

NCDH

A NATIONAL CENTRE FOR
DECARBONISATION OF HEAT



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NATIONAL CENTRE FOR DECARBONISATION OF HEAT – CREATING WEST MIDLANDS LEADERSHIP IN THE NATIONAL HEATING TRANSITION

The decarbonisation of heat is *the* major energy challenge that the UK faces over the coming decades and for the West Midlands region, this presents a major opportunity. Britain has committed to achieving net-zero by 2050, but the climate crisis has a habit of imposing ever-tighter deadlines. It may turn out that we need to convert all of Britain's housing to low-carbon heating and high-spec insulation in 20 years or fewer. In any event, it is an enormous challenge.

It is recognised across the political divide that this is a national infrastructure programme that will draw in investment running to ~£500 billion. It will touch every citizen, every home and every region. It will be a programme which requires the regions to step-up. Converting 26 million homes to low-carbon heating systems is an enormous challenge – which is not simply technological. Like Covid-19, decarbonising domestic heat demands wartime mobilisation of manufacturing, supply chains and skills.

A national heat programme will be established over the coming decade to deploy a new range of ways of generating heat and to dramatically improve the thermal insulation of the UK housing stock. Simultaneously, a massive infrastructure upgrade will be required to ensure that the electricity grid and gas distribution network, at street-by-street level, are able to cope with the enhanced electricity load and the distribution of hydrogen.

This programme will require a dramatic scaling up of manufacturing of heat pumps, new boiler designs and housing retrofit solutions, the skilled workforce to develop, design and install new heat systems and a new service industry to support the new heat infrastructure. Though an extraordinary challenge, it is also a very significant opportunity for developing a new industrial sector and in particular for a region with a skills and productivity deficit and potentially industrial sectors for which there may be reduced demand post-Covid.

The West Midlands is the hardest-hit region in England, in both health and economic terms, from the pandemic. A rise in unemployment triggered by the crisis is impacting vulnerable households disproportionately, exacerbating existing high levels of inequality. This is the exemplar of a UK region in need of investment to reduce inequalities. It is also home to some of the most deprived, fuel-poor communities whose homes are some of those which most urgently need to be made thermally efficient.

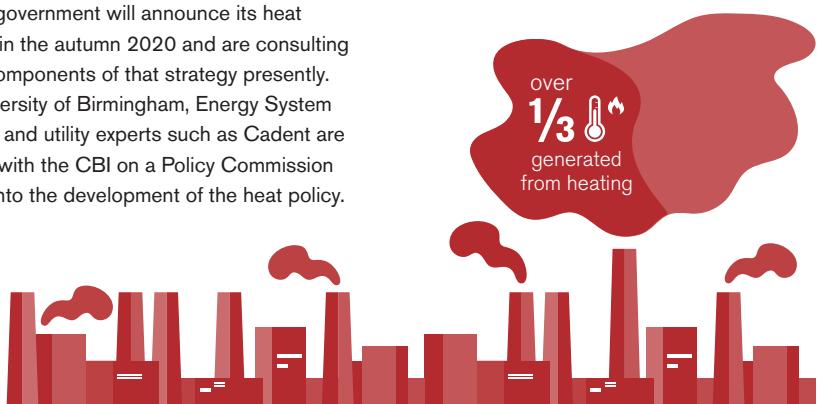
The scale of intervention mirrors that which happened in the Offshore Wind sector. This delivered a sectorial transition by recognising that a scale-up and cost reduction programme required the development of a programme that oversaw the definition of standards, the development of supply chains, co-ordination of planning, scaling of the manufacturing capability and working with business to allow them to transition into the sector. This has seen the UK become a world-leader for Offshore Wind and has driven economic growth in several regions. It is the exemplar that heat needs to follow.

The UK government will announce its heat strategy in the autumn 2020 and are consulting on the components of that strategy presently. The University of Birmingham, Energy System Catapult and utility experts such as Cadent are working with the CBI on a Policy Commission to feed into the development of the heat policy.

There is an opportunity for the West Midlands region to take a leading role in the development of this sector. It is home to a number of major companies (eg, Worcester-Bosch and Baxi), state-of-the-art manufacturing expertise through the Manufacturing Technology Centre, the Energy Systems Catapult, Energy Capital and a powerful network of Midlands universities through the Energy Research Accelerator.

To secure the regional leadership and drive the decarbonisation agenda, the Manufacturing Technology Centre, Energy Systems Catapult and the Energy Research Accelerator are advocating the development of a **National Centre for the Decarbonisation of Heat**, NCDH. This should be based in the West Midlands.

The NCDH aims to create new programmes designed to allow Britain to catch up quickly. Not by funding yet more R&D, but by clearing the industrial and commercial roadblocks to the rapid growth of promising technologies and business models. This, in turn, would create tens of thousands of skilled jobs.



The strategic direction for low-carbon heating – heat pumps, hydrogen, biomass, district heating – is not yet clear and will emerge through the national heat policy. But whichever technology, or mix of technologies, eventually predominates, all face the challenges of scaling up: manufacturing capacity, supply chains and a skilled workforce. These are the problems the NCDH will help to solve.

The NCDH will, therefore, include the elements:

- Manufacturing acceleration
- Skills academy
- Business incubator
- Building integration and living lab
- Standards and verification

The NCDH would be based at Tyseley Energy Park in Birmingham, located in the East Birmingham North Solihull corridor, which is identified through the East Birmingham Inclusive Growth Strategy and Power to the People, as a priority area for investing in fuel poverty communities. This part of the West Midlands location is an ideal test-bed as it is surrounded by large amounts of poorly insulated housing stock and high levels of fuel poverty.

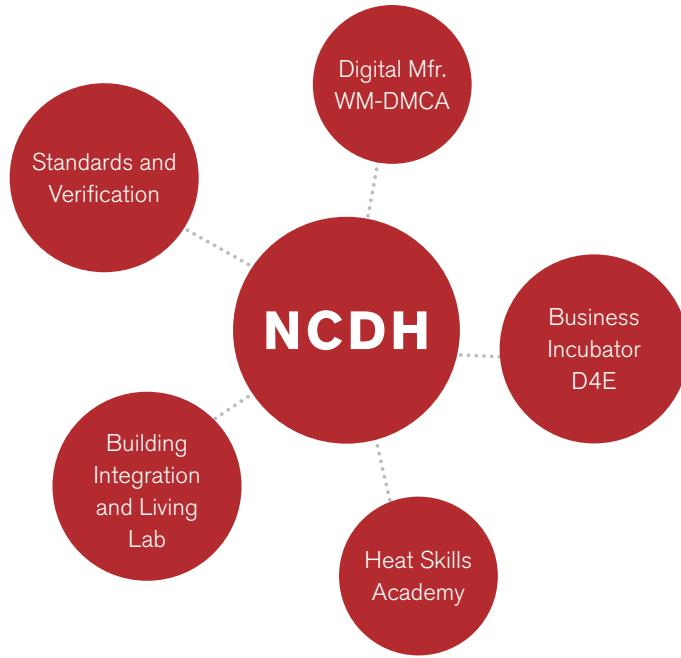
The five components of the NCDH are all essential ingredients of a joined-up heat deployment programme. They would be headquartered in a new facility at Tyseley Energy Park, but link regionally and nationally.

DIGITAL/SMART MANUFACTURING:

Decarbonising heat will mean retrofitting 26 million homes at a likely cost of ~£500 billion. This 'thermal transition' means we must both scale-up the manufacturing of existing low-carbon heat technologies, and develop designs and standards that allow next-generation technologies to integrate into the evolving energy systems.

One way to speed up the thermal transition is to standardise and automate wherever possible. This creates a huge opportunity for smart manufacturing techniques and rapid scale-up of manufacturing solutions.

- The Manufacturing Technology Centre and Energy Research Accelerator have developed a rapidly deployable, Industry 4.0, manufacturing process operated by robots and controlled remotely, making it possible to produce components efficiently and close to market. It has already been demonstrated through the flexible production of pipe assemblies, which are ubiquitous in heating systems. It has also been designed around thermal storage systems.



- The definition of integration standards and manufacturing standards is an area of expertise of the Manufacturing Technology Centre presently being deployed into the construction sector.
- The design of manufacturing processes that are linked to systems integration is a crucial component of delivering whole systems solutions for retrofit. One option being presently explored is providing a ready-to-install roof assembly, which has a fully integrated energy solution.

The **NCDH Manufacturing Accelerator** would work with the heat technologies manufacturing sector to support the rapid scale-up and fast deployment of heating solutions. It would embed regional expertise including the Manufacturing Technology Centre, the Energy Systems Catapult and the eight Midlands universities that make up the Energy Research Accelerator. It would work closely with the UK's Active Building Centre to help deliver the technologies it has developed.

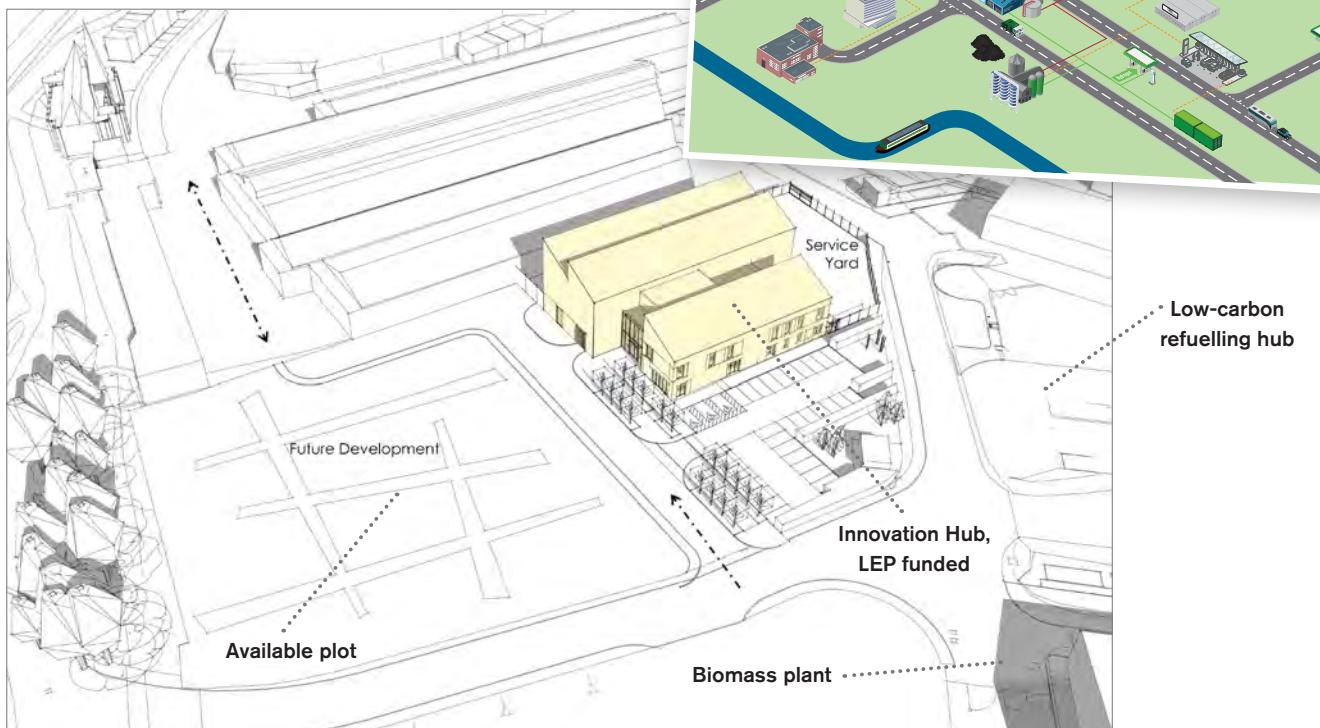
SKILLS:

Converting 26 million homes to low-carbon heat, the scaling up of manufacturing and the associated supply chains and the service industry that follows will require tens of thousands of newly skilled workers. As a benchmark, the existing workforce installs around 1.5 million gas boilers each year under business as usual. To decarbonise heat, boilers will have to be replaced by a wider range of novel technologies, and the replacement rate will need to accelerate dramatically. There is then the need for the development of the service sector to maintain the new 'boilers' and support the customers.

The **NCDH Heat Skills Academy** will help coordinate and train existing and new heating engineers in heat pumps, hydrogen boilers, smart system controls, digital platforms, building integration, energy efficiency, retrofit coordination and surveying, building performance assessment and monitoring. The Energy Systems Catapult is working with several partners including BEAMA and TrustMark to build on existing skills and training capabilities to support the new academy and the Manufacturing Technology Centre has a well-developed programme, and associated facilities, of apprenticeship training across a number of sectors.



Tyseley Energy Park



BUILDING INTEGRATION AND LIVING LAB:

Decarbonising heat will require far greater integration of energy systems – electricity, heat, storage, controls – than ever before. Many of these systems will be both digital and smart. Combined with the capital expense of some elements, such as heat pumps and whole-house retrofits, this means energy providers will have to develop new business models such as 'comfort as a service'. It will be important to compare a range of concepts and innovations to find the appropriate balance between opportunity and risk, considering the views of all relevant parties, and managing the inevitable conflict between them. This, in turn, means that decarbonising heat will depend on familiarising consumers with both new technologies and new commercial relationships. One high priority will be to nurture new services and business models that prioritise and protect those who are experiencing fuel poverty.

The NCDH Building Integration and Living Lab unit will build on the Energy Systems Catapult's expertise in systems integration, local area energy planning, and consumer and fuel poverty trials in real-world homes. This will provide capability to test and demonstrate energy innovations, market arrangements, policy and regulations with real consumers – as we move towards a Net Zero carbon future. It will also help address the challenges of retrofitting new products into existing building stock. The agile and scalable approach to building the unit lends itself to responding to

the dynamic nature of heat decarbonisation and future industry needs, and could potentially be part of a larger, more extensive, place-specific retrofit programme. This unit will also ensure new software, control systems, AI and machine learning are factored into other NCBH capabilities such as digital manufacturing, business incubation and standards.

BUSINESS INCUBATOR:

The role of the NCDH is not to support R&D but to help demonstrate prototypes get to market quickly. The **NCDH Business incubator** would do this by drawing on the Centre's system integration, skills and manufacturing expertise to help SME innovators bring their products and services to market in time to help achieve our climate targets. The incubator would build on the Energy Systems Catapult Innovator Support and International Platforms, which have already helped 25 SMEs commercialise over the past two years. Through the ERDF-funded business support programmes, the Energy Research Accelerator partnership is working with over a thousand regional energy SMEs, which can be funnelled into the business support and incubation programmes. Expanding this approach with the physical capabilities of the NCDH would ensure the UK captures the wider economic benefits domestically and internationally. To support businesses, the NCDH will house a team of business support specialists who can advise on market potential, systems integration, finance, IP protection, business models and mentoring. The Energy Systems Catapult will

shortly publish a feasibility study showing the need for a physical energy incubator in the UK, called D4E, and the benefits of locating it in the West Midlands.

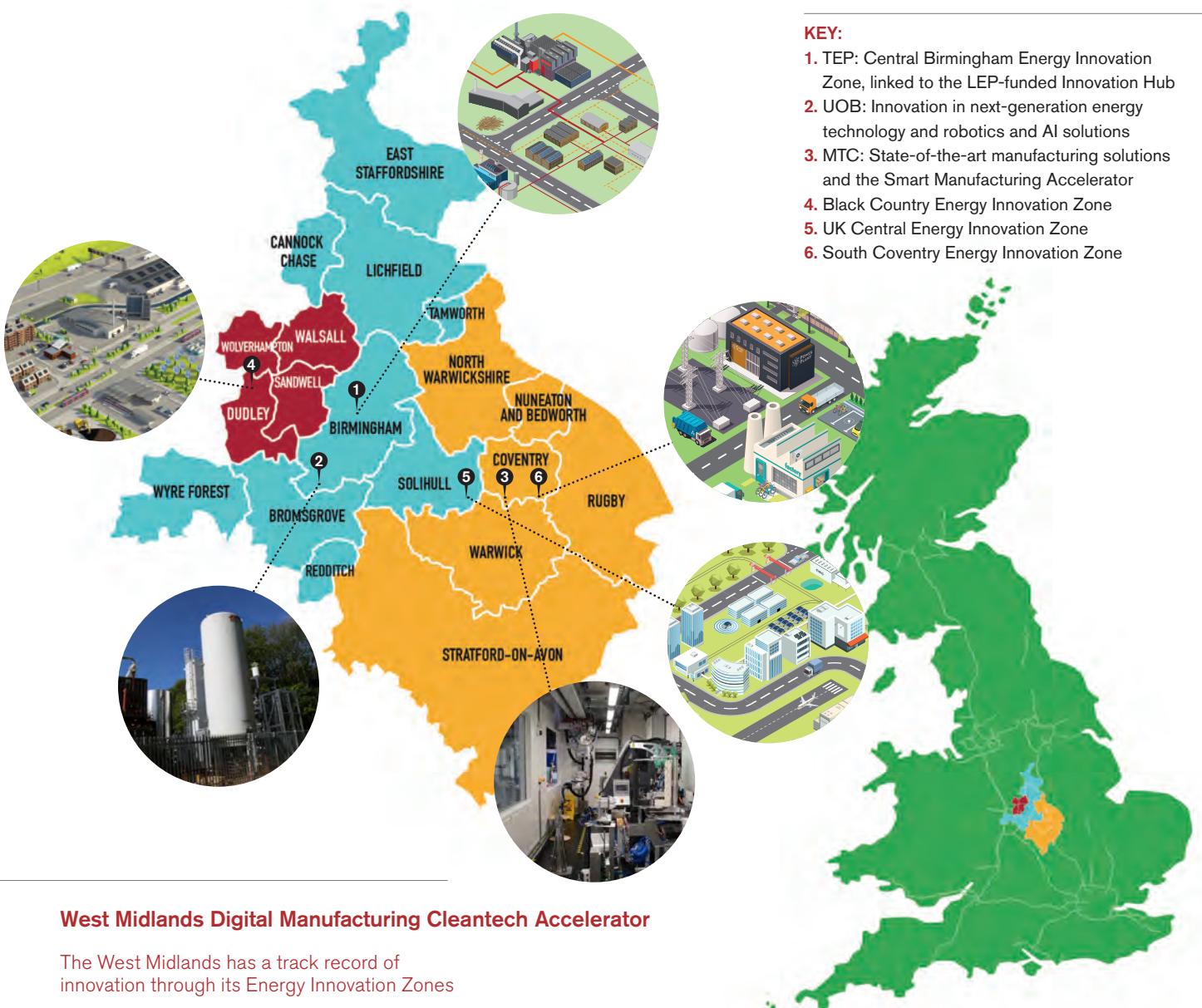
STANDARDS AND VERIFICATION:

The low-carbon heating market will soon need national standards to help it expand quickly. Here the NCDH can play a central role in coordinating standards organisations such as BSI, BEAMA and IEEE to develop the right standards and verification structures. The definition of not only the performance standards, but standardising interfaces between system components is crucial for ensuring greater market access and hence scale-up, but also that it is possible to bring new technological approaches into the deployed systems. The NCDH would work with the standards bodies and industry to help ensure the standards are defined, met and implemented. The NCDH will also provide a range of facilities which will be used to test and validate the efficiency and performance of new technologies.



One high priority will be to nurture new services and business models that prioritise and protect those who are experiencing fuel poverty.





West Midlands Digital Manufacturing Cleantech Accelerator

The West Midlands has a track record of innovation through its Energy Innovation Zones

WHY THE WEST MIDLANDS,

WHY TYSELEY?

- Clean energy focus: the West Midlands has the highest number of companies (10,000) providing low-carbon goods and services after London, with 56,000 people working in the energy and cleantech sectors. Some of the country's biggest and most important energy businesses are headquartered in the region, including manufacturers such as Baxi and Worcester Bosch, whose capacity will be vital for scaling up production of new heating technologies.
- Academic expertise: the Energy Research Accelerator, with eight universities across the Midlands, three of which are within the West Midlands (Aston, Birmingham and Warwick).
- National innovation assets including the Manufacturing Technology Centre and Energy Systems Catapult.
- Political backing of the West Midlands Combined Authority, expressed through Energy Capital, the Energy Innovation

Zones (EIZ) and the West Midlands Local Industrial Strategy.

- Need: Tyseley is surrounded by poor-quality housing stock and high levels of fuel poverty and provides an ideal location for piloting what needs to be achieved nationally.
- Tyseley Energy Park is within the Tyseley Environmental Enterprise District, which makes it an ideal location for businesses to co-locate.
- Momentum: Tyseley Energy Park has already been designated an EIZ, received £7 million investment from GBSLEP, built low-carbon energy assets, and plans to build an innovation hub to scale-up low-carbon energy products and services.

SCALE:

The NCDH would need to establish 5,000–10,000m² of space at Tyseley Energy Park to house its activities, including 1,000m² of incubation space and 1,000m² of training facilities and laboratories for systems integration testing, verification and validation. It will also

KEY:

1. TEP: Central Birmingham Energy Innovation Zone, linked to the LEP-funded Innovation Hub
2. UOB: Innovation in next-generation energy technology and robotics and AI solutions
3. MTC: State-of-the-art manufacturing solutions and the Smart Manufacturing Accelerator
4. Black Country Energy Innovation Zone
5. UK Central Energy Innovation Zone
6. South Coventry Energy Innovation Zone

establish a Living Lab in 100s of homes in nearby communities across the East Birmingham North Solihull Corridor.

We estimate the capital costs of the facility would cost £40 million in total, the programmes of activity is estimated to be a further £30 million over five years. Industrial partners in the region include Engie, CoGen, Orsted, ITM, WPD, Siemens, Webster and Horsfall. They have/are investing an estimated £0.4 billion associated with heat decarbonisation in the Central Birmingham Energy Innovation Zone (Tyseley Energy Park) where the NCDH will be based. Excluding the £0.5 billion industry component, the consortium brings over £35 million of leveraged regional funding. Longer-term, the National Centre for Decarbonisation of Heat would develop a sustainability model based on industry funding services and projects from the centre. Given the existential importance of the challenge, the return on this investment will be significant for the region.

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