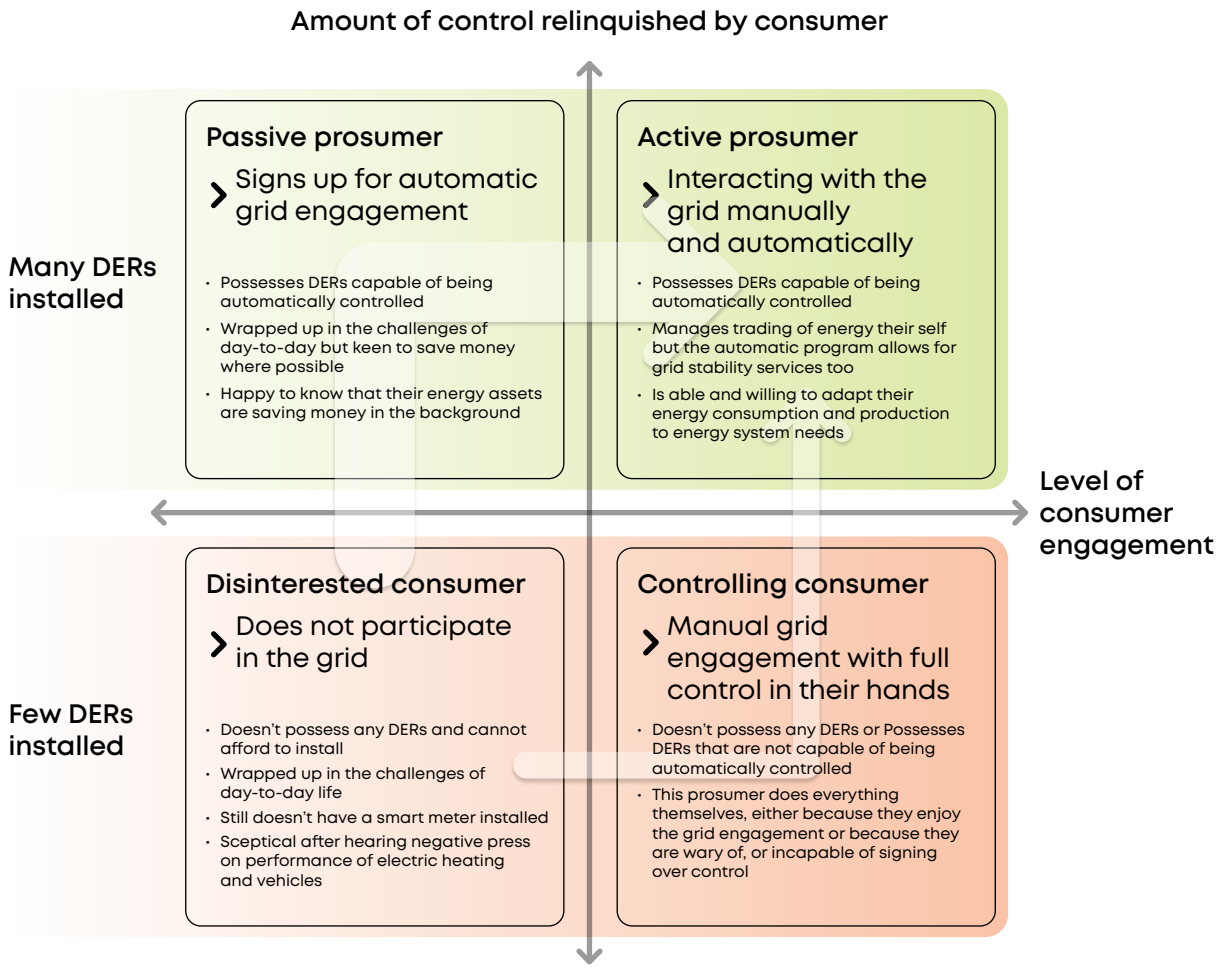

Figure 1: Consumer engagement vs control matrix, identifying different energy system consumer types and pathways to mass energy system participation

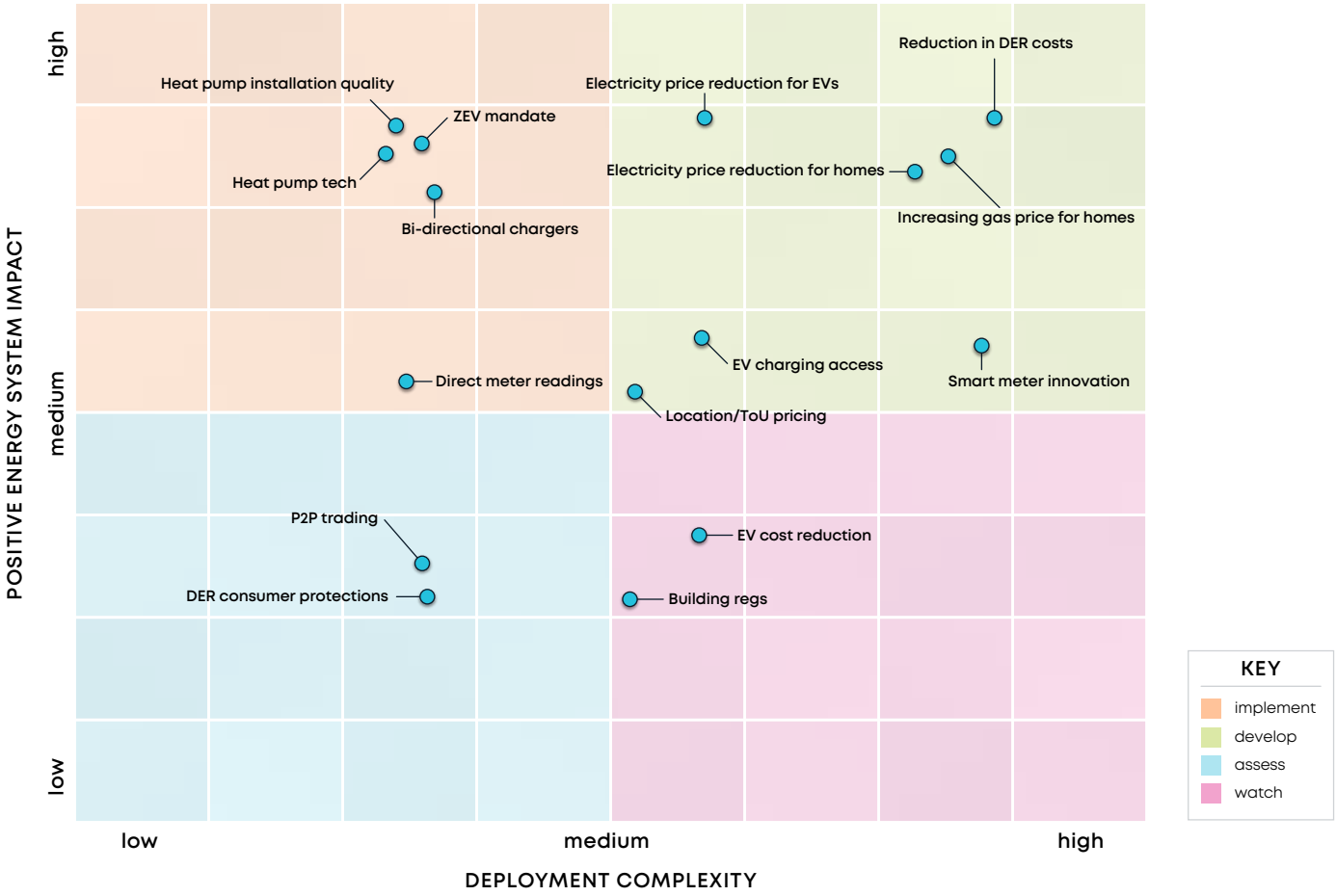

Figure 2: Energy system impact vs deployment complexity matrix of solutions to enable mass energy system participation

1. Incentivising vehicle electrification

Political

The UK government's zero emission vehicle (ZEV) mandate provides much needed clarity for automotive and energy industries. Through it, 80% of new cars and 70% of new vans sold in Great Britain will be zero emission by 2030, increasing to 100% by 2035 and guaranteeing year-on-year market growth.[1]

Changes to the electricity market in terms of location and time-of-use pricing will enable EV owners to take advantage of lower electricity costs for consumption and high rates for supplying energy to the grid.

Economic

With prices falling, there are fewer barriers to the capital cost of buying electric vehicles (although increased import barriers may adversely affect this). Moreover, many incentives exist in the form of reduced road tax and, low emissions zone charging. That being said, longer range EVs still typically command a price premium over their traditional combustion driven competitors. A reduction in this difference and an expansion in the second-hand EV market is required to truly democratise EV ownership to a wider section of society.

Discussions moved on to the 'spark gap' (also known as the 'spark ratio' or 'spark spread') which represents the difference between electricity and gas unit prices. A reduction in the electricity price would greatly lower EV operating costs but would likely and unfairly push cost onto users of gas fuel, who may be unable to respond to the market change, particularly with the low levels of heat pump usage today.

Social

Increasing access to EV charging for homes and businesses with no off-street parking – or for multiple occupancy buildings – is obviously desirable. It'll need a combination of more and better performing public EV charger availability, along with digital services that provide optimal user experience.

Technology

The wide availability of vehicles and chargers capable of bi-directional charging (V2H – vehicle to home, or V2G – vehicle to grid) may reduce the ROI for EVs as services provided to the grid by these EVs will potentially lower electricity bills.

2. Incentivising home energy efficiency

Primarily, this will be achieved by insulation and well installed and operated heat-pumps, although momentum is building around district heating and ambient loop heat pumps as demonstrated by the likes of the Silvertown development in East London.

Political

It was felt that building regulations and local planning policy could be effective tools for driving the energy efficiency of buildings. There might also be opportunity for changes to the calculation mechanism of the standard assessment process (SAP), which is used to verify the energy efficiency of a building.

Economic

There was discussion around the economic complexity of the UK energy market, where actions can have unintended consequences. For example, an increase in domestic gas and heating oil prices would reduce the ROI time of low carbon tech and energy efficient measures. But this would adversely affect users of gas and oil who can't afford the capital expense of fabric improvements or a switch to electrical heating, vehicles and energy storage.

Likewise – and back to the spark gap – a reduction in the electricity price would have the similar consequence of punishing gas fuel users. It would also lessen the importance of heat pump installation performance.

Social

A powerful factor here is the perceived high cost and poor performance of new generation electric heating from incumbent non-renewable heating system manufacturers, installers and maintainers.

It was felt that education and awareness could play a role in changing perceptions. However, reducing the capital costs of insulation, and the capital and operating costs of electrified heating, would be more effective in propelling a mass transition to new heating methods and DERs.

Technology

Positively, it was noted that further advances in heat pump technology – such as new refrigerants or networked or ambient loop heat pumps – will make energy efficient domestic and business heating more attractive.

Further, optimised management of DERs through advanced home and business energy management systems will return performance and operating cost benefits and drive use.

It was suggested that optimising the design and installation of electric heating systems is key to making operating costs less than those of gas boilers. In addition, according to the UK CMA: "The consumer standards (MCS) landscape is complex and confusing for people to navigate. Some aspects need strengthening to better safeguard consumers (e.g. monitoring, complaints management and financial protections.[2])

3. Gaining consumer engagement

Political

Attendees felt government could have an impact in this area by revising licensing and regulation (for example, licensing local energy suppliers and enabling metering of assets instead of metering at boundary) to enable local peer-to-peer energy trading.

Economic

This part of the debate highlighted the economic realities of consumer acceptance during the energy transition. While education and awareness have an important role to play in changing perceptions, stakeholders were in no doubt that reduced capital and operating costs electrified heating, vehicles and energy storage would be more effective in mass DER transition.

Social

It was felt that behavioural change – in terms of energy devices in homes and businesses and in the way energy consumers respond to the needs of the grid – is essential for the net zero imperative. The consensus was that change is more likely if consumers are offered a fair and significant return for providing services to the grid.
This is where local peer-to-peer energy trading may have an impact.

Technology

The roundtable clearly saw a need for more accurate smart metering data, with incorrect tariff information being cited by one participant as a current issue and lack of a central API/standard for sharing tariff data by another. Two routes to resolution were discussed:

- Within the smart metering system – which would involve relaxing hardware and software restrictions to enable innovation and accelerating standard APIs, but at the cost of security and with a larger privacy compliance burden.

- Outside the smart metering system – through consumer access devices (CAD). These can extract interval readings from smart meters locally, which can then be used by the consumer or, energy service providers (with the consumer's permission).

4 Conclusion

As we strive to meet net zero emission targets, it's imperative to engage and empower all segments of society in the transition to distributed energy sources. By addressing the political, economic, social, and technological challenges identified in this report, we believe significant progress can be made, bringing benefits for all.

The roundtable concluded that rolling out DERs and attempting to move home and business owners from 'disinterested consumer' to 'active prosumer' category is key to a participatory energy system.

Indeed, fostering mass participation in the energy system is a pathway to a net zero system that is equitable, resilient and sustainable and the focus for achieving this should be on how we ensure that the sustainable choice is the easiest/default/cheapest option so that the onus isn't primarily upon the consumer to take the risk.

If you've got this far, we'd love to hear from you. To continue the conversation, and delve more deeply into this topic, please contact: niall.mottram@cambridgeconsultants.com

References

1 Future Energy Scenarios: ESO Pathways to Net Zero, Page 57 - https://www.nationalgrideso.com/document/322316/download

2 Consumer protection in the green heating and insulation sector – page 89 https://assets.publishing.service.gov.uk/media/6475f1685f7bb7000c7fa176/Consumer_protection_in_the_green_heating_and_insulation_sector_-_Final_report.pdf

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As the deep tech powerhouse of Capgemini, Cambridge Consultants (CC), is a global team of 800 bright, talented people. We are united by the ambition to turn brilliant ideas into technologies, products and services that have never been seen before. And which will transform business, society and the planet. Deep tech is a mindset; a bold strategy that harnesses radical science and engineering to achieve things no-one else can. It enables our clients to gain unassailable commercial advantage from defendable technology that they own. We are trusted by some of the world's biggest brands and most ambitious start-ups to realise their critical technology-based aspirations – and we've been doing it for 60 years. Cambridge Consultants is part of Capgemini Invent.

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Cambridge Cleantech sits between the present and the possible, facilitating global connections within the cleantech ecosystem and enabling green innovations to thrive. As the UK's leading cleantech innovation network, Cambridge Cleantech brings together innovators, investors, corporates, academics and the public sector to create a sustainable future. Through events, technology scouting, projects and investment matching, we tackle global sustainability challenges in some of the most dynamic sectors, including energy, transport, building tech, water, hydrogen and circular economy.

For further information or to discuss your requirements, please contact:

Niall Mottram, VP of Energy & CDR
niall.mottram@cambridgeconsultants.com

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