

D4E: An energy innovation platform for the West Midlands



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This study was prepared for Climate - KIC by the Energy System Catapult (ESC), in partnership with Sustainable Ventures, to provide a market evidenced report for establishing an Energy Innovation Platform in the West Midlands.



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Executive summary

Massive strides in energy innovation have been made over the past decade. It promises to revolutionise the economy. But, progress is still too slow and too narrow. Unless we put this right, the UK will fail to reach its Net Zero emissions target and miss out on a huge economic opportunity.



Executive summary

Our research has identified wide gaps in the public support for energy innovators.

Existing public support for energy innovation is good at bringing forward new technologies through university funding, and at supporting big industrial innovators in sectors like solar and offshore wind. But, it is poor at the bit in the middle: helping smaller innovators to commercialise. Unlike the US, Britain has few incubators that focus on energy innovation, and none with the vital expertise in digital technologies needed to unleash its full potential.

This market based report provides a study of the UK and specifically West Midlands Innovation landscape. This year long study provides evidence and analysis of the gaps and needs for Energy Innovation. We believe a big part of the solution can be answered by establishing a new business incubator, D4E, which stands for Digitalisation, Decentralisation, Democratisation, Decarbonisation for Energy. By focusing on these vital trends, D4E will put the West Midlands at the forefront of energy innovation helping to lead the global energy transition.

D4E is vital because:

- > *the climate crisis grows ever more acute.* Global emissions and temperatures continue to rise. Britain – in spite of its new target of Net Zero by 2050 – is still set to miss its next two carbon budgets. The West Midlands' target is 2041.
- > *the economic opportunity of energy innovation is huge.* If we seize it, the prize is higher productivity, exports, growth and jobs – helping to deliver the Industrial Strategy.
- > *the evidence gathered by our study shows that UK support for innovation fails to satisfy the needs of SME clean energy innovators.*

What's the problem?

Energy innovation has made huge progress in the last ten years. Just look at its impact on solar, wind and batteries, where it has reduced unit costs dramatically and enabled clean energy to undercut fossil fuels. But, most progress has been made in electricity supply and huge challenges remain in transport and heat. Solving these will depend greatly on integrating aspects of the energy system – electricity, gas, heat and transport that have been seen previously as separate – closing gaps in the data and allowing innovators to extract value. The key to this is *digitalisation*, by which smart devices and systems can communicate across the traditional energy boundaries. This means energy innovators need help to gain the new skills and knowledge required to commercialise digital products and services.

Our research has identified wide gaps in the public support for energy innovators. Much of this funding is channelled through universities, which is one reason Britain has been far better at inventing new technologies than commercialising them. In particular, there is a dearth of support for late-stage, large scale demonstrations.

The evidence also suggests that success depends upon energy policy-makers moving away from a siloed, supply-driven perspective towards one that enables systems integration. To make the most of the energy opportunities offered by big data and new business models, policy-makers will need to provide innovators with effective planning tools and supportive regulatory frameworks. That may well mean offering greater, 'democratisation' of energy and faster reform than in the past.

Business incubators either those funded by big business or public funds don't address system level problems nor focus on digitalisation for energy. Unless we put this right, it will be far harder for Britain to hit its Net Zero target. Or if it does, it will need to use imported products and services.

The International Energy Agency (IEA) estimates that to achieve the aims of the Paris Agreement requires investment of \$13.5 trillion, or around \$840 billion per year to 2030.

Instead, we need a broader range of ‘systems innovation’ to support new products, services and business models. These will need to be integrated with new supply chains and changes in regulatory rules. Activities that encourage adoption and scale of this approach are needed. This will help educate end-users, stakeholders and influencers, promoting the benefits and fostering uptake.

New energy solutions and services, and the technical and commercial systems in which they operate, will all need to be tailored to different markets, user groups and regions. Energy innovators will have to consider the wider changes needed to support their new service early in their development. For SMEs, building such a wide range of capabilities is challenging. They will need new forms of support, provided by a new type of innovation platform.

The prize

If we get it right, however, the economic benefits will be enormous. The International Energy Agency (IEA) estimates that to achieve the aims of the Paris Agreement requires investment of \$13.5 trillion, or around \$840 billion per year to 2030. Since digitalisation of energy systems are critical, the countries that lead this innovation will develop products and services to export to the laggards. The government estimates the potential benefits of smart and flexible grid exports are worth £40 billion a year.¹ Supporting energy innovation is therefore important to achieving industrial strategies of both the UK and the West Midlands Combined Authority.

Why will D4E help?

It is widely recognised that innovative young companies are much more likely to succeed if nurtured in incubators. However, fewer than 5% of Britain’s SMEs have had any contact with an incubator. There is no way of knowing how much potential innovation has been lost as a result. What’s more, Britain’s existing incubators cannot match the scale and nature of the challenge:

- > *Too few*: the UK has plenty of incubators offering general business support. In clean energy, the UK has only three corporate incubators (controlled by energy big companies and operated virtually), and none that are open to all-comers.
- > *Too patchy*: existing provision is full of holes. Innovators need different types of support at the various stages of development, from early-stage research to full-scale production. In the UK, some of the vital later stages – large scale trials, scaling up production – are poorly supported.
- > *Behind the times*: the keys to solving some of the thorniest challenges are:
 - data – the application of machine learning to big data to create ‘smart’ platforms and systems;
 - digitalisation – the progressive integration of parts of the energy system previously seen as separate – such as gas, electricity, heat, transport, built environment – and the integration of proven technologies into commercial solutions;
 - developing new business models that provide products and services that consumers value and are willing and able to pay for.

Data and digitalisation are fundamental to support the whole system. It is the foundation for integration, decarbonising and decentralising energy markets, stimulating innovation and facilitating production of energy by consumers. Yet, no incubator in Britain offers these system-level skills. D4E would put right all these deficiencies under one roof.

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What is D4E?

D4E will be Britain’s first business innovation platform to focus wholly on energy, with a strong focus on digitalisation. It will also work as a broader networked innovation hub, to help innovators solve the toughest problems of the energy transition and exploit its opportunities. It will do this by connecting innovators, investors, regulators, universities and markets more effectively than ever before. It will help SMEs (Small and Medium sized Enterprises) to innovate more efficiently – and to fail fast if need be – by filling the market gaps we have identified.

D4E will offer energy innovators an end-to-end service, meaning help at every stage of the journey from invention to full commercialisation. But, it will place greatest emphasis on filling market gaps, by focusing on:

- > *Digitalisation*, which is driving the decentralisation and convergence of energy markets
- > *Data Services*, which will help decarbonise the energy sector and provide evidence to support commercial demonstration of new products and services
- > *Energy commercialisation*, which will support large-scale commercial demonstrations of new products and services, and scaling-up to commercial production or service delivery, with expertise not available elsewhere

The D4E innovation platform will take a three-pronged approach:

- > *Physical incubator*, housed in a single building to maximise the benefits of clustering, mentoring and networking
- > *Virtual incubator/accelerator*, to link existing regional innovation organisations, national networks and assets
- > *Services*, providing energy innovators with services and expert advice unavailable elsewhere to help them commercialise

Creating: ***"A powerful West Midlands platform to accelerate energy innovation, from concept to commercialisation, stimulating energy transition globally at pace."***

An important part of D4E will be its Strategic Advisory Board, made up of local authorities, LEPs, universities, Energy Systems Catapult, funding agencies, utilities, service providers and manufacturers. The board will scan the horizon to identify emerging problems and opportunities that clean energy innovators need to tackle, and will set challenges for D4E and its clients.

To maximise its resources, D4E will operate a *physical hub and virtual spoke model*, providing services directly wherever it can add value, but also drawing expertise from existing bodies. These include: the Manufacturing Technology Centre, Energy Systems Catapult, LEPs, WMCA, Universities, HVMC, Growth Hubs and Energy Innovation Zones (EIZs) among others. If successful, this approach should also allow D4E to grow quickly from *regional to national reach*.

D4E will be Britain's first business innovation platform to focus wholly on energy, and have a strong focus on digitalisation.

D4E services

D4E will apply the unique and extensive expertise of Energy Systems Catapult (ESC) to offer innovators a series of services that, according to more than 80% of respondents to our surveys, cannot be found elsewhere. ESC would lead the Strategic Advisory Board in establishing D4E and leverage its innovator support platform's experiences to help develop D4E's launch services.

- > **The innovation window:** This study found that although sources of business support are plentiful, there is almost too much choice, making it hard for innovators to identify a suitable provider. Worse, far too few providers cater for the specific needs of small energy innovators. D4E's web portal and innovation managers will guide companies to the right services for their stage of development, provided either in-house or through a broad network of existing virtual support services.
- > **The energy innovation data library:** Data is vital for innovation in energy services, but can be expensive for early stage companies. D4E will maintain access to a library of databases for innovators to either access free or at little cost, enabling them to develop products and services more quickly and cheaply than before.
- > **Energy markets, policy and regulation:** The regulations covering UK energy markets are notoriously complicated. This consultancy service will guide innovators, companies and investors through the legislative complexities and provide evidence of the regulatory changes needed to support the commercialisation of innovations in the energy sector.
- > **Product development and validation:** For companies with products in the early stages of development (TRL 3-6), D4E's innovation managers, and its network of technical experts, can advise on proof of concept testing, design for manufacture, and supply chain planning. We can access and utilise regional and national virtual assets such as ESC's Living Lab and Smart Data Communications Company (DCC), 'digital sandbox'.
- > **Commercialisation:** When a young company is ready to launch its product or service, a major cost – and risk – is the need to build marketing and sales teams. D4E's in-house team will help the company develop commercialisation strategies, secure engagement in large scale demonstrations and secure its first customers at lower cost.
- > **Funding readiness:** Innovators often struggle to understand exactly what information investors need in order to make a decision. Innovation managers will provide bespoke advice to help them prepare business and financial plans, ensuring the investment messages align, de-risking the investment decision. D4E will organise themed networking events to introduce SMEs and investors.

Combined with D4E's focus on digitalisation, data services and energy commercialisation, these services fill the gaps our market study has identified. We believe this will accelerate and broaden clean energy innovation, placing the West Midlands at the front of the global energy transition.

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Why West Midlands?

West Midlands presents a unique combination of commitment, resources and challenges that make it an ideal launch pad for D4E.

The West Midlands Combined Authority (WMCA) has shown its commitment to the energy transition within the Local Industrial Strategy (WM LIS), Energy Capital and its backing for Energy Innovation Zones (EIZs). The region already hosts significant innovation expertise in organisations such as Energy Research Accelerator, Manufacturing Technology Centre, WMG, Birmingham and Aston Universities and Energy Systems Catapult. Further innovation expertise can be found in major energy companies including National Grid and Centrica, equipment manufacturers like Worcester Bosch, and several national building contractors.

Regional challenges include poor productivity, fuel poverty and higher than average CO₂ emissions, all of which demand innovative answers. The West Midlands' GVA is 89% of the national average, which equates to £10bn of lost economic activity. A recent BEIS research paper concludes that when an incubator is established in a given region, within five years the target sector for the incubator sees a 243% rise in economic activity compared to non-target sectors. D4E will help lever the region's low carbon innovation capabilities, stimulating wider investment in the sector.²

Clean energy innovation in the West Midlands is strong in terms of technology development, but weak in terms of commercialisation and scale-up. D4E is designed to fix this. D4E will foster stronger collaboration with other clean energy innovation initiatives in the West Midlands such as the Energy Innovation Zones (EIZs) and Birmingham Universities Innovation Hub.

The region is the manufacturing heart of the country, and will invest £ billions in infrastructure to 2030. This will create huge opportunities for the West Midlands to lead in developing innovative solutions in housing, industry, transport and energy. At the same time, Birmingham's nineteenth century housing stock, energy intensive manufacturing industries and leadership in electric vehicles provides great commercial scale test beds to develop cost-effective, consumer-focused energy solutions. These will use data and advanced controls to solve the biggest challenges in emissions reduction.

Some of the reduction in Britain's greenhouse gas emissions has been achieved through off-shoring the supply chain, which is ultimately unsustainable for both the global climate goals and our economy. Building a low-carbon manufacturing sector in the Midlands will help us keep cutting our emissions while producing the necessary products at home with substantial economic benefits.

These characteristics make the West Midlands the ideal place to launch D4E, and then expand it to the rest of the country.

A recent BEIS research paper concludes that when an incubator is established in a given region, within five years the target sector for the incubator sees a 243% rise in economic activity compared to non-target sectors.

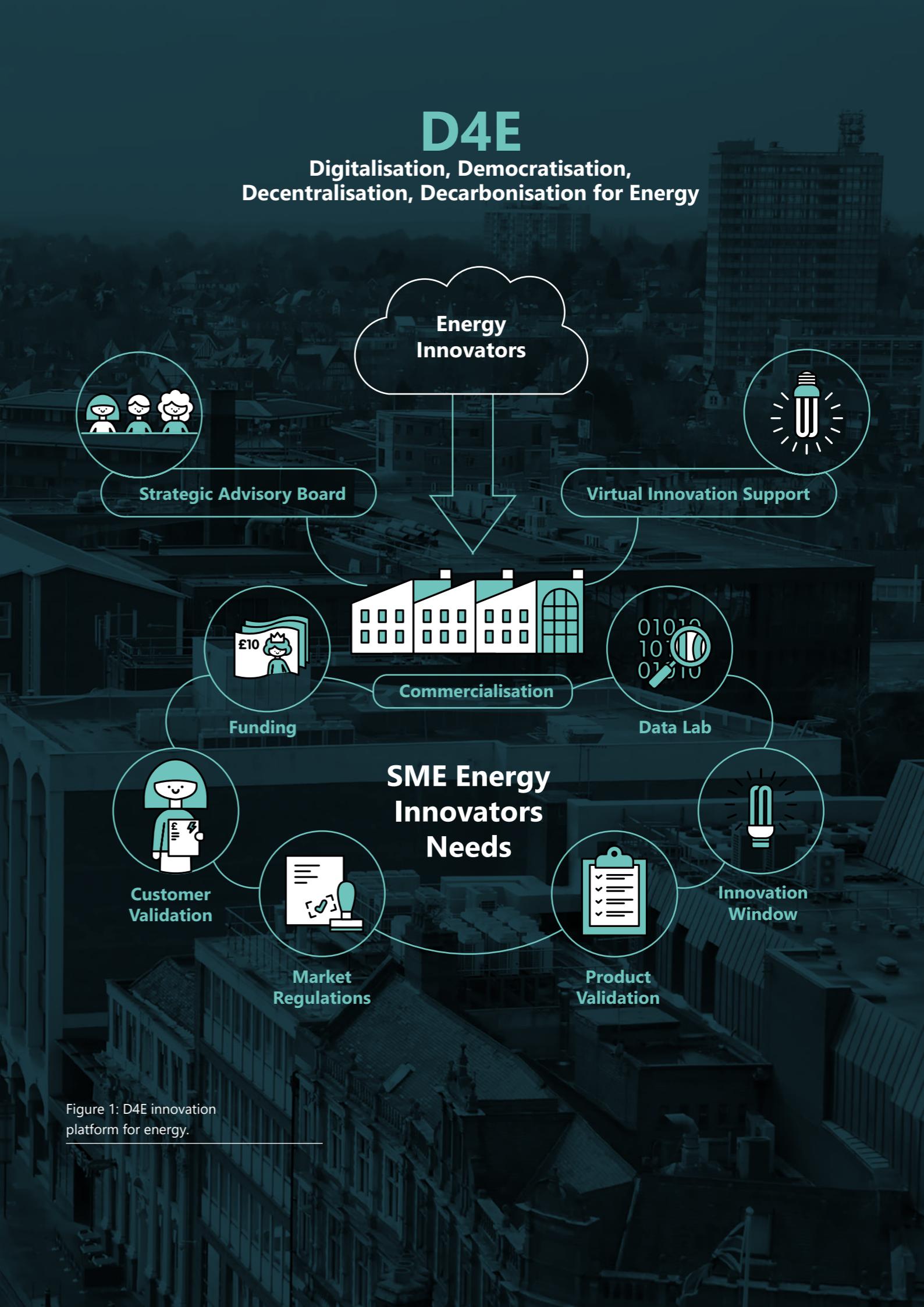
Evidence

Unlike some proposals in this field, D4E is based on the results of a rigorous study, carried out over 12 months by Energy Systems Catapult and Sustainable Ventures, funded by Climate-KIC. It began with a market landscape study to gauge the depth and breadth of innovation support services available to energy-related SMEs in the West Midlands. This was followed by in-depth interviews and workshops with SMEs and stakeholders. Analysis of all the results informed design of D4E and its proposed services, which were then market-tested in a second survey. As a result, we are confident that D4E is the right response to the market gaps we have identified.

Recommendations

We believe this report makes a strong case for launching D4E. Given the urgency of the energy transition, and the undoubted importance of digitalisation, we recommend D4E should be launched immediately as an integrated physical and virtual incubator in the West Midlands. To keep start-up costs to a minimum – we estimate within a range of £7.0-9.0 million – it should be housed in a refurbished post-industrial site. At first, the premises should be large enough to accommodate 20 SME energy innovators, but with neighbouring units available for expansion.

To make this happen, we recommend that WMCA and BEIS convene a meeting with likely stakeholders to discuss funding for the first stage of D4E, and align D4E's launch to support for the Covid-19 Green Recovery programme.



Chapter 1: Defining the challenge

We need to speed innovation in clean energy urgently, both to tackle climate change and make the most of the enormous economic opportunity offered by the energy transition. Britain has traditionally been excellent at inventing things, but weaker at commercialising them. If we hope to create the Google of energy, we will have to rethink our approach to innovation radically.



The energy sector faces a set of unique challenges. It is fragmented, regulated, risk averse and – unlike telecommunications or finance – it lacks a clear, sector-wide data strategy to drive change.

A recent report by Energy Systems Catapult's Energy Data Taskforce shows that 40% of renewable generating capacity is connected directly to regional distribution networks. However, this capacity is effectively invisible to the National Grid, and so it cannot be incorporated into balancing and planning services.³ Making this decentralised generation visible would help make the sector more productive and efficient. A key challenge is to develop a digital strategy and, with it, the digitalisation of the energy systems infrastructure.

In the West Midlands, the country's manufacturing heart, the evidence shows that there are significant gaps in publicly funded support services for innovation in clean energy, particularly in the later commercialisation stages, and especially in the field of digitalisation. Correcting these gaps is fundamental if Britain is to lead the energy transition, capturing opportunities for digital innovation and ensure innovation in integrated energy solutions. Based on publicly available evidence alone, there is strong evidence to further investigate the case for establishing a new energy systems incubator / accelerator focused initially on digital technologies to support the energy transition.

The crisis

Innovation in clean energy has produced astonishing results over the past decade. Just look at solar, wind and batteries, where costs have plunged, and installed capacity has soared. In Britain offshore wind now undercuts gas power without subsidy.

As impressive as this progress has been, it is nowhere near enough. According to the International Energy Agency (IEA), on our current trajectory temperatures will rise 2.7C by 2100 – and then keep climbing.⁴

In Britain, the severity of the climate crisis is now recognised widely. The government has recently stiffened our legally binding 2050 emissions target from an 80% reduction to Net Zero. In the West Midlands the target date has been brought forward to 2041. While the increased ambition is of course welcome, it also means that we are further behind than we thought. The Committee on Climate Change (CCC) predicts that the UK will miss its fourth and fifth carbon budgets and has called on the government to up its game:

"There are seventeen months until COP26 and new commitments must be made".⁵

One major problem is that innovation so far has concentrated on what might be described as the 'easy bit': electricity generation, where emissions have fallen 68%, largely through renewables displacing coal. By contrast, emissions from housing (mainly gas) have fallen just 16% and transport only 3%.⁶ These sectors are harder inherently to clean up.

In transport, with rapid progress in electric vehicles (EVs), the pathway to deeper emissions cuts, at least for light duty vehicles, is becoming clearer, although heavy duty trucks, aviation and shipping remain a challenge.

Britain has 26 million homes, most of which are badly insulated and energy inefficient, which account for about a fifth of total UK emissions.

The greatest challenge, however, is the residential sector. Britain has 26 million homes, most of which are badly insulated and energy inefficient, which account for about a fifth of total UK emissions. So to reach Net Zero by 2050, we need to retrofit almost one million homes per year and we have scarcely started.

To confront global warming, therefore, we need not only to accelerate clean energy innovation, but to pursue it across a wider front and tailor it to different sectors.

The opportunity

Fortunately, our urgent need to decarbonise the energy system presents not only a crisis, but also a massive opportunity.

The IEA calculates, that to deliver the Paris Agreement, the energy sector will have to invest \$13.5 trillion to 2030⁷, or around \$840 billion each year. Of that, \$8 trillion is needed for transport and buildings, where the winning technologies and business models have not yet emerged. The countries that develop them will not only reduce their own energy emissions and costs, but also have products and services to export into booming markets worldwide.

The government has recognised, through its Industrial Strategy, and Clean Growth Strategy the low carbon energy revolution as “one of the greatest industrial opportunities of our time” in which “whole new industries will be created”.⁸ One example could be the energy retrofitting of British homes. If the cost per home could be reduced to £15,000⁹, the total bill for 26 million homes would come to £390 billion, or £13 billion a year for thirty years. This represents an enormous market for those who can develop cost-effective, low carbon, home energy technologies and innovative business models to help fund their installation.

The challenge of innovating for the energy transition

Broader innovation in clean energy is made more challenging, but also more powerful, by two grand trends sweeping through the global economy. One is digitalisation, or the combination of big data and machine learning that has led to smart devices and the ‘Internet of Things’. The other is ‘interoperability’, meaning the progressive adoption of intelligent energy systems, particularly in the built environment and transport, which were seen previously as separate energy systems entirely. It is now clear that interoperability is vital for reducing emissions across many of the most challenging sectors. Digitalisation is the means by which it can happen.

One practical example is the hybrid boiler. It combines a gas boiler, an air-source heat pump and smart controls supplied with live data from the gas and electricity grids. This allows it to switch fuels to minimise emissions and reduce energy bills. Also, this relieves pressure on the electricity grid at peak times. Digitalisation, in turn, opens an opportunity for companies to create new services that aggregate the control of many such devices to benefit both consumers and grid operators. The new services and associated business models will need to be tailored to different markets, user groups and regions.

Digital technologies support decarbonisation because smart devices allow energy systems to converge.

Creating such services, which would help decarbonise the grid, depends entirely on generating and consuming devices being ‘visible’ to each other so they can communicate and interact. This is not possible as things stand and is the reason why our new innovation platform must focus initially on digitalisation.

Digitalisation has three other corollaries: decarbonisation, decentralisation and ‘democratisation’ of energy markets: hence D4E.

Digital technologies support decarbonisation because smart devices allow energy systems to converge. For example, EVs help reduce CO₂ emissions, not only because they can run on wind or solar power. Their storage capacity can help the electricity grid absorb a greater proportion of variable renewable generation, reducing the overall carbon intensity of the grid.

Decentralisation comes about because the energy transition means both supply and demand are increasingly local issues. Almost all of the new wind and solar generation is connected not to the national grid but to local networks. At the same time, demand for EV charging, and to a lesser extent heat-pumps, is causing hotspots of electricity demand that increasingly conflict with constraints in local grid capacity. This combination means supply and demand must increasingly be balanced locally, creating the need for measures such as demand-side management and peer-to-peer trading. This presents new economic opportunities in local economies.

Democratisation refers to the blurring of the traditional distinction between producers and consumers of energy. In the past, the relationship was simple and linear: big companies generated and distributed electricity, gas or petrol and consumers largely took what they were given. These days, many businesses and householders produce energy themselves, either to consume and increasingly to trade. Digitalisation means owners of small-scale solar PV, batteries, hybrid boilers, heat batteries, EVs, or even a humble fridge-freezer fitted with a demand-side management device, will increasingly be able to sell their services to the local grid through aggregators.

The emergence of this new breed of ‘pro-sumers’ requires us to understand their behaviours and needs. This will drive the development of better monitoring and smart, connected systems in the home. To achieve this, we will need a broader range of ‘systems innovation’ to support new products, services and business models. For SMEs, building such a wide range of capabilities is challenging. They will need new forms of support, most probably provided by a new type of organisation.

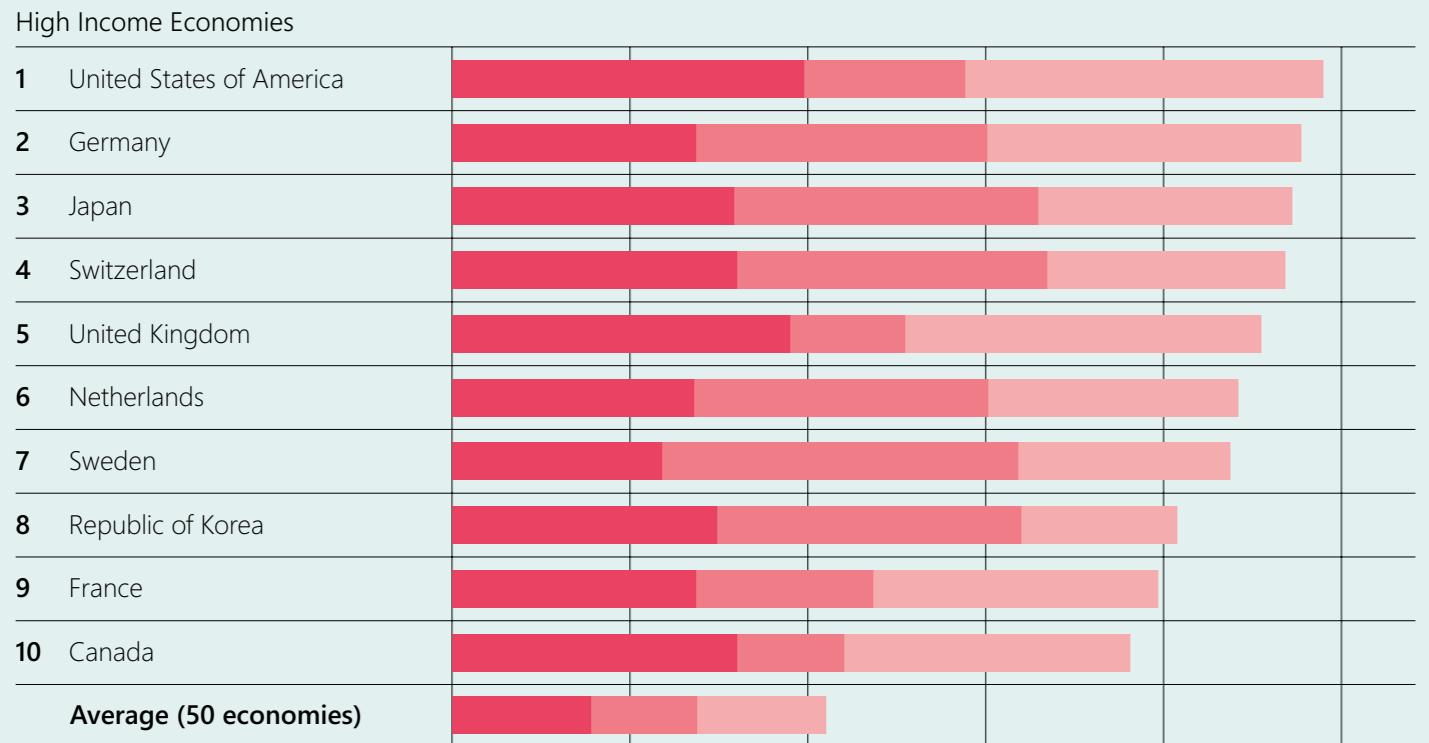
Innovation in the UK

Realising the enormous benefits transition to clean energy brings requires an outpouring of innovation. The evidence suggests that the UK does not yet have the resources or expertise to provide it.

Britain can be rightly proud of its long list of world-changing inventions: refrigeration, jet engine, computer, graphene. But, its record in innovation – commercialising those breakthroughs – has been weaker. Too often, as the Industrial Strategy recognises, British inventions have been commercialised by others.

There are of course exceptions, but the general point is supported by the GII World Innovation Index, produced annually by Cornell, INSEAD and the World Intellectual Property Organization. In the 2019 edition, the UK ranks fifth overall, down from second place in 2015.¹⁰ As the world's fifth largest economy, Britain may perhaps not be too dismayed by those scores. But, as shown in Figure 2, the country's position relies heavily on the research outputs of its universities, shown as the dark red on the graph. We lag behind the other top ten nations significantly when we examine the quantity of patents secured (mid red bar). Our performance is dwarfed by all but Canada.

**Metrics for quality of innovation:
top 10 high – and middle-income economies, 2019**



**Figure 2: Global innovation quality
rankings by country, 2019.¹¹**

The shortfall in levels of innovation ranged from 4-8% below English best practice in Coventry in Warwickshire, and 8-12% below in Birmingham and Solihull.

Innovation in the West Midlands

In the West Midlands, the heart of British manufacturing, the situation appears to be the same as the country as a whole. Perhaps worse, according detailed regional analysis contained in three reports by the Midlands Engine, the West Midlands LEPs, and the Enterprise Research Centre (ERC).¹² Taken together, they suggest, that although the West Midlands boasts some formidable innovation assets, its innovation performance has some worrying weaknesses.

Like the national picture, the analysis suggests the West Midlands may be better at inventing things and weaker commercialising them. For instance, the West Midlands secured some £248 million in grant funding from Innovate UK during 2010-15. This was proportionately higher than expected given the region's population of firms and higher educational bodies (8% rather than 6%). But, two thirds of this (66%) went to just four big organisations: Warwick and Birmingham universities, the Manufacturing Technology Centre (MTC) and car-maker JLR. The region's small companies secured far less: £47 million split between 300 micro, small and medium sized firms. This represents just 4.1% of the total Innovate UK funding to this group, lower than the 5.2% expected relative to the number of West Midlands SMEs.¹³

Since universities generally conduct primary research, and smaller companies are more likely to commercialise products and services, this research seems to confirm that the West Midlands – like the UK as a whole – is stronger at the early stages of innovation, but weaker at converting this into products and services that actually make a difference.

This picture of relative weakness is supported by the ERC report. It found that innovation in LEP areas across the West Midlands lags that of the best performing LEPs in England. The shortfall in levels of innovation ranged from 4-8% below English best practice in Coventry, Warwickshire and 8-12% below in Birmingham and Solihull.¹⁴

The detailed findings of the ERC report are equally worrying. It found that about a third of companies in the West Midlands were undertaking 'new-to-the-firm' innovation – things they hadn't done before, but which other companies had. The number of companies engaged in 'new-to-the-market' innovation – in other words, real innovation – was just 1 in 10. Most of this was concentrated in larger companies with funding from Innovate UK and the EPSRC.

Overall, the ERC report concluded that levels of all types of innovation in the West Midlands were moderate compared to the UK and low compared to international competitors.

A study by BEIS found 205 incubators and 163 accelerators supporting 3,450 and 3,660 businesses per year respectively.

Support for innovation in the UK and West Midlands

The West Midlands' performance in innovation raises the question of whether the support available to firms in the region is adequate – especially for energy innovators. Even before we started our research, the publicly available evidence suggested not.

Support for innovation generally falls into two categories: grant funding, where cash is awarded to support specific projects; and business support provided through a range of organisations. The main grant funding bodies for energy-related innovation are Innovate UK and BEIS. The bulk of this funding into the West Midlands has gone largely to universities and big innovation institutions. Business support for start-ups and SMEs is generally provided through local authority and university delivered programmes, incubators and accelerators. Both grant funding and business support are vital to help start-ups and SMEs bring energy innovations to the market.

Incubators and accelerators

Incubators and accelerators are similar but distinct. Both types of organisation are intended to support innovative companies through their early years until they become self-supporting. But, that's where the similarity ends.

Incubators have been around for longer – at least thirty years – although they have proliferated this decade. They are typically 'physical', providing office space and laboratories for their clients, for which they charge rent. They also offer training and mentoring. By and large, they do not invest in their clients.

Accelerators, by contrast, have sprung up in the last decade. They are less about offering physical workspace and more about providing services that may be 'virtual' – accessed online only. They are highly selective and rather than charge rent they usually take equity in their clients. In the BEIS survey, 61% invested an average of £39,000, compared to 14% and £25,000 for incubators. Many of the earliest accelerators were funded by venture capitalists, but now some are funded by corporate owners such as energy utilities.

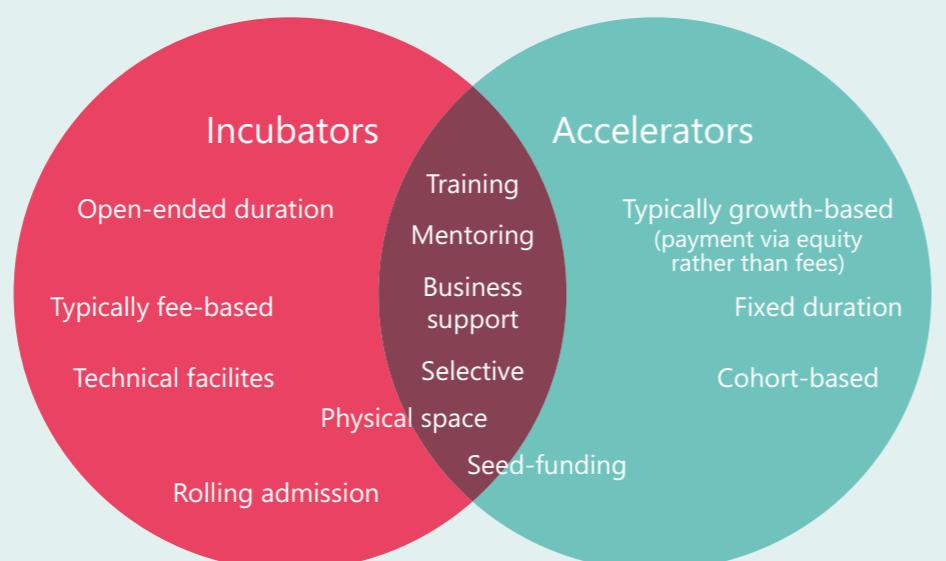


Figure 3: Features of incubators and accelerators. Source: BEIS¹⁵

Source: (Bone et al. 2017) adapted from (Dempwolf, Auer, and Fabriani 2014)

In early 2018, a study by Energy Systems Catapult found that, apart from grant funding programmes, only three UK incubators or accelerators had energy innovation as a significant part of their portfolio.

At first glance, there would seem to be no shortage of incubators in the UK. A study by BEIS found 205 incubators and 163 accelerators supporting 3,450 and 3,660 businesses per year respectively.¹⁶ Both types of organisation have proliferated over the past decade: more than half the incubators, and all but a handful of the accelerators, were created since 2011.

On closer inspection, however, very few of these offer support specifically for energy innovators. Among incubators, 45% have no particular sector focus and only 11% list themselves as supporting 'Energy and Environment'. For accelerators, the figures are 30% and 5.5%.

The category Energy and Environment is rather broad. Research shows that most incubators and accelerators had portfolios comprising environmental and cleantech innovators. None specialise on any specific area of energy. There is little support for systems innovation. This is where new energy technologies integrate across conventional boundaries to deliver new services for homes, buildings, transport and local energy systems. These in turn, usually require new business models and commercial arrangements.

Our own research shows there are no incubators that focus on digitalisation of energy. The handful of corporate accelerators who may tend in this direction are highly selective. They largely serve the R&D priorities or product portfolio interests of their energy utility owners (see Chapter 3). Equally the clean tech incubator, Carbon Limiting Technologies, funded by the government's Energy Entrepreneurs Fund, has a wider remit than purely energy

Incubation and business support tailored to energy innovation looks even sparser when compared to the US. They have more than 100 energy innovation support programmes including fifteen leading physical Incubators for clean energy and a coordinating body, the Innovate Energy Network (IEN), managed by EPRI/NREL. The IEN guides innovators to the right support for their stage of development, or to one of its 500-strong network of mentors. It also coordinates the presentation of energy innovators from its incubator network to corporates, utilities and investors.

If we measure US support for energy innovation by their population or GDP, with a view to replicating this in the UK, we would have 15 to 20 energy innovation support programmes and a single co-ordinating body.

In early 2018, a study by Energy Systems Catapult found that apart from grant funding programmes, only three UK incubators or accelerators had energy innovation as a significant part of their portfolio. All were corporate, and so would reflect R&D priorities of their energy utility owners. The breadth of disruptive innovation needed across the UK market, together with that needed to deliver least cost decarbonisation, regionally and nationwide, was not included in their remit or funding priorities. The study found a notable lack of incubators and accelerators with expertise in specific sectors or digital energy and very little support for system-based innovation.

Publicly available evidence and previous research by Energy Systems Catapult, demonstrates clearly that support for energy innovation in the UK is insufficient to meet the scale of the challenge. What is needed, therefore, is a thorough investigation into the case for establishing a new innovation platform, D4E, dedicated wholly to energy with a strong focus on digitalisation.

Chapter 2: Market landscape

This study is based on the results of rigorous investigation. The aim was to produce an evidence-based study to inform the design of a new regional innovation platform. The new body would be the country's first innovation platform focused exclusively on energy. It will combine a physical and virtual incubator for maximum impact and reach; offer expert innovation and commercialisation services available nowhere else and focus on digitalisation as the key to system innovation. In this way it will help deliver WMCA's ambitious economic and carbon reduction plans for the West Midlands.



In January 2019 EIT Climate-KIC commissioned Energy Systems Catapult and Sustainable Ventures to report on the scope and effectiveness of support services to SMEs and start-ups involved in energy-related innovation across the West Midlands. Then we would assess the need for a West Midlands regional innovation platform to support energy-related innovation and, if appropriate, recommend a business model.

'Innovation' was taken in a broad sense, meaning not simply to invent and commercialise new products, or improve existing ones. It included ideas that break down traditional boundaries between energy systems and between energy producing and consuming sectors. One example could be a new business model that replaces the sale of gas or electricity as a commodity with those that provide comfort as a service. Another could be one in which householders with smart hybrid-boilers could sell balancing services to the electricity grid.

Similarly, 'energy-related' innovation includes not only the energy sector as defined traditionally by supply, transmission and distribution of power, heat and transport fuel. It includes other sectors with an outsized impact on energy consumption and CO₂ emissions: built environment, transport, and energy-intensive industries such as steel and glass. Taken together, we refer to the four as these 'focus sectors'.

The study combined new and targeted market research with rigorous analysis. First we conducted a 'landscaping' study. This assessed the depth and breadth of innovation support, through local and national programmes, to SMEs in the West Midlands and across the focus sectors.

Next, we analysed the gaps in provision. Then we conducted structured interviews with SMEs and stakeholders. We held a workshop to design a series of new services for SMEs involved in energy-related innovation which were tested through a survey of energy-related SME innovators. Finally, analysts at Energy Systems Catapult drew on all the findings to develop a series of value propositions and a business model for the proposed organisation, D4E (Digitisation, Democratisation, Decentralisation, Decarbonisation for Energy). This chapter presents the results of first phase of research.

Landscape study

It is well understood that SMEs need different kinds of support for innovation. Their innovation needs at different stages, from concept to commercialisation are illustrated in Figure 4. Our landscaping study mapped the extent and types of energy-innovation support available currently to West Midland based SMEs, including the programmes and organisations delivering it. The work was based on desk-research and fifteen interviews with companies, industry bodies and funding organisations in the focus sectors.

Landscaping identified six categories of support

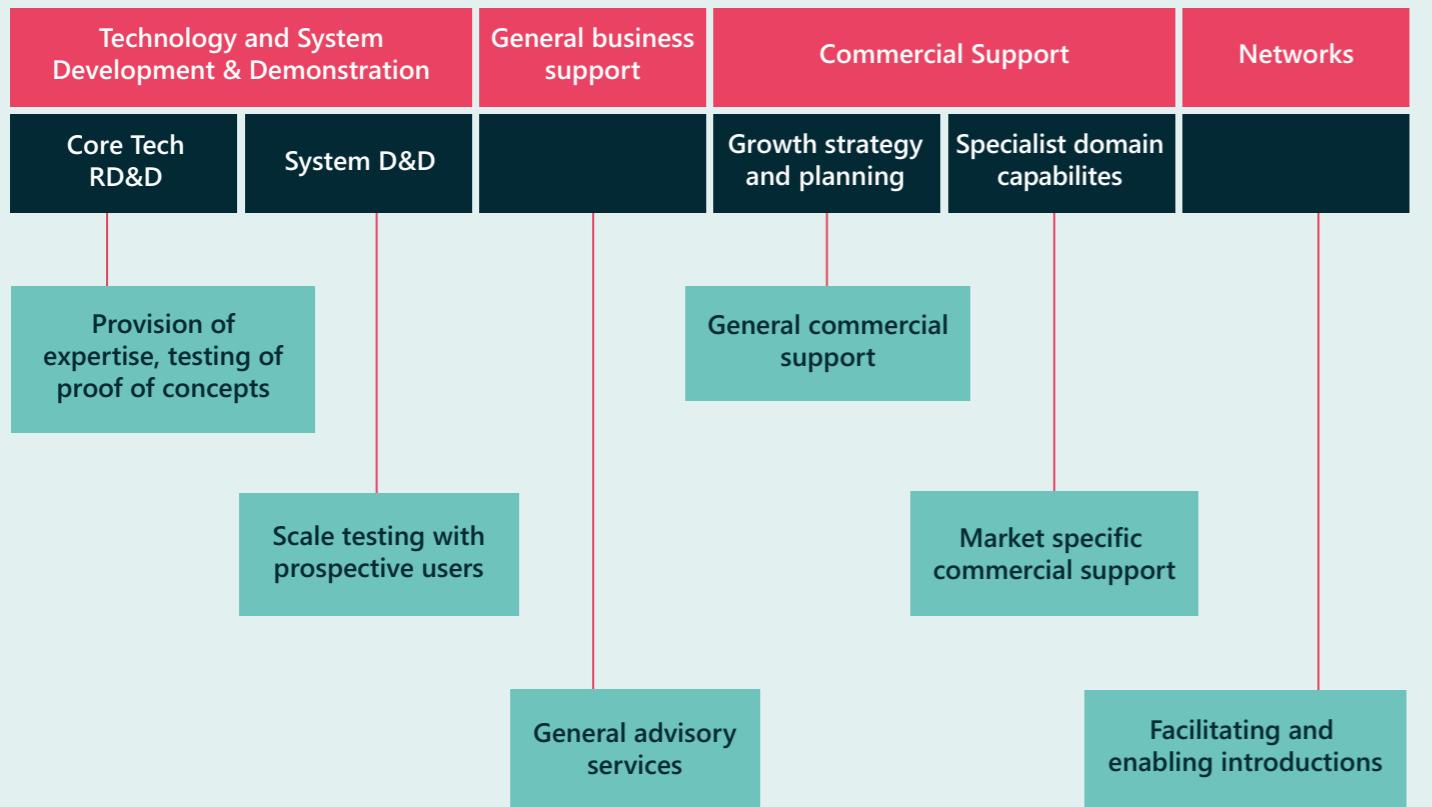


Figure 4: Types of support required by SME innovators by stage of development.

The first step was to identify support programmes available to SME energy-related innovators in the West Midlands, and the types of service they provide. These could be either local programmes or national programmes available to companies in the region. The next step was to analyse which of these programmes and services were available within each of the Focus Sectors.

The research identified two broad types of support: programmes that provide grant-funding for individual projects and those that offer broader business or innovation support for SMEs. These two broad categories can be subdivided into six types of business and innovation support and two forms of grant funded support, as shown in Table 1. Altogether, we identified 120 programmes, run by agencies in the region or accessible from the region, that might be relevant to SME energy-related innovators.

Our work identified eight broad categories of support programmes

Category description	
Enabling economic activity – diagnosis, signposting, business improvement	Funded programmes offering diagnosis and signposting to more specialist support business functions.
Access to technical facilities or expertise	Programmes to access technical facilities and experts to help develop technology and solutions, (up to TRL 5/6) to system-level test and operational demo facilities (TRL 6-7), and a few end-user trial environments (TRL 7-8).
Co-working and incubation space with start-up support	Primarily coworking office space with benefits of an entrepreneurial community. Often includes mentoring, access to business, professional services and corporate partners.
Business Acceleration Programmes	Structured / semi-structured acceleration programmes tailored to pre-commercial SMEs. Some aligned to a tech or market sector.
Corporate or strategic investor sponsorship	Specialist programmes funded by corporates with strategic interest in accessing SME innovators.
Sector specific acceleration programmes	Sector specialist programmes, designed to support SME into a target sector to help address sector challenges.
Grant Funding (mostly national)	Grant calls, challenges or competitions aimed typically at core technology development and demonstration.
Sector specialist organisations	Sector centres or organisations established to foster innovation in a sector enhancing sector growth and transition.

Table 1: Business support and grant funding support available to West Midlands SMEs by type.

What support is available to energy-related SME innovators in the West Midlands?

Business and innovation support

The first of the six business support categories, *Enabling economic activity*, covers organisations designed to promote growth, new business formation, jobs and innovation. They are usually publicly funded. In the West Midlands, the Growth Hubs, run by each of the Local Enterprise Partnerships, are good examples. These offer a broad range of business support including: skills and training; starting a company; innovation; access to funding; advice on regulations etc. Typically they also offer a ‘front end diagnostic’ service to help SMEs better understand their general needs before guiding them to expert sources of help. By definition they are sector-agnostic, therefore they do not specialise in energy innovation.

The second category, *Access to technical facilities or expertise*, covers programmes that provide access to specialist facilities or expertise to test and demonstrate new technologies. They may also offer office space and support for commercialisation, but their defining feature is access to specialist equipment. Typically they are not energy or even sector specific. For instance, Science 2 Industry, based at the University of Birmingham, provides support for all sectors from agriculture to food and drink to construction. Low Carbon Research and Innovation, based at Aston University, does specialise in bioproducts and energy-from-waste, however.

The main source of grant funding for energy innovation in the UK is the Department of Business, Energy and Industrial Strategy (BEIS). Their spending on energy innovation is expected to reach £400 million per year by 2021.

Co-working with a level of incubation support covers largely conventional incubators. SMEs can share office space with other entrepreneurs, take advantage of advice, workshops, mentoring and support with commercialisation. Incubators are increasingly offering ‘makers’ spaces’ on the same site, with computers and engineering tools to help produce designs and prototypes. Birmingham based examples include: Eagle Labs, run by Barclays; Geovation, run by Ordnance Survey and HM Land Registry; and STEAMhouse, run by City University, which is planning a £48 million expansion. None of the incubators we identified focus on energy.

Acceleration and growth programmes typically provide support tailored to particular stages of business development and may also be sector focused. In the West Midlands, for example, Entrepreneurs for the Future caters to early stage start-ups in digital, clean tech and low carbon.

Among the national programmes, the EIT Climate-KIC Accelerator is part of an EU-wide network. It is the only EU-funded accelerator to focus on the climate impact of cleantech commercialisation. It offers grants of up to €95,000 and provides coaching and resources to support cleantech SME development. It also runs initiatives such as the Climate Launch Pad competition for green business ideas and 24-hour ‘Climathon’ to generate carbon reduction ideas for individual cities. Climate-KIC is involved in the West Midlands’ Energy Capital partnership. Through this it has funded two co-branded support programmes delivered by the universities of Birmingham and Aston and Energy Systems Catapult. Another programme through which energy innovators can receive incubation support is the Energy Entrepreneurs Fund administered through Carbon Limiting Technologies.

Corporate and strategic investor programmes are owned typically by big energy utilities that want to keep an eye on, invest in, or acquire emerging technologies. They clearly focus on energy, but are highly selective, providing valuable support to rather few SMEs. They also tend to reflect the corporates’ own R&D priorities and commercial interests, so may not support the most disruptive ideas. Examples include: EDF’s Blue Labs, the Eon Agile Accelerator and Engie Innovation.

Sector specific programmes are typically publicly funded organisations designed to help the sector reach decarbonisation or energy transition targets, which we discuss below.

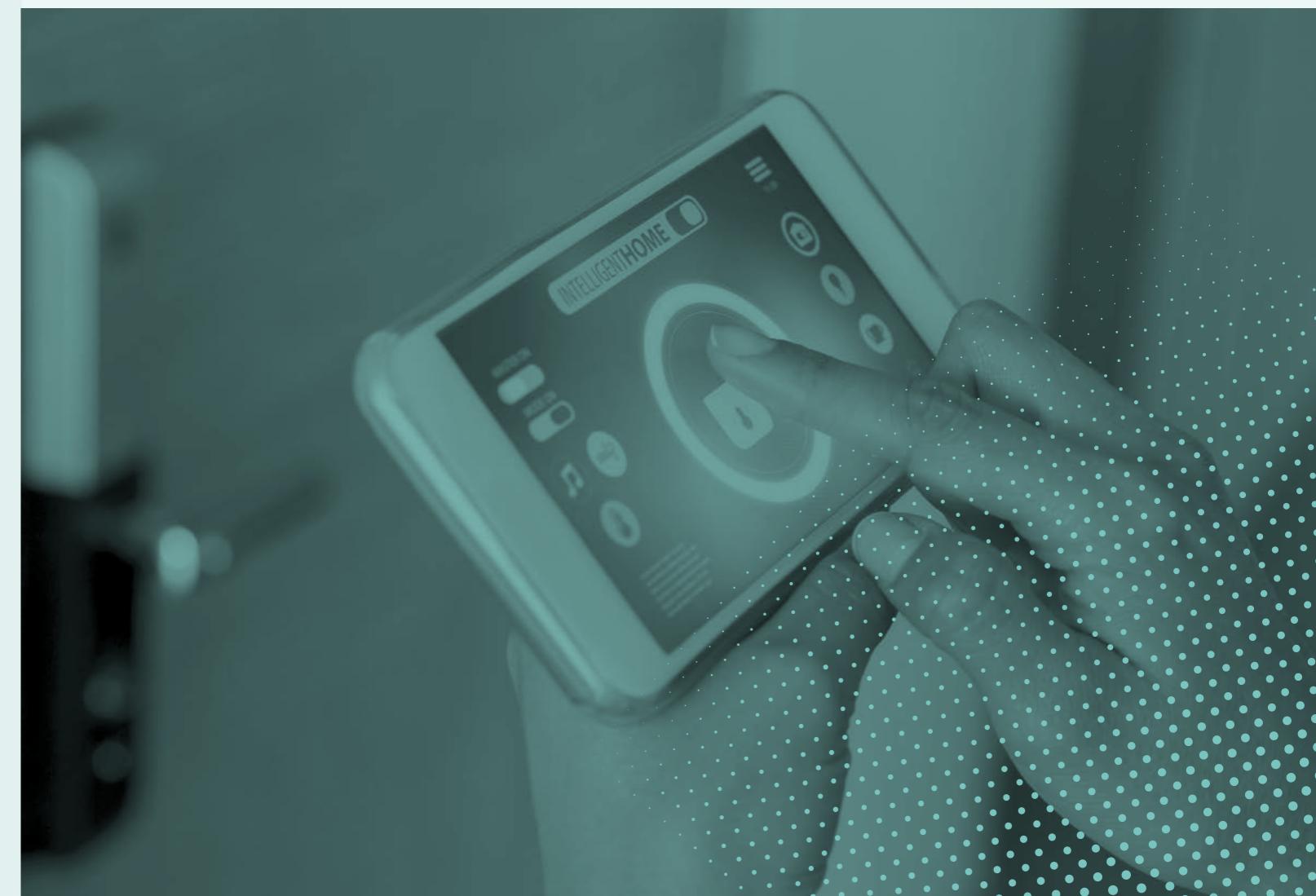
Grant funded programmes

The main source of grant-funding for energy innovation in the UK is the Department of Business, Energy and Industrial Strategy (BEIS). Their spending on energy innovation is expected to reach £400 million per year by 2021.¹⁷ The main channel is the BEIS Energy Innovation Programme. Their budget of £505 million for 2015-2021 is to be allocated as follows:

- > £70 million in smart systems
- > £90 million in the built environment (energy efficiency and heating)
- > £100 million in industrial decarbonisation, carbon capture, use and storage (CCUS)
- > £180 million in nuclear innovation
- > £15 million in renewables innovation
- > £50 million in support for energy entrepreneurs and green financing

Energy innovation will also receive some of the £1.2 billion allocated to the Research Councils and Innovate UK. There is also £246 million for the Faraday Challenge and a total of £620 million from several other departments, including DfD, Defra and DIT.

Another big source is the Industrial Strategy Challenge Fund (ISCF) which supports four ‘Grand Challenges’, one of which is Clean Growth. Taken together, the Energy Innovation Programme and the ISCF fund a wide range of programmes. These tend to be either grants for collaborative research, development and demonstration projects, or funding for specialist sector centres, as discussed in the next section.



The West Midlands has or is developing some system-level test facilities, but few of these have any SME support programmes yet.

Sector analysis

Having identified the support available to SME energy-innovators, the next step identified what support was available to them in each of the focus sectors.

Energy

In energy, sector-specific support is available through three corporate accelerators – EDF Blue Labs, Eon Agile and Engie Innovation – which are highly selective. Three publicly funded sector programmes also specialise in business support for SME energy-innovators:

- > Energy Systems Catapult's Innovator Support Platform (ISP) which supports new technologies that drive the shift to a more distributed, intermittent and renewable energy supply. ISP offers three levels of support including 'incubator', and a more specialist 'accelerator' for potentially high impact SMEs. It includes access to the Catapult's 'Living Lab', which is a network of residential properties in which energy innovators can carry out customer facing trials and develop their business models ahead of full scale commercialisation.
- > Accelerating Thermal Energy Technology Adoption (ATETA) supports R&D in: thermal energy; smart grids and systems integration; renewable power and fuel cell technology. It provides laboratories and a range of business support. It is available only to SMEs in the Greater Birmingham and Solihull LEP area and delivered by Birmingham Energy Institute and Energy Systems Catapult.

Low Carbon Research and Innovation Programme for Bioenergy and Bioproducts is a (2016-2022) ERDF funded programme at Aston University. It supports West Midland SMEs to develop low-carbon innovation in bioproducts and energy-from-waste. The biggest source of grant funding in energy innovation is the Industrial Strategy Challenge Fund, which supports work in specific areas. For instance, The Faraday Battery Challenge will invest £246 million over four years. It supports early-stage R&D and later stage innovation through the UK Battery and Industrialisation Centre (UKBIC, described below). Another ISCF scheme is Prospering from the Energy Revolution, announced July 2019, which will invest around £100 million supporting work on smart systems to raise the proportion of renewable energy on the grid.

R&D grant funding is sometimes conditional on collaboration between innovators. Often open to businesses of all sizes they are designed to encourage SMEs and larger industrial companies to work together with a focus on commercialising the technology and bringing products or services to market. Another example is the BEIS Energy Entrepreneurs Fund, now in its seventh phase and which has supported 130 projects so far. Yet another is the BEIS Industrial Energy Efficiency Accelerator, which supports later stage technologies (TRL5 and above) in sectors such chemicals, paper, and food and drink. In 80% of successful applications the technology provider is an SME, although this is not a formal requirement. For Distribution Network Operators (DNOs), the Network Innovation Competition (NIC) and Network Innovation Allowance (NIA) work in a similar way.

Another ISCF scheme is Prospering from the Energy Revolution, announced July 2019, which will invest around £100 million supporting work on smart systems to raise the proportion of renewable energy on the grid.

Aside from collaborative RD&D projects, a significant slice of public funding has been channelled through purpose-built organisations that focus on technology development within a defined area of activity. In the Midlands, one such organisation is the Energy Research Accelerator (ERA), which combines eight Midlands universities and the British Geological Survey. It works with government and industry to research and demonstrate technologies for generation, storage and integration, and is an important partner in the Faraday Challenge. ERA does not run an SME support programme, but all its university members have their own programmes.

Another specialist centre is the UK Battery Industrialisation Centre (UKBIC) at Warwick University, which will focus on building manufacturing capability and later-stage testing.

System level testing and demonstration facilities are particularly valuable to energy innovators, because their technologies must integrate within the wider energy system and with systems in other sectors such as housing or transport (or both). The West Midlands has, or is, developing some system-level test facilities, but few of these have any SME support programmes yet. Examples include:

- > Smart Energy Network Demonstrator (SEND) at University of Keele's 600-acre site (located in the Stoke and Staffordshire LEP area) claims to be Europe's first 'at scale' living laboratory where new energy efficient technologies such as demand side management can be researched.
- > ERA is a partner in the Nottingham Trent Basin Community Energy Test Bed. This is a full-scale demonstration of an integrated energy system using solar and thermal ground source energy and Europe's largest community battery (2MWh). It has 45 low-energy homes so far, with a further 100 planned.
- > Energy Innovation Zones (West Midlands). EIZs are intended to host commercial demonstrations that integrate low carbon technologies and novel business models across energy systems and sectors. If necessary, and with Ofgem approval, they will adjust or waive specific national energy regulations to allow this to happen. Five EIZs are planned at Tyseley, UK Central, Black Country, Rugeley and Coventry and Warwick.
- > ERA has 'at-scale' demonstrators at six universities in the West Midlands and one at Nottingham covering Integrated Energy, Thermal Energy, Geo-Energy.

Several other regional initiatives could provide system-level testing and demonstration for specific aspects of integration. For example, The West Midlands Future Mobility Zone, covering Birmingham, Solihull and Coventry, could trial technologies at the interface between energy and mobility. The West Midlands 5G Testbed and Trials Programmes, which is part of the West Midlands Housing Package, could demonstrate technologies that integrate energy systems and new housing.

Some types of energy products could also undergo end-to-end testing at the UKBIC (described above) or MTC's Factory In a Box.

Housing

Energy-related innovation in the construction sector is supported by SME support programmes, grant funded initiatives and specialist sector centres. However, support for SMEs overall is sparse.

Among SME support programmes, Built Environment Climate Change Innovations (BECCI) is an ERDF funded programme offering free support to SMEs developing low carbon products and services for buildings. These include: insulation, building fabric, ventilation, water re-use and treatment, waste management and smart grid. It is operated by the University of Wolverhampton and available to SMEs based in the Black Country or the Marches. It provides support in innovation including equipment trials.

The West Midlands Innovation Alliance has set up a new network (2019) to engage with construction sector innovators. This will inform the West Midlands Local Industrial Strategy (WM LIS) Construction Sector Action Plan, which is being prepared by the Black Country LEP.¹⁸ It has identified a need to help construction SMEs collaborate with each other and with large companies to win contracts. However, these sector action plans do not offer overt business or innovation support for SMEs.

Many large construction firms have moved their business operations to the West Midlands to take advantage of the region's excellent business and professional services. The WM LIS aims to forge links between these firms and construction related initiatives in the West Midlands which include:

- > WMCA Construction Gateway: a new three-year programme to train over 2,000 new recruits linked to major projects such as HS2, WM Housing Deal, Springfield. It focuses around skills needed for new opportunities for off-site manufacturing.
- > The University of Wolverhampton's Springfield Campus, which aims to be Europe's largest specialist construction campus and technology hub, and to encourage the uptake of new technologies and techniques. It also hosts the university's School of Architecture and Built Environment, the Elite Centre for Manufacturing Skills, and the Brownfield Research and Innovation Centre.
- > Manufacturing Technology Centre's role as a partner in the ICSF funded Construction Innovation Hub (see below).

Grant funded initiatives in construction include several under the BEIS Energy Innovation Programme. They include initiatives that fall under the title Innovations in the Built Environment, through which BEIS expects to spend £90 million. Such programmes as Investing in Low Carbon Heating Technology, has £10 million for innovative technologies that reduce carbon emissions from buildings. It also includes measures to boost SME access to an energy efficiency competition offering £6 million for technologies that encourage SMEs in the commercial and industrial to be more energy efficient.

"If we want to achieve rapid impact at scale using known techniques, the greatest effect we're going to have is to work with larger organisations.

SME business support is not a focus for us. It may be a bi-product of what we're doing but, it is not a particular focus area."

An interviewee

Another significant source of funding for low carbon technology in buildings is the ICSF's Transforming Construction stream. It allocated £170 million to modernise the sector using digital technology to improve safety, health and energy efficiency. But, it is unlikely much of this will be directed to supporting SMEs.

One interviewee told us: *"If we want to achieve rapid impact at scale using known techniques, the greatest effect we're going to have is to work with larger organisations. SME business support is not a focus for us. It may be a bi-product of what we're doing but, it is not a particular focus area."*

While this may preclude specific SME support programmes, it is likely that some of the initiatives will provide opportunities for SMEs. Roughly £60 million of the Transforming Construction funding will be distributed through Innovate UK competitions to support collaborative R&D and demonstration projects, all of which require at least one SME to be involved.

The other £110 million will fund sector specialist organisations, such as the Active Building Centre (ABC). This organisation develops technologies and materials for 'active buildings': properties that generate more energy than they use. The ABC is funded to carry out 20 demonstrator projects by spring 2022. Areas like the WMCA, which is driving the low carbon agenda, are seen as likely locations for projects.

Two other building related organisations that touch on low-carbon objectives include:

- > The Construction Innovation Hub, a partnership of the Manufacturing Technology Centre (part of the High Value Manufacturing Catapult), the Building Research Establishment (BRE) and the Centre for Digital Britain. This hub has been established to spend £72 million of funding from the ICSF on CR&D projects that will drive collaboration to develop and commercialise digital building manufacturing technology to, contributing to lower cost, greener building methods.
- > The Centre for Digital Britain, a collaboration between BEIS and Cambridge University, supporting the digitisation of infrastructure and construction.

In the private sector, larger companies in housing have innovation teams that engage with SMEs, screen promising concepts and involve them in trials or pilot projects. Examples include Places for People, Engie-Keepmoat, Skanska, Laing O'Rourke, and Land Sec. Some engage in corporate venturing activity and invest in promising SMEs. Several, such as Skanska, also run open competitions to source innovation. These activities tend to be highly selective, yet cover a wide range of sectors (energy, non-energy, cleantech) and have limited bandwidth to nurture an eco-system of innovators.

Transport

The transport sector is better supported than housing or energy. However, support programmes, grant funded initiatives and specialist sector centres focus mainly on innovation in low carbon vehicles. They ignore the innovation required in the energy system needed to support them.

Our research identified four SME support programmes for low carbon vehicle technologies. The most relevant is the Advanced Propulsion Centre's Technology Developer Accelerator Programme (TDAP). The programme currently supports 15 SMEs and provides assistance in three phases: 1) market analysis to identify potential customers and develop an offer that will appeal to them, 2) business planning, 3) technology development including building prototypes. Technologies supported include: lightweight materials, electro chemicals and battery projects, software, as well as charging and engine technology.

Other transport related SME programmes include:

- > InMotion Ventures, funded and owned by Jaguar Land Rover, invests in a wide range of transport related technologies at all stages of innovation. This included: novel ride sharing apps, intelligent systems for personal navigation, platforms for easy booking of group trips, and innovative pay by mile insurance.
- > Digi-Rail is part-funded by the ERDF and provides innovation support to SMEs developing digital products and services for the rail industry. This includes: rolling stock design, smart ticketing, traffic management, energy optimisation and station information systems. This includes: individual consultation and diagnosis, workshops and access to technical expertise and rail industry buyers.
- > Beyond the West Midlands, Transport for London has two innovation programmes:
 - Accelerator, which accepted six SMEs in 2017 with technologies intended to reduce congestion and/or pollution in London. It is unclear if this programme is still active.
 - 'Open call' on four challenge areas: Bus Safety, London Road Lab, Connected Retail, and Mayors Civic Innovation. Selected applicants typically receive a cash prize with access to TfL management, facilities and pilot projects.¹⁹

The latest grant funded project, Driving the Electric Revolution Challenge, launched in mid-2019 with £80 million in cross-sector funding from the ISCF. It is intended to bolster Britain's position in power electronics, machines and drives (PEMD). Demand is forecast to rise because of growing production of EVs, hybrid aircraft and consumer products. The UK is already recognised as a world leader in PEMD design and IP. This funding is intended to grow our manufacturing capability so that products we design are also built here.

We found two other grant-funded programmes for collaborative transport projects:

- > Hydrogen for Transport Programme will provide up to £23 million via the Office of Low Emission Vehicles (OLEV) to support the growth of refuelling infrastructure. Stage 2 will support five grant funded projects.
- > Future Fuels for Flight and Freight Competition will provide up to £20 million in capital grant funding from Department of Transport to increase domestic production of advanced low carbon fuels to reduce emissions from planes and HGVs.

For example, Centre for CAV has invested over £225 million in 80 projects involving a wide variety of SMEs as well as larger organisations.

The biggest specialist centre in transport is the Advanced Propulsion Centre. The APC is a joint venture between government and vehicle manufacturers, established as a centre of excellence for the research, development and production of low carbon vehicles. It has a broad remit, covering the acceleration of low carbon vehicle technology from research to commercialisation. The APC is primarily a funding body as distinct from a delivery organisation, and allocating funding to successful bidders in particular calls and challenges.

There are many other national and regional initiatives to support collaborative innovation and demonstrators in EVs. Some are: OLEV, EVET, Centre for Connected and Autonomous Vehicles (Centre for CAV) and IUK/BEIS funded EV demonstration projects. West Midlands' regional initiatives include: Future Mobility, CAV, Drive Midlands, and ZENZIC. None of these groups offer structured SME business support programmes, as far as we know, but they can and do engage with SMEs, often through collaborative R&D projects. For example, Centre for CAV has invested over £225 million in 80 projects involving a wide variety of SMEs as well as larger organisations.

Energy intensive industries (EII)

The Energy Intensive Industries (EII) comprise the eight highest-emitting industrial sectors. Together they are responsible for around two thirds of industrial emissions. They include: iron and steel, glass, ceramics, chemicals, food and drink, cement, pulp and paper and oil refining. We interviewed several of the relevant trade associations for our research. One of these, Make UK, which represents the steel industry and manufacturers across all sectors, has 6,000 members of which 85% are SMEs.

The EIIs have high emissions and significant barriers to decarbonisation, including international competition, policy uncertainty and investment cycles as long as 40 years. The main approach has been government-prompted industry collaboration supported by grant funding.

In 2015 each sector agreed a decarbonisation roadmap, followed by action plans in 2017. Plans focused on initiatives to identify the technology improvements to cut emissions and to set up programmes or facilities to help develop and demonstrate them. The proposed Glass Futures facility at St Helens intended to test novel heating technologies, such as hydrogen, which will be relevant to other sectors such as cement and ceramics.

The ceramics action plan commits the sector to establishing an innovation platform. This will commence by defining innovation priorities over the short and medium term and at a range of TRL development stages. Work areas include: improved refractories for kiln walls; floors and ceilings, low energy coatings; low carbon biogas and syngas; pre-calcination of clay and other raw materials; and CCS.

It is notable that while these EII initiatives recognise the importance of technology development for decarbonisation, and the magnitude of the task at hand, they offer few programmes to foster collaboration between industry, university, funding agencies and energy innovators.

Summary of support across the focus sectors

The preceding four sections highlighted programmes, grant funding, and centres that support energy-related innovation in energy, housing, transport and the EIIs. A summary of these across all four focus sectors is set out in Table 2. We analyse the gaps in provision in the next chapter.

Focus Sector	Specialist SME support programmes (categories 5 and 6)	Funding streams through BEIS Energy Innovation or ISCF	Funding for collaborative projects	Sector or technology specialist organisations
Energy	<ul style="list-style-type: none"> EDF Blue Labs E.ON Agile Engie Innovation ESC – ISP ATETA EBRI – Low Carbon Innovation (bioenergy) 	<ul style="list-style-type: none"> Faraday Battery Challenge (£246m, ICSF) Prospering from the Energy Revolution (£100m, ICSF/IUK) Driving the Electric Revolution (x-sector share of £80m, ICSF/IUK) 	<ul style="list-style-type: none"> BEIS Energy Innovation Grants (some solutions relate to Housing, Transport, EEI) Industrial Energy Efficiency Accelerator (£12.1) 	With the exception of university departments there were no specific specialists identified
Housing	Built Environment Climate Change Innovation (BECCI)	<ul style="list-style-type: none"> Innovative Built Environment Transforming Construction (ISCF) (£170) 	Transforming Construction plans to allocate £60m to support R&D projects via IUK calls (projects must include one or more SME's)	<ul style="list-style-type: none"> Active Building Centre (£36m from ISCF) Centre for Digital Britain (ISCF) Construction Innovation Hub (£72m from ICSF) SPECIFIC (IUK)
Transport	<ul style="list-style-type: none"> JLR InMotion (Industry) APC Technology Developer Accelerator Programme Digi-Rail (ERDF/Industry) TfL Accelerator 	Driving the Electric Revolution (ISCF) (x-sector share of £80m)	<ul style="list-style-type: none"> Hydrogen for Transport Programme (£23m, OLEV) Future Fuels for Flight and freight (£20m, DfT) UK Government Centre for CAV (£225m, 80 projects) 	<ul style="list-style-type: none"> Advanced Propulsion Centre (Government / Industry) UK Battery Industrialisation Centre (£108m from Faraday CF and BEIS)
Energy Intensive Industries	No sector specific SME innovator support programmes identified	<ul style="list-style-type: none"> Innovative Low Carbon Industry Industrial Decarbonisation (£170m, ISCF) Transforming Foundation Industries (ISCF) Driving the Electric Revolution (x-sector share of £80m) 	<ul style="list-style-type: none"> Industrial Energy Efficiency Accelerator (£12.1m) Industrial Energy Transformation Fund (£315m – in development) Industrial Heat Recovery Support Programme (£18m) Hy4Heat Programme Hydrogen Supply Competition (closed) Industrial Fuel Switching 	<ul style="list-style-type: none"> 2050 Roadmap Action Plans envisage the establishing of industry focused technology development centres Glass Futures (ISCF/ Industry)

Table 2: Summary of sector specific support services for low carbon SME innovators across all four focus sectors (programmes are BEIS funded unless otherwise specified). Note: this list represents the principle programmes, a more comprehensive listing is available on application to ESC. SMEs with suitable innovations and capabilities can engage in most of the programmes in the right-hand three columns, typically as a partner or supplier in collaborative projects.



Chapter 3: Gap analysis

At first glance, it may seem as if West Midlands SMEs that need support for energy-related innovation are well provided for. Our landscaping study created a database of 120 organisations and programmes, providing a wide range of support across the four focus sectors. On closer analysis, however, it is clear there are some significant gaps.



Gap analysis

To find the gaps, we compared our database with the types of SME innovation support identified in Chapter 2, figure 4. This showed innovation for: core technology and system development and demonstration; general business support; commercialisation (Types 1 and 2); and networks. We checked whether or not each type of support was available and, if so, how widely. We also made a judgment about how easy it would be for SMEs to access.

Broadly speaking, this suggests the following services were less available:

- > Sector-focused acceleration, especially in housing/construction; energy; and energy intensive industries (EII).
- > Commercial support (Types 1 and 2), particularly for SMEs outside incubators and start-up accelerator programmes.
- > Little focus on strategic support for scale-up SMEs
- > Systems-level test and trial environments

For Energy Innovators in the West Midlands		Technology and System Development and Demonstration		General Business Support	Commercial Support		Network		
		1. Core Tech CR&D	2. System D&D		1. Growth Strategy & Planning	2. Specialist Domain Capabilities		No. of programmes	Ease of admission
SME Support Programmes	1	Enabling economic activity – diagnosis signposting, business improvement			✓✓✓	✓		✓✓	H
	2	Access to technical facilities or expertise	✓✓✓	✓			✓	✓	M
	3	Co-working and incubation space with start up support		✓✓✓			✓✓	M/L	H
	4	Business acceleration programmes		✓	✓✓		✓✓✓	M	M
	5	Corporate or strategic investor sponsored	✓✓	✓	✓	✓✓	✓✓	L	H
	6	Sector specific acceleration programmes	✓			✓✓✓	✓✓✓	L	H
Govt Funded Calls	7	Grant funded projects	✓✓	✓✓		✓	✓	M/L	M
	8	Sector specialist organisation	✓✓	✓			✓	M/L	M

Little provision	✓
Some provision	✓✓
Detailed / specialist level of support	✓✓✓

Table 3: A qualitative summary of the availability various types of innovation support and our view of how easy each is to access.

The results of this qualitative assessment are presented in Tables 3 and 4 below.

Tech & System D&D (1): Core tech RD&D	Tech & System D&D (2): System D&D	General business support	Commercial support (1) Growth strategy & business planning	Commercial support (2) Specialist domain capabilities	Networks & Sector centres
Energy	ERA (TEP-EIZ), SEND, [Trent Basin] [ERA: EBRI, EIC...]	Growth Hubs BGP2, Enterprise for Success, (start-ups) Innovate to Succeed, Access Interns, Higher Level Skills Match, Productivity through People, Made in the Midlands, Mentoring for Growth, CW Scale-up Network, WINN & Investing in GrowthPattLabs, International Business Hub, TRAN-SIP etc	Climate-KIC, NatWest Acc, SET2 Scale-up Digital & Ind.4.0: Innovation Birmingham: Serendip, Eagle, Entrepreneurs for the Future EU: FastTrack to Innovation, InnoEnergy, EIC Accelerator (SME instrument)	[EDF Blue Labs, EoN Agile, Innogy, Engie Innovation] [APC-TDAP] WMG-SME Group, MTC-REACH, ESC ISP BECCI, [PiLabs, Innovation Gateway]	Sustainability West Midlands, Innovation Alliance Drive Midlands, CAV Hub, ZENZIC, MDI, Smart City M-Centre CEM,CITB, Springfield CIH:MTC/BRE /CDBB, [ABC, I3P, UKGBC] (IEEA)
Mobility	UKBIC WMG-EIC e.g. AMTECC, AMCASH, CASIM, S21 [A4i]	CIH (MTC), Springfield? Centre for DB	Bizzinn (MICRA), Steam House, Innovation Birmingham	[APC-TDAP]	Drive Midlands, CAV Hub, ZENZIC, MDI, Smart City M-Centre
Construction / Housing	CIH (MTC), Centre for DB	EntRESS, LC SMEs, BEEP, BEST			
Energy Intensive Industry	ATETA, ARLI, BASIS	ERA [EIZ]			

Table 4: Relative density of West Midlands funded support programmes for energy-related SMEs by sector.

Notes:

Technology and System Development and Demonstration Support:

Type 1: Core tech RD&D includes: components, lab-testing, engineering demonstrators (up to TRL5).

Type 2: System D&D includes: System-level and operational tests, user trials, commercial pilots (TRL6-8).

Commercial Support:

Type 1: Support to develop key growth strategies, including: market analysis, customer segmentation, routes to market and business models, validating a customer value proposition;

Type 2: Similar to Type 1 but, also provides access to specialist market domain expertise and capabilities relating to sector/user needs, supply chain economics, sector transformation, emerging business models, market arrangements, regulations, standards etc.

The Local Industrial Strategy suggests more SME support may be needed to achieve growth sector targets.

A close read of Tables 3 and 4 suggests the following conclusions:

Columns 1 and 2 – Technology systems development and demonstration

Technology development and demonstration relies largely on national public funded grant programmes and initiatives.

There are many programmes that can help SMEs, and other businesses, access third party facilities and expertise, usually within universities, catapults and research institutes. These programmes fall within Category 2. Most are funded by STFC and ERDF and match funded by universities. There are fewer identified SME support programmes that focus on finding proceeding opportunities for technology demonstration with industry, although TDAP, IEAA and ESC's Living Lab are exceptions. For funding R&D and demonstration projects SME energy-innovators rely mainly on calls from Innovate UK and BEIS.

Technology funding supports technical progress, not commercialisation

When grant funds are made available to support technology development or demonstration, the focus is on improving the technology. This may, or may not, lead to commercial opportunities for the SME, but this is not the main objective of these programmes. Few programmes or organisations ask searching *business and market* questions of their SME clients first, before going on to assess the technology. The MTC and APC are notable exceptions in the transport manufacturing sector.

Column 3 General business support

General business support for start-ups, and improving business functions, appear relatively well provided for in the West Midlands. The Local Industrial Strategy suggests more SME support may be needed to achieve growth sector targets. The challenge here for SMEs is the difficulty of identifying relevant programmes and securing grant funding.

These areas of support are generally provided by programmes in Categories 1 and 3 (see Table 3).

Both types of programmes are easily accessible to start-ups and SMEs and, in most cases, are provided free. Because these programmes are sector agnostic, they are equally accessible to energy innovators and all SMEs across the focus sectors.

Many of these programmes are delivered by West Midlands' universities and some by teams put in place by the LEPs or local authorities. Most are funded partly or fully by the European Regional Development Fund or other EU sources. While funding is guaranteed for a certain period after Brexit, its future is uncertain thereafter. Some regional business support programmes are closing in 2019 and do not yet have further funding (e.g. Black Country Skills Factory Bite Sized Courses). Others such as EBRI's SME support programme have an offer of ERDF funding for 2019-2022.

BEIS has not yet decided how some of the ISCF funding streams, such as Transforming Foundation Industries and Driving the Electric Revolution, will be allocated. So, it is hard to know the extent, to which this funding might support SMEs in future.

Column 4 and 5 Commercial support

There is a real shortage of specialised commercial support (Type 2) in the sector programmes and initiatives reviewed.

Type 1 commercial support is generally accessible in the region through the wide range of stand-alone business support programmes (Category 1). SMEs can find out about these through the Business Hubs and Innovation West Midlands. Type 1 business support is also available for eligible SMEs through the Acceleration programmes provided at the physical incubation spaces, such as, Innovation Birmingham and Bizz Inn.

Type 2 commercial support is provided largely by corporate strategic investor and sector specialist SME support programmes. Corporate programmes are rare, highly selective and not accessible by the majority of SMEs. Sector SME support is variable across the focus sectors.

In energy, Energy Systems Catapult ISP ATETA (thermal), EBRI SME support (bioenergy) are programmes focused on energy innovation that can provide commercial support with sector expertise to SMEs who meet their admission requirements.

In housing, we rank BECCI as a sector specialist programme for energy-related technologies for buildings, but it is unclear what level of Type 2 commercial support it provides.

In transport, the Advanced Propulsion Centre's Technology Development Accelerator Programme provides detailed commercial support across both Type 1 and Type 2. But, it follows a set template (phases 1 and 2 clarify business proposition and test requirements, phase 3 supports work on prototypes). This could limit its ability to provide bespoke support for an SME.

In EIIIs, we have found no strategic investor or sector specialist programmes to support SME-innovators.



D4E: An energy innovation platform for the West Midlands

Alignment

Nor, it seems, is there much co-ordination of programmes across or even within the four Focus sectors. There is little sense that individual initiatives dovetail to achieve an overarching goal.

The transport landscape seems the best co-ordinated. Here, complementary programmes and organisations address different areas of need and collaborate to drive innovation, including participation from SMEs.

The energy technology sector, by contrast, is well served with grants for R&D. But, it has few sector-specific programmes to support SMEs in business growth and most of those are corporate and highly selective.

The housing/construction sector, and the EIIs, have few if any programmes providing business and incubation support for SME-innovators.

Gaps

To summarise, our research suggests the biggest gaps are in:

- > commercial support services, particularly Type 2 (column 5). Services include helping SME businesses validate their market and focus on growth strategies earlier, and system-level trials, helping them expand into new sectors.
- > facilities to support system-level testing and operational trials with real users, particularly in energy services, housing/construction and EII. Transport is currently better endowed with system-level test-beds.
- > digitalisation: we failed to find a single open, physical incubator that focuses on digitalisation for energy innovation.

Since the energy transition, increasingly, demands innovation across traditional system and sector boundaries (Chapter 1), these gaps are highly significant. If we fail to fill them, it could stymie both emissions reduction targets and the aims of the Industrial Strategy. As we noted in Chapter 1, support for innovation in the US is already far more extensive and co-ordinated than here. It is also moving quickly towards supporting innovation in whole-energy-systems rather than individual technologies, through programmes such as New York's Reforming the Energy Vision (NYREV). The same is true in France with its Station F and Australia in its Energy Lab. If we are to ride the energy transition to reduce emissions and boost growth, we will need to do the same, and that means overhauling our support for energy-related innovation.

Chapter 4: Filling the gaps

Having analysed the market landscape for gaps in support for energy innovation, the next phase of the work was to devise a series of 'value propositions', or services, to fill them.



Filling the gaps

First we needed to refine our understanding of the gaps we had identified, through structured interviews with SMEs and other stakeholders (mainly providers of innovation support). The SME interviews provided a detailed picture of the incubation support services they had, or had not, accessed. We learnt of services they felt they needed and their likely impacts. The stakeholder interviews gave us additional insights into the support services available currently and potential gaps.

We presented the results of these interviews, and the market landscape report (Chapter 2), at a day-long workshop to brainstorm ideas for new services. Analysts at Energy Systems Catapult then developed these ideas into six customer value propositions.

Finally, we tested reaction to these proposals in a survey of a third group of SME energy innovators. As a result, we have developed six services for energy innovators that no existing platform provides. We believe these services fill the most important gaps. Each of the services were supported strongly by the SMEs we surveyed, four of them scoring at least 80% agreement.

Summary from the research findings

Some opinions, and concerns, were widely shared by many interviewees. Among the SMEs, the recurring themes were:

- > **Public sources of funding** – central here, was the time needed to evaluate different funding organisations, the uncertainty of success, and the difficulty of making the SME's technology fit the funding call criteria
- > **Funding comes in tranches** – which means there is a pause between each stage, where innovators lose time, money and momentum
- > **Available services** – A wide variety of services are available. But, there is inadequate information and no single point of co-ordination
- > **Sourcing relevant advice** – There is limited market specific mentoring services and no single agency supporting all stages of an SME's development e.g. diagnosing needs, providing or helping to access relevant support, checking the support was effective, and which helped the company not just the technology
- > **Finding their first customers** – They mentioned, particularly, the time required to develop business models and deliver strategy was also a concern
- > **Hampering progress** – stakeholders and SMEs agreed that the following services were either not available or in limited supply:
 - Testing facilities – proof of concept and early demonstration
 - Regulator advice
 - Market specific commercialisation skills
- > **Loneliness** – the degree of isolation from other innovators or support organisations impacted on take up of available services

Of all the points raised, we think that three are particularly important: early consideration of commercial issues; funding coming in tranches; and the lack of 'wrap-around' care and 'signposting'.

Taken together, these suggest there are barriers between each of the various stages of innovation. These hold energy innovators back (Figure 5). With better understanding of these issues, and help to overcome them, SMEs could bring new energy products and services to market quicker (Figure 6).

Innovation is hard, particularly the process, to and from, each stage in the company and the product development stage. The barriers a company faces as innovation moves from one stage of the innovation process to the next are well known. They extend development time and lessen impact.

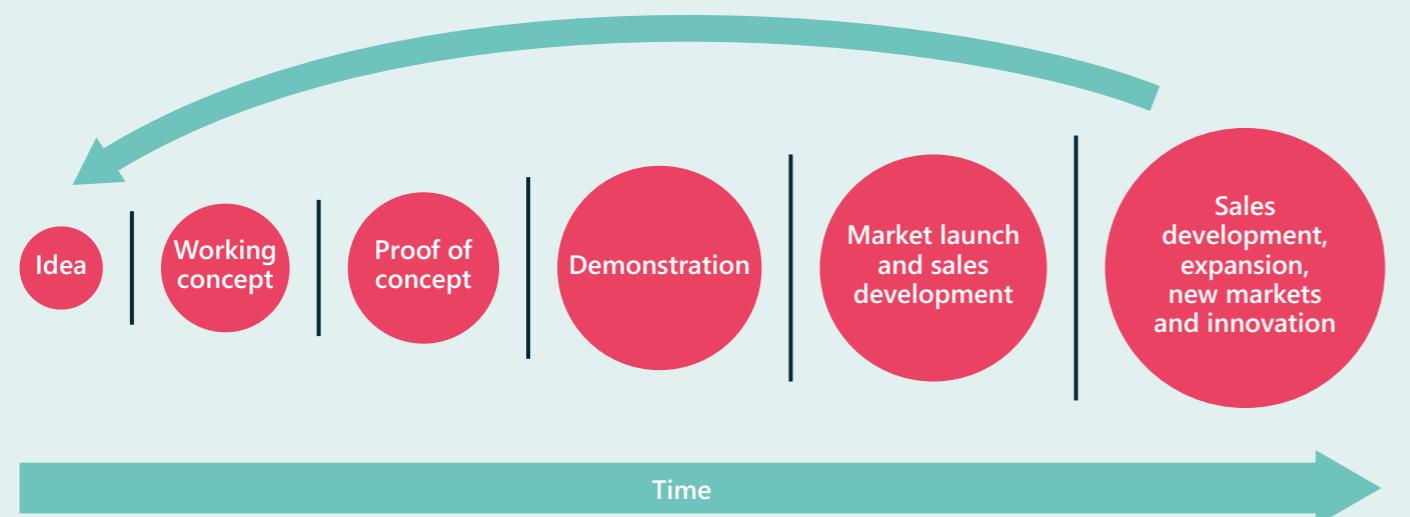


Figure 5: Innovation phases.

Innovation is hard, help to manage transitioning its phases quickens the journey



Figure 6: Aligned innovation brings new products and services to market faster.

Detailed Research Findings

A wide variety of services exist to support energy innovators, but innovators are largely unaware of them, or find them hard to navigate.

Our research shows that many SMEs are simply unaware of the range of support services available to them currently. One workshop member said:

"I never knew there were all these programmes available and I've been on the circuit for the past five years"

Among interviewees who were aware of the services available, a consistent theme was the difficulty of finding the right organisation and services to support their specific energy innovation, business need and stage of development:

"Experience has taught us that the likelihood of success in applying for public funding is low and that, when rejected, we get very little constructive feedback; therefore, we don't pursue public funded support routes anymore"

"As an experienced entrepreneur, I appreciate the value of my time and now only go to very targeted conferences to network"

Lack of "signposting" to available services is a significant issue.

Stakeholders and SMEs agreed that a major issue was the lack of a single, centralised source, of information about what services were available from which organisations – or "signposting". This was especially true for SMEs, who lack the resources to research and navigate the various public sector support agencies. One interviewee summed up:

"[The lack of signposting] all adds to the confusion. It must be very frustrating for people who want to get things done. The more we can all pull together and stop the silo-proliferation the better."

Broad agreement on the needs of SME energy innovators.

SMEs and stakeholders agreed broadly about the most important needs of SME energy innovators. We asked them to identify the top three priorities, which produced the following list:

- a. Funding requirements
 - i. Help with grant applications
 - ii. Advice on bid writing and consortium building
- b. Advice
 - i. Dependant on company life stage
 - ii. Mentoring
- c. Commercialisation
 - i. Partners
 - ii. Contact skills

On funding in particular, SMEs wanted:

- a. Help with writing grant application and filling in the paperwork
- b. Advice on bid writing and consortium building
- c. Help looking for partners
- d. Finding and accessing funding pots
- e. Easy access to advice on funding
- f. Attending focused meetings when exploring funding opportunities
- g. The facilitation of matched funding if required.

Some of the reasons SMEs need help with funding are illustrated by a sample of the problems they had encountered:

"The SMEs were wasting a lot of time by having to kiss a lot of frogs"

"I am not willing to give away my IP in exchange for funding"

"Bid applications are quite limiting as you have to mould yourself to the call which limits innovation from the outset"

In interview, stakeholders and the SMEs noted funding comes typically in tranches that theoretically match the TRL stages. This means there is a pause between each stage, where innovators lose time, money and momentum.

A smoother transition between stages and "follow-on funding" could mean that innovators completing one stage would proceed automatically to the next stage. This could save time and accelerate energy innovations to market and potentially give the West Midlands a competitive advantage.

Apart from funding, SMEs wanted advice. How interviewees defined "help and advice" depended heavily on their company's stage of development, previous experience and their area of innovation. Examples included:

- > How to access third-party testing facilities and where to find them
- > How to develop propositions for different types of customer
- > Manufacturing processes to increase production

As one interviewee said:

"I am having issues finding help to scale up my manufacturing capabilities and building processes"

Whereas, another mentioned:

"We approached seven grant writers and none of them knew anything about sector-specific funding sources."

SMEs welcomed advice from mentors, especially those who had "walked the walk", and those mentors with specific energy innovation experience. SMEs thought the most effective mentors were those who "rolled up their sleeves and mucked in".

Help with commercialisation was another major point, raised equally by SMEs and stakeholders:

"I need to transition from a project base to commercialisation"

"I didn't realise how much time and effort was needed to build a customer proposition and I'm not sure it's even right"

"I need to find customers and fast"

"We can only help up to a certain point, and helping commercialise an idea, isn't one of our areas"

There were also more specific needs around commercialisation. One company explained its sales lead-time was two years and needed further funding to cover its cash flow while the sales were "in progress".

Stakeholders believed if SMEs considered their customers, markets, business models and strategy earlier in their business development, there would be fewer business failures. Those who did fail would do so faster, saving time and money. Such a 'fail fast' culture would benefit energy innovation and the region.

Stakeholders mentioned, on several occasions, the term 'wrap-around' care. This could cover all the business functions – marketing, financial models, investor pitches, access to markets. It would provide a broader set of support services. The idea would "support the company and not just the innovation".

Unmet needs of SME energy innovators could hamper progress.

SMEs and stakeholders identified a series of needs not yet being met, including:

- a. Testing facilities – proof of concept and demonstration
- b. Intellectual property (IP)
- c. Regulatory advice
- d. Companies' obligations
- e. Specific commercialisation requirements
- f. General business mechanics

Any one of these factors could hamper an innovation or cause a small company to fail. This collection of gaps is likely to hamper energy innovation by SMEs in the region and nationally.

An SME's need for support depends on its degree of 'isolation'

This insight was based on the types and location of the SME respondents.

A range of companies of differing sizes, stages of development and exposure to innovation support services were selected to attend a workshop.

- > five using the Sustainable Ventures incubator (one of our partners in this study)
- > five who had used some form of innovation support other than Sustainable Ventures
- > five who thought they hadn't used a support mechanism

Although, this is a qualitative finding when comparing the interviews of the three groups, it was seen that good innovation support helps greatly. The more isolated the company, the harder innovation becomes (Figure 7). This insight resonated with the workshop.

Innovation is hard, it gets harder the more isolated you are.

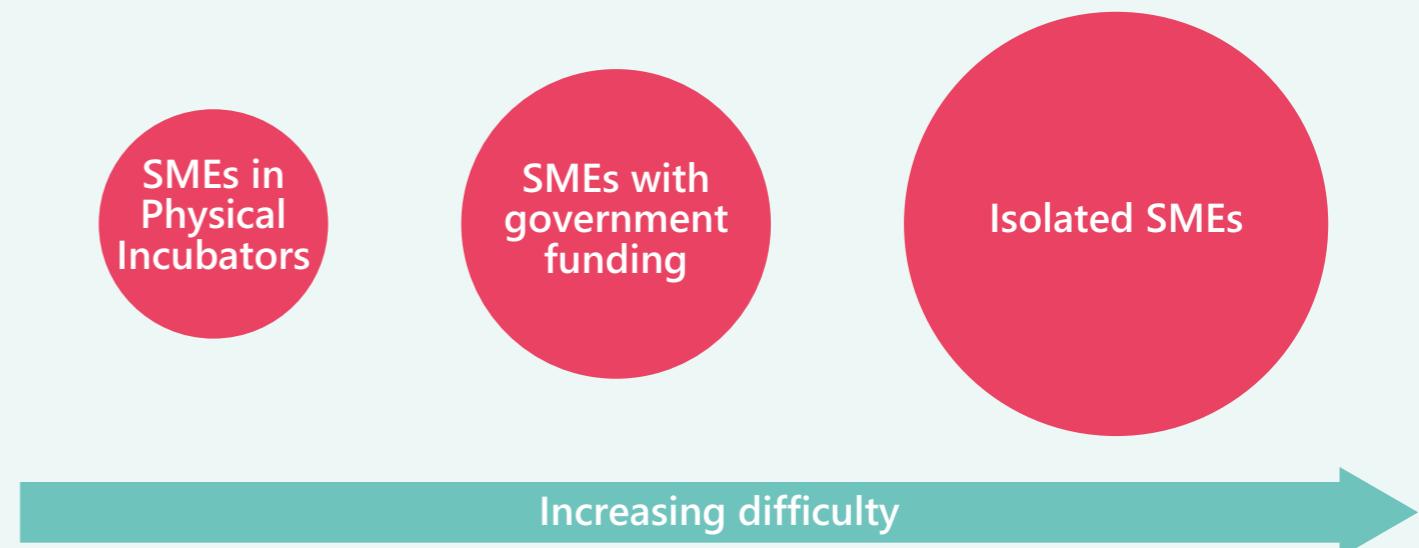


Figure 7: SME's with physical incubators support increasing likelihood of failure.

Workshop

We convened the workshop in September 2019 to discuss our findings with SMEs and stakeholders. We aimed to agree the gaps we had identified and devise new services to fill them. The organisations represented included 13 SMEs and nine stakeholders.²⁰

After the research findings had been presented and debated, the workshop conducted an exercise that produced an interesting result. Each attendee was given a card carrying a quote describing one of the SMEs that had been interviewed. They were asked to place it on a map of innovation support services to indicate what kind of help this company would need. The resulting pattern closely matched the gaps identified in the market landscape research (see Figure 8).

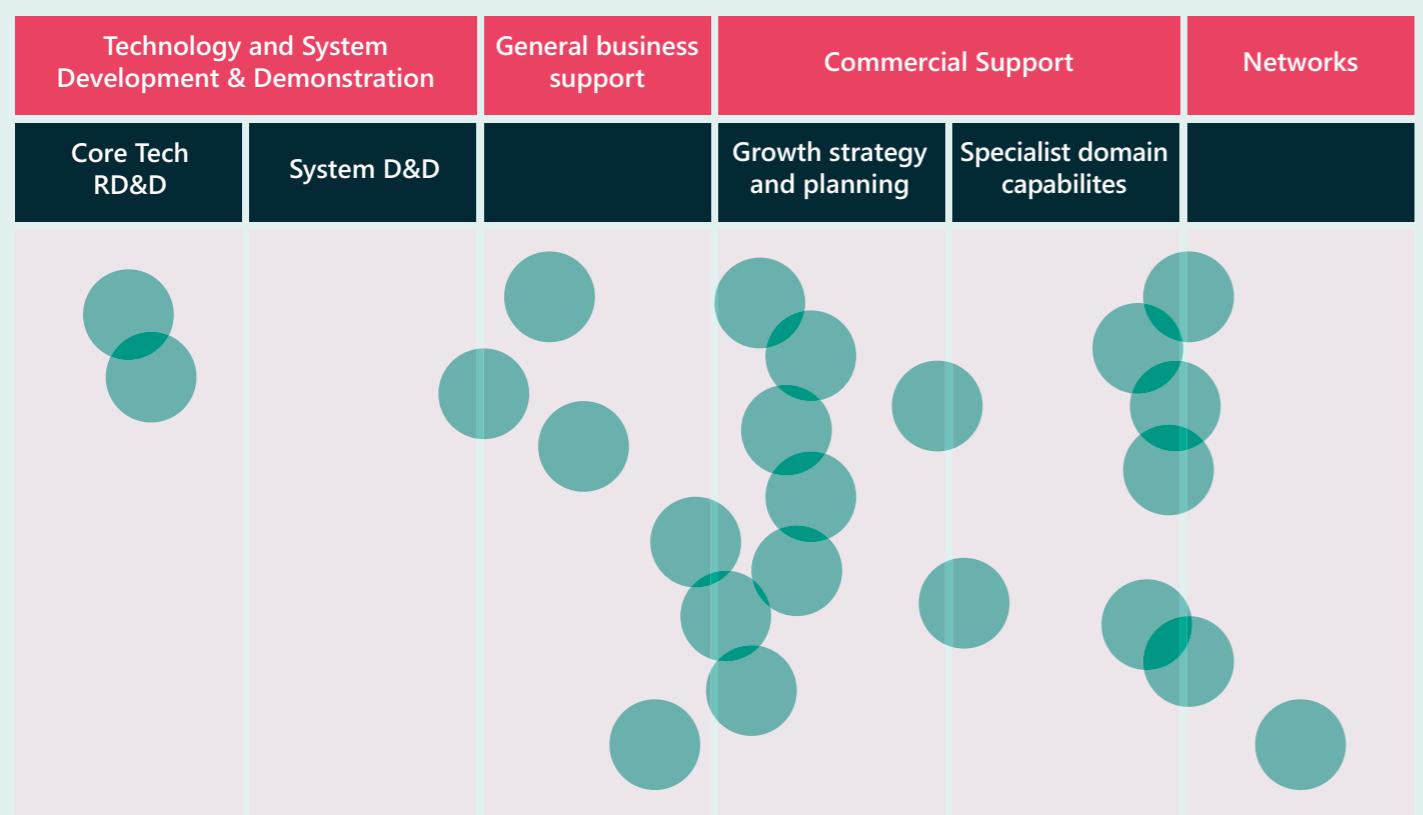


Figure 8: Landscape support categories – SME Needs.

The workshop then broke into smaller groups, which, working with the business canvas model, developed new services to fill the gaps identified by the study. We asked them to avoid duplicating any existing services available to energy innovators within the region. The working groups came up with twelve ideas, which were debated in full session and whittled down.

Proposed services

Following the workshop, analysts at Energy Systems Catapult refined the list to six services, delivered through a new organization with the working title 'Regional Innovation Platform for Energy' – now D4E. The services (and organization) are described in more detail in the next chapter, but briefly:

The Innovation Platform

From the landscaping survey, innovators face a bewildering array of possible (non-energy) business support services. The Platform will serve as a shop window. These will be delivered through which SMEs can identify and access suitable support services through a website and advice from expert innovation managers.

The energy innovation data library

Data is vital for innovation in energy services but, can be expensive for early stage companies. D4E will maintain a library of data for innovators to access free or at little cost. This would allow SMEs to carry out modelling and simulation and help overcome some of the cost barriers to initial product or service testing. By improving access to data and software tools, SMEs can quickly validate or adapt their idea before significant investment in demonstrations.

Energy markets, policy and regulation

The regulations covering UK energy markets are notoriously complicated. This service will guide innovators, companies and investors through the legislative complexities with a combination of masterclasses and consultancy.

Product development and validation

For companies with products in the early stages of development (TRL 3-6), innovation managers and a network of external technical experts can advise on proof of concept testing, design for manufacture, and supply chain planning.

Expert support for commercialisation

When a young company is ready to launch its product or service, a major cost – and risk – is the need to build marketing and sales teams. D4E's in-house teams will help the company develop marketing and sales strategies and securing its first customers without the burden of having to recruit its own full-time marketing team.

Funding readiness

Innovators often struggle to understand exactly what information investors need in order to make a funding decision. This service will help SMEs to identify and prepare for funding opportunities. Innovation managers will provide bespoke advice to help them prepare business and financial plans. D4E will organise themed networking events to introduce SMEs and investors.

The survey confirms the results of our market landscape and primary research which suggests there is a strong case for launching such services.

Survey: the SME reaction to our proposed services

Having developed these six service propositions, it was important to test the reaction to the value propositions among a different group of SMEs involved in energy-related innovation. We did this through an online survey distributed through organisations with SME membership lists.

The survey result shows the SMEs approved overwhelmingly of the proposed services (Table 5). Respondents were asked to score each proposal 0-100 depending on how much, or little, they liked it. The highest scoring proposals were product validation and the innovation platform. Both scored an average of 86%, and the lowest scoring was the commercialisation service, but even that gained the 75% average approval.

They were asked for their honest opinion on the propositions and asked to rate the idea on a scale of 0-100 how much they liked or didn't like the idea.

Value Proposition	Average Liked
The product development and validation service This idea provides an SME with access to a virtual hub of technical experts so that you can: develop products and services, design for manufacture, develop proof of concept testing and develop an IP strategy or pricing policy. It would also provide a validation service for manufacturing and supply chain services.	86
The innovation platform This idea is for a shop window in the form of a website of all the services available to SMEs on a regional basis. An added provision of an Innovation Manager will act as a guide to all the services and define the most appropriate road map for the business to take.	86
The energy innovation data library This idea is for a service that can provide real life energy data and software for modelling. This would mean SMEs could model how their product or service would interact within the energy system.	80
The energy eco-system service This idea provides Masterclasses for SMEs, corporate organisations and investors in energy regulations, industry standards and market understanding. This can provide the opportunity, across all active business and regulatory bodies within the energy market, to collaborate and provide information like due diligence reports.	80
The funding readiness service This idea provides a regular series of events exposing innovators to investors. This will build SMEs' skills and expertise to make them investable and commercialise innovative products and services at pace. The events will also help develop investor and innovator understanding of the energy market.	77
The rapid pre-revenue and commercialisation service This idea provides a business with short term marketing and sales capabilities, rather than having to recruit personnel into the business. This team can provide: landscape reports, sales leads and pitches, sales plan, cost planning, market engagement and customer needs mapping.	75

Table 5: Survey response to D4E service propositions.

Although the survey showed strong SME support for all the proposed services, this was validated through a further question regarding SMEs immediate requirements and any they might need in six months' time. This produced the lists in Table 6, all of which are covered by our proposed services.

Support activities required now	Support activities required in 6 months
Proof of concept	Proof of concept
Investor readiness	Regulations demonstration testing
Sales referrals	Route to market planning
Technical advice	Legal / IP advice
Grant / bid writing	Grant / bid writing
Customer testing	Commercial contracts advice
Legal / IP advice	= Investor readiness; sales referrals and recommendations; technical simulation modelling; investor readiness advice.
Technical / simulation modelling	
=Regulations demonstrations testing; market landscaping and route to market planning	

Table 6: SME specific support requirements.

The apparent urgent need for support may explain their enthusiastic response to the proposed services. Table 7 on the following page emphasises the need and value that a proposed Innovation Platform would bring to the market. Support for sharing space with fellow innovators and working collaboratively suggests services need to be delivered both physically and virtually. A service that introduces SMEs to investors was well received, a role for the proposed Funding Readiness service.

Statements	% agree with statement	% neutral with statement	% disagree with statement
I would like to know what support services are available to my business	71	17	12
I would like to collaborate with other innovators	70	13	17
A specific space for energy innovators would be useful	68	20	8
I would like to be in a shared space with other innovators	64	14	22
I would like introductions to corporate investors	57	18	26
I require energy specific expertise to progress my business	44	26	30
I can find/have found all the support I need for my business	42	25	29

Table 7: Needs of respondents' businesses.

Table 8 illustrates the relevance of the SME's participating in the research. The groups selected all fall into the target audience for the energy transition innovation. 79% were involved in decarbonisation of energy; 73% in decentralisation; 52% in "democratisation" (see Chapter 1); and 58% in digitalisation.

Business goals development	% agree with statement	% neutral/disagree with statement
My business goals have been developed around decarbonisation	79	21
My business goals have been developed around decentralising energy	73	27
My business goals have been developed around democratization of energy	52	48
My business goals have been developed around digitalisation of energy	58	42

Table 8: Respondents' business goals by energy theme.

Most of the SMEs participating in the research shared the same needs and challenges. The research identifies a common 'energy innovation language' needs to be developed to increase understanding between companies. This language will also increase consumer understanding.

Conclusions

Our proposed services have been developed with the help of SME energy innovators and other stakeholders. They are overwhelmingly supported by SME energy innovators whose needs they satisfy. The survey confirms the results of our market landscape and primary research, which suggests there is a strong case for launching such services. In the next chapter we explain the services in greater depth. We make the case for providing them through a new organisation, D4E – Digitalisation, Decentralisation, Democratisation, Decarbonisation for Energy.





Chapter 5: The D4E innovation platform

Our research has revealed significant gaps in support services accessible to SME energy innovators in the West Midlands and nationwide (Chapters 2 and 3). We have proposed a series of new services to fill them (Chapter 4). We also believe these services should be provided by a new organisation.

The D4E innovation platform

D4E will be Britain's first innovation platform designed to help solve the toughest problems of the energy transition and exploit its opportunities. It will do this by connecting innovators with investors, regulators, universities, local government and markets more effectively than ever before. It will help SMEs to innovate more efficiently – and to fail fast if need be – by filling the market gaps we have identified.

D4E would:

- > Create the country's first open innovation platform to focus exclusively on energy
- > Combine a physical and virtual campus to create a joined up regional platform for maximum impact and reach
- > Offer expert innovation and commercialisation services available nowhere else
- > Lever digitalisation as the entry point for system innovation. This itself is vital to decarbonise harder-to-reach sectors such as domestic heat.
- > Create a platform for energy innovators across the energy sector and the markets it serves

By helping SME energy innovators to innovate and grow faster, it will bring major economic benefits to the West Midlands through productivity, exports, growth and jobs. In short, we define D4E as:

"A platform to accelerate energy innovators through capturing the benefits of the energy transition"

D4E will operate as an innovation platform with a *physical hub and virtual spoke model*. It will provide expert services directly wherever it can add value, but also work with existing bodies such as the Manufacturing Technology Centre (MTC), Warwick Manufacturing Group (WMG), Birmingham and Aston Universities, Knowledge Transfer Networks (KTNs) or the High Value Manufacturing Catapult (HVMC), Energy Innovation Zones (EIZs) and other commercial partners. This approach should also allow D4E to grow quickly from regional to national reach.

This unique combination of skills, focus and structure makes D4E such a powerful proposal.

Why we need a new innovation platform

In principle, the proposed services we have developed could be provided through an existing body. But, for maximum impact we believe they must be delivered by a new organisation whose focus and approach will be distinct from anything that exists today.

D4E will take a three-pronged approach:

- > *Physical*, housed in a single building to maximise the benefits of clustering, mentoring and networking;
- > *Virtual*, to link existing regional and national innovation organisations and assets
- > *Services*, providing expert advice on energy commercialisation not available elsewhere

Unlike existing incubators and accelerators, D4E will offer innovators an end-to-end service. This means help at every stage of the journey from invention to full commercialisation. But it will place greatest emphasis on filling market gaps, by focusing on:

- > *Digitalisation*, which is driving the decentralisation and convergence of energy markets
- > *Data services*, which will help decarbonise the energy sector and provide evidence to support commercial demonstration of new products and services
- > *Energy commercialisation*, supporting large-scale commercial demonstrations of new products and services, and scaling-up to commercial production, with expertise not available elsewhere.

Some elements of the plan may look familiar: physical incubators are commonplace, for example, as are virtual accelerators. But, D4E will be wholly distinctive in several vital respects. It will be the only open (non-corporate) incubator:

- > to focus exclusively on energy
- > with deep extensive in the four D's for energy: digitalisation, decentralisation, democratisation and decarbonisation. The first of these is the key to with the first being the key to systems innovation
- > that offers end-to-end innovation support, from invention to commercialisation, either through in-house or outsourced services

It is this unique combination of skills, focus and structure that makes D4E such a powerful proposition.

The combination of physical and virtual is especially powerful. Our research shows that innovators find sharing workspace with like-minded but non-competing SMEs extremely useful. It helps them share and solve problems quickly. Analysis by BEIS suggests the value of sharing a physical workspace lies largely in these softer benefits: a sense of community and mutual support that helps build the confidence of entrepreneurs.²¹

At the same time, many of the proposed services can be provided virtually, that is, from partner organisations. Our proposed Innovation Window service (see services section below) is a good example. As our research shows, SME energy innovators find that one of the biggest barriers to getting the right help is finding out what's available, or even knowing where to start. The Innovation Window will solve that problem by providing an online database of all the available services and organisations. Innovators can filter and search these both regionally and nationally. This extends the reach of the service to the whole country and makes it more efficient and economic. It also helps avoid duplication between D4E and existing innovation organisations such MTC, WMG, KTN or HVMC.

D4E's powerful combination of physical presence and a virtual spoke approach is tailored to deliver a suite of services that fill the gap in existing provision. This makes it unique, supporting SME's from concept to commercialisation.

Another unique feature is the focus on digitalisation and commercial trials. D4E's mission is based on the insight that digitalisation is the key to systems innovation in energy. This in turn is vital to decarbonising domestic heating and other hard-to-reach applications. Digitalisation is one of the areas in which D4E will develop deep expertise in-house, since it is not currently available from any other innovation support organisation.

One of the biggest gaps we identified was in support for large scale, commercial trials of innovative products and services. This will be another defining aspect of D4E. The new organisation will be able to draw on virtual expertise within Energy Systems Catapult. Examples include the market research Consumer Insight Panel, or its Living Lab of 100 homes that have been wired to monitor trials of new products and services.

Governance and strategic direction, a key element of D4E, will come from its Strategic Advisory Board. This will be made up of local and regional authorities, LEPs, universities, funding agencies, commercial partners, service providers and manufacturers.

The Board will perform several important roles. First it will be the governance body of the incubator, setting its strategic direction. It will scan the horizon to identify emerging problems and opportunities that clean energy innovators need to tackle. It will set challenges for D4E and its clients. Second, it will form a coalition of like-minded stakeholders, that will lobby regional and national government and helps secure public and private funding. Lastly, each board member will also be expected to bring its their own resources to the project. Some might provide grant funding for facilities and equipment, others to fund individual projects. All will use their own networks to help D4E's SME clients find partners and sources of funding, bringing commercial muscle to energy innovation.

One of the biggest gaps we identified was a lack of support for large scale, commercial trials of innovative products and services. This will be another defining aspect of D4E.

Services

Our research has identified a series of gaps in support for SME energy innovators. D4E would fill them by providing the following services.

The Innovation Window

As shown in Chapter 2, energy innovators in the West Midlands face a bewildering array of possible support services. Many simply don't know how to find out about them, or even where to start. The Innovation Window will help SMEs identify and access suitable support services through a website and advice from expert innovation managers.

All services will be categorised so that SMEs can use the website to search for the specific support they need rapidly that is appropriate to their technology and stage of development. The output would be a list of business support services such as strategy advice, product development and operational productivity.

As well as the website, D4E's SME incubator clients will have access to an innovation manager to provide expert guidance. The aim of this additional service is to create a programme of individually tailored support for each company that progresses in line with its development. The innovation manager will be on hand to update the support roadmap, ensuring continuity as the needs of the business change.

Key features:

- > A directory of all services available to SMEs in the area and a website with simple user inputs that allows SMEs to filter and search those services easily.
- > An innovation manager to help develop a plan to support the SME's commercialisation journey.
- > A tool to create a business support roadmap, drawing on the directory of services.



The energy innovation data library

Data is vital for innovation in energy services but, can be expensive for early stage companies. D4E will maintain a library of data for innovators to access free or at little cost. This would allow SMEs to carry out modelling and simulation, helping overcome some of the cost barriers to initial product or service testing. By improving access to data and software tools, SMEs can quickly validate or adapt their idea quickly before significant investment in demonstrations.

D4E would train SMEs how to use the software and develop models to maximise the value from the data and software. Ad hoc support would also be available from software providers.

Key features:

- > Library of data and software for SMEs to search after registering for access.
- > Catalogued datasets that can be downloaded.
- > Software that can be downloaded and installed.
- > Training on how to use the software and modelling methodology.

Energy markets, policy and regulation

The regulations covering UK energy markets are notoriously complicated. This service will guide innovators, companies and investors through the legislative complexities with a combination of masterclasses and consultancy.

The service will offer masterclasses in energy regulations, industry standards and market trends. They will be open to SMEs, corporates and investors to improve their understanding of the energy system. In addition to the masterclasses, the service will provide bespoke advice to SMEs about the regulations and standards they will need to meet to enter the energy market, and provide to investors undertaking doing due diligence.

Key features:

- > Masterclasses for SMEs on, for example, energy regulations, government policy etc.
- > Market insight for investors about changing regulations and future trends.
- > Bespoke consultancy for SMEs on the impact of policy and regulation on their business.

Product development and validation

For companies with products in the early stages of development (TRL 3-6), D4E's innovation managers, and its network of technical experts, will help with product development and methods for proof of concept testing. Advice on design for manufacture and supply chain planning can also be facilitated through this network to support more advanced product development. The network will help SMEs reach regional and national virtual assets such as Energy Systems Catapult's Living Lab and DCC's digital sandbox.

In addition, a testing lab will be developed to support prototype level testing. Exposing the product to consumers will enable SMEs to rapidly iterate their technologies with real-world feedback before starting expensive design validation tests.

Key features:

- > Innovation manager on hand to guide the SME to the right expert to suit its needs
- > Network of technical experts with product development experience that can be called on to support SMEs
- > Network of product testing facilities
- > Bespoke lab for prototype early market product testing

Customer validation

Technically sound innovations often fail on first contact with the market. With this service, innovators can test their products and services on potential customers early in the development process. Innovation managers will help design the market research and commercial trials, drawing on D4E's virtual network, such as Energy Systems Catapult's Consumer Insight Panel or its Living Lab of 100 homes.

The Consumer Insight Panel can provide either a quick gauge of consumer reaction to a proposed product or service or be used to conduct qualitative research to probe more deeply.

For SMEs with a product or service that is ready to trial, the research team will help design the demonstration and provide advice on recruiting participants.

Key features:

- > Customer research team to help SMEs design and conduct research
- > Consumer panel for surveys and interviews
- > Customer research team to support design and conduct trials
- > Access to virtual networks for residential trials

Commercialisation

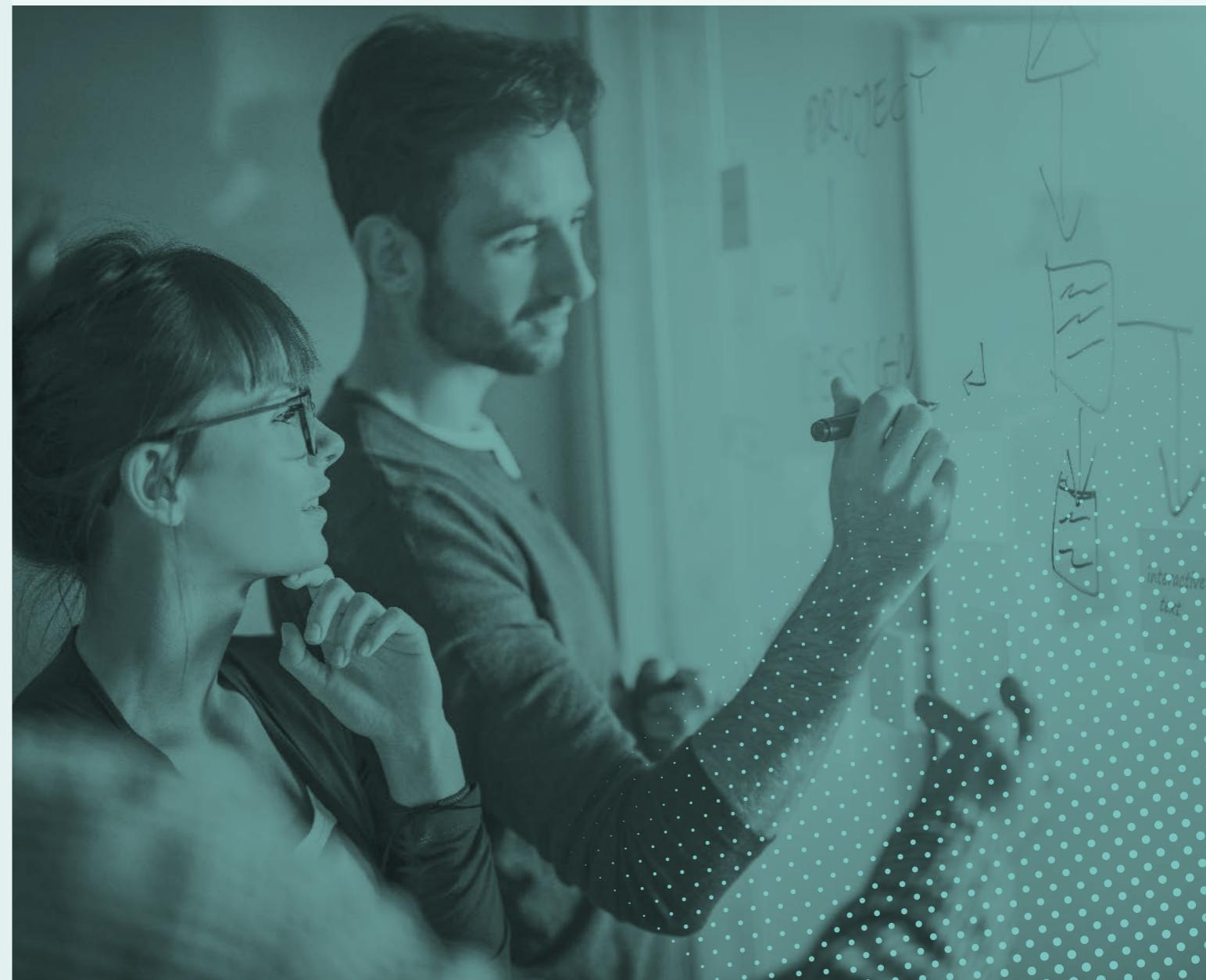
When a young company is ready to launch its product or service, a major cost and risk, is the need to build marketing and sales teams. D4E's in-house teams will help the SME develop marketing and sales strategies and secure its first customers without the burden of having to recruit its own full-time marketing team.

SMEs will have ad hoc access to an experienced sales and marketing team to help it create a marketing and sales strategy. This service will go beyond providing advice and deliver marketing materials for the business, putting the strategy into action.

The sales team will also support an SME by providing: landscape reports; sales plans; cost planning; market engagement and mapping of customer needs. It will also help generate qualified sales leads and support the SME in developing pitches appropriate to the company's stage of commercial development.

Key features:

- > A D4E innovation manager will help develop a commercialisation strategy suited to an SME's needs
- > An experienced marketing team to help present the brand to market
- > An experienced sales team will help identify key markets and techniques to improve sales conversion



Funding readiness

Innovators often struggle to understand exactly what information investors need in order to make a decision. This service will help SMEs to identify and prepare for funding opportunities. Innovation managers will provide bespoke advice to help them prepare business and financial plans. And D4E will also organise themed networking events to introduce SMEs and investors.

This service will help SMEs prepare for investment and provide advice on how they can commercialise quickly. SMEs can choose to receive support through a series of events giving high-level advice or through bespoke consultancy on how to prepare their business for investors. The D4E innovation manager will help identify suitable funding sources and prepare materials, such as financial and business plans, to access those funding routes.

Networking events to bring investors and SMEs together will also include themed seminars on trends and opportunities in the energy system, designed for specific groups of SMEs and investors.

Key features:

- > Innovation manager to provide bespoke advice to SMEs, which will identify funding needs and sources and help develop materials for investors including financial and business plans
- > D4E team to recruit investors and SMEs to events
- > Energy system experts to provide seminars at investment networking events

Business model

D4E is intended to be “*A platform to accelerate energy innovators through capturing the benefits of the energy transition*”. The platform consists of three core elements: physical, virtual and services.

D4E’s physical presence would comprise a former industrial building refurbished to give it a campus feel. It will house a range of product development and demonstration assets. The facility would be scalable but, modestly sized to start with, meaning it could open in December 2021 and maximise capital spending on innovation services.

Those services would be provided by a dedicated team of innovation managers and other professionals. They would help energy entrepreneurs commercialise their innovations through D4E’s in-house services, while also drawing on the region’s virtual resources. D4E would couch these services in a campus-style learning environment and culture, allowing innovators to develop their products and services as quickly as they are able. This will facilitate the free flow of information and feedback.

The governance of the innovation platform would come from the Strategic Advisory Board comprising government, industrial partners and funding bodies. Its role is to guide development of both the incubator and its clients, the SME energy innovators, to help them grow to commercial scale quickly.

Because D4E needs both a virtual and a physical presence, its biggest costs will include a building and equipment, expert staff, data and an online platform. Launch costs would be supported, in the first instance, from a combination of grants, corporate sponsorship and innovation grant funding. Financial contributions from SMEs will provide additional revenue as we provide services and facilities. Innovation development funding will be sought post launch.

Revenue Streams	Cost Structure
One-off <ul style="list-style-type: none"> > Public grant to help with D4E establishment > Combined R&D support for energy innovator projects 	One-off <ul style="list-style-type: none"> > Building fit-out > Software development: <ul style="list-style-type: none"> – Website – Online roadmap tool – CRM for workflow management through roadmap – Database
Recurring <ul style="list-style-type: none"> > Rent from energy innovators using the workspace > Corporate membership programme to sponsor energy innovation > Corporate sponsorship for challenge calls, either directly to specific groups of energy innovators or more general calls, a % of which would cover the facilities' overhead > Government grant to D4E to support the administration of the programme > Energy innovators purchasing D4E services > D4E acting as a partner to an innovation programme > Private sector revenue from organisations looking for consultancy support delivered by an energy innovator 	Recurring <ul style="list-style-type: none"> > Building maintenance and lease > Expert resource to deliver services > Data/software licenses

Table 9: D4E revenues and costs.

Financials

	Year 1 – 5 (Annually)				
	YR1	YR2	YR3	YR4	YR5
Grant Income	2,640	1,205	1,400	1,560	1,700
Expenditure					
Rent and rates	30	150	180	210	240
General, legal and administrative	55	130	140	150	160
Service delivery	225	275	350	400	450
Refurbishment costs	2,010	150	150	150	150
Employee costs	320	500	580	650	700

Table 10: D4E launch cost breakdown.

The provisional cost estimate to support D4E's launch phase is between of £8.5m to £9.5m broken down, as follows in Table 10.

Our research shows there are significant gaps in the available support for SME energy innovators currently.

Once we have a clear idea of a minimum number of likely SME clients, it becomes easier to control the costs and risks of the physical incubator by making it modular. The West Midlands has plenty of former industrial sites with buildings available to refurbish. D4E could initially lease and fit out a small building with facilities for approximately 20 SMEs. If the market develops as we expect, then D4E would take on extra buildings as demand rises.

Even were the D4E project not to progress beyond its initial phase, we would still know more than we did at the start. The knowledge gained would be arguably more valuable than that produced by a full-scale feasibility study, which would not come cheap and could never eliminate all uncertainties. In effect, a modular approach to D4E should be considered applied research.

For these reasons, we believe the next step should be to launch D4E as a scalable physical and virtual incubator in 2020. This would be achieved as follows:

- > Phase 1 – Business plan delivery, including commercial revenue, facility development and finance plans to be completed in Q1 2021. This phase would also establish D4E's corporate structure and Strategic Advisory Board, with detailed agreements finalised in Q2 2021.
- > Phase 2 – The facility would be refurbished and its development and deployment assets installed by the end of Q3 2021.
- > Phase 3 – Design of D4E's virtual and in-house services would start in Q1 and those services would be operational in time for the launch in Q4 2021.
- > Phase 4 – D4E's marketing plan would start in Q2 to secure the launch cohort ready to join the innovation platform in Q4 2021.

The virtual aspect of the D4E business model is relatively low risk and costs can be kept in line with demand. For example, the interactive website needed to support the Innovation Window and Energy Innovation Data Library requires little more than software development and maintenance and data and software licenses. On the other hand, starting a physical incubator involves significant upfront costs, such as leasing and equipping a building. This could put the project at risk if demand failed to match the capacity that had been built. A key question, therefore, is the likely level of demand for D4E's physical incubator services in the West Midlands.

Our research shows there are significant gaps in the support available currently for SME energy innovators. We also know that our proposed services fill those gaps and are attractive to SME energy innovators. What is less certain is how many SME energy innovators exist in the West Midlands, and how much they might be prepared to pay for the services. We believe, however, that we can minimise these uncertainties and the associated risks.

While we cannot yet estimate the total population of SME energy innovators, it would be easier to confirm sufficient demand for a small-scale, but scalable, physical incubator. Our research has already identified a number of innovators that were looking for the kinds of facilities we propose. Some that were considering relocating from London to the West Midlands. We can also call upon potential partners such as Energy Systems Catapult's Innovator Support Platform (a virtual incubator-accelerator) and organisations such as Climate-KIC and the University of Birmingham, to help size the market and identify candidate SMEs. Founder members of D4E's Strategic Advisory Board would be chosen partly for their ability to help in this way.



Chapter 6: Recommendations

This study has identified significant market gaps in the support services available to SME energy innovators in the West Midlands and the country as a whole. It has devised a set of unique services to fill those gaps, which would greatly accelerate the energy transition, helping Britain reduce its emissions and achieve its industrial strategy. It has also designed the UK's first energy innovation platform to address the four D's and to focus on digitalisation, the key to unlocking innovation across the energy system boundaries. This turn vital to decarbonising harder-to-reach sectors such as domestic heat.

Recommendations

Our preferred option, therefore, is to launch the first phase of a modular, or scalable, incubator in which the start-up costs are kept to a minimum – we estimate in the region of £7.0-9.0 million.

As we explained in Chapter 5, D4E has two aspects, physical and virtual, both of which are intrinsic to its success. D4E needs to be physical, offering office and other workspace to SME energy innovators to maximise the impact of mentoring and networking. It must also be virtual, working through an online platform, to extend its geographical reach and collaborate with existing innovation bodies in the region such as MTC and EI2Zs. Since D4E needs a physical presence, start-up costs are significant, but also, we believe, scalable.

Having established a strong case for launching D4E, the conventional approach would be to conduct a detailed feasibility study. But this would take another year and would not come cheap. We also doubt that a feasibility study would meaningfully reduce the remaining uncertainties.

Alternatively, D4E could launch as a fully-fledged innovation campus, with enough capacity to service the West Midlands from the outset. But, this would obviously be risky given that we cannot yet be certain about the ultimate demand.

Our preferred option, therefore, is to launch the first phase of a modular, or scalable, incubator in which the start-up costs are kept to a minimum – we estimate in the region of £7.0-9.0 million. Since we can be more certain of attracting enough clients to support this first phase, the risks are lower. Given the urgency of the energy transition, and the undoubted importance of digitalisation, in all likelihood the organisation will need to expand quickly.

We recommend that WMCA and BEIS convene a meeting with likely stakeholders to discuss funding for the first stage of D4E and align its launch to support for the Covid-19 Green Recovery programme, which we believe should be supported by the Covid Green economic fund.

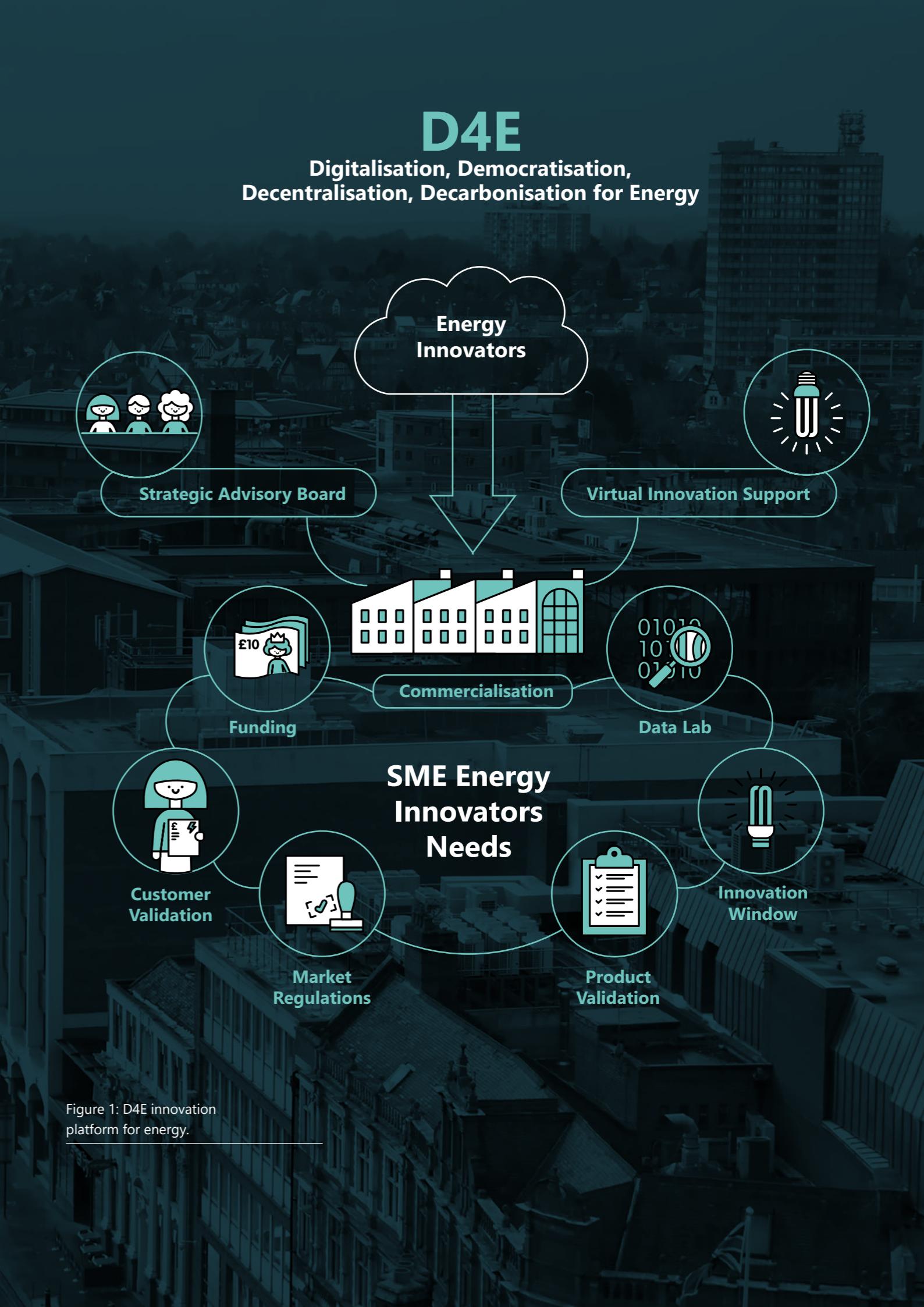


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