Department for Business, Energy & Industrial Strategy

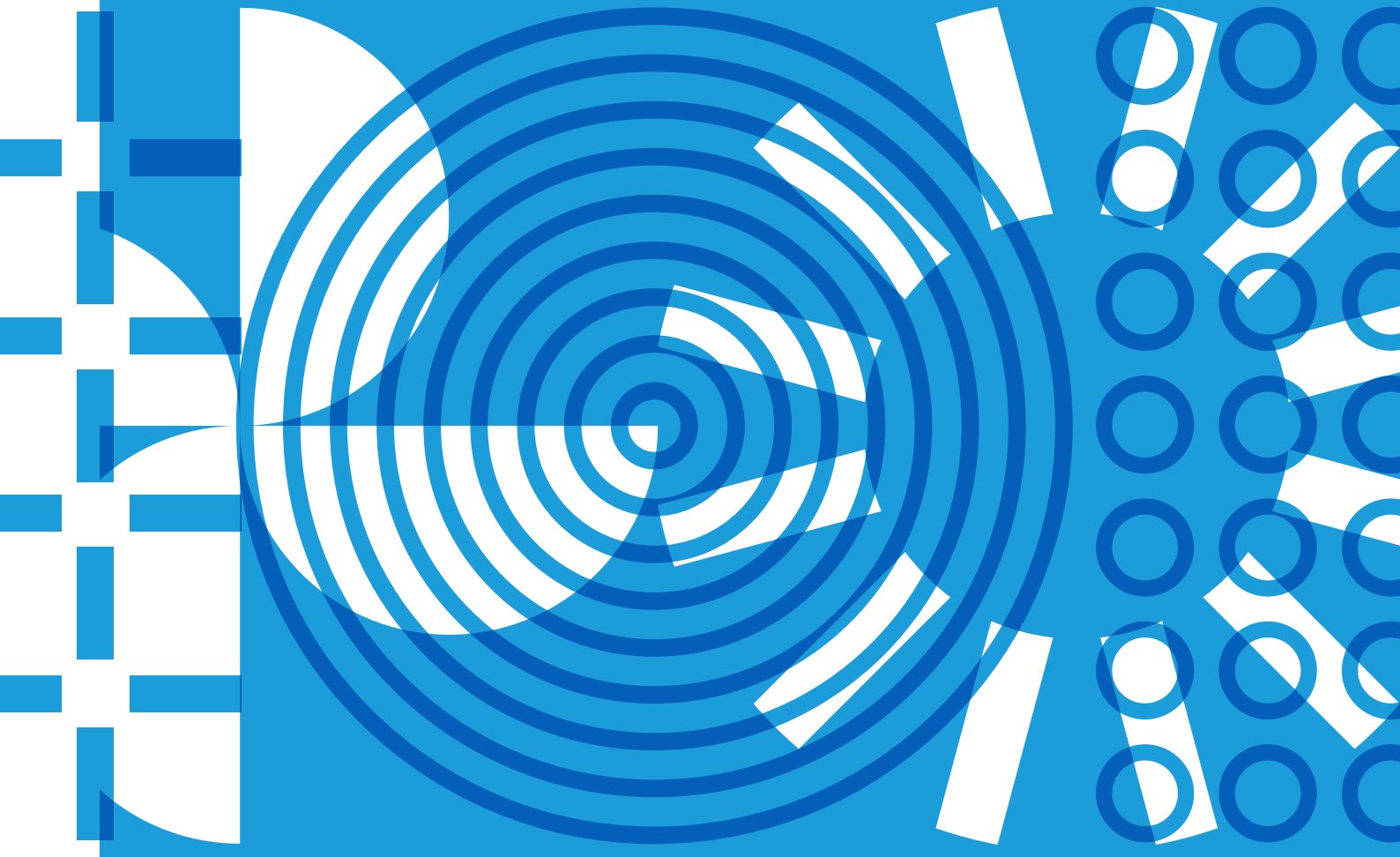
Cabinet Office

Government Property Function

CATAPULT Energy Systems

Modern Energy Partners Phase 2

Chapter 1: Introduction and programme delivery summary



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Foreword

Climate change is recognised by governments across the globe as an emergency which must be addressed, with far-reaching and irreversible implications for life on earth should immediate action not be taken.

In June 2019, the UK Government made a legally-binding commitment to reach net zero greenhouse gas (GHG) emissions by 2050. This commitment, combined with an interim ambition to halve direct emissions from the public sector by 2032, requires radical action now to decarbonise our buildings.

We know public sector estate accounts for 2% of all UK emissions, and overall, emissions from the built environment direct account for 34% of UK emissions. It is therefore essential that the public sector demonstrate leadership and drive down emissions by using credible and consistent approaches to decarbonise the public sector estate.

The Modern Energy Partners (MEP) programme, which was funded through BEIS's Energy Innovation Portfolio and co-sponsored by BEIS and Cabinet Office, is a clear example of this ambition.

Philip New CEO
Energy Systems Catapult

Over the last two years we have worked with some of the largest emitting government departments to develop a systematic and innovative integrated approach to decarbonising campus-style sites. Many people at sites and central offices around the country have supported the programme generously and we are very grateful for their contributions. These innovative tools and approaches can now be utilised, scaled up and applied more widely to the wider public sector estate.

The lessons learned, new ideas, and refined systems developed by the MEP programme are explained within this report. We hope this report is used to improve awareness and understanding of the opportunities and challenges which lie ahead on this journey.

We encourage Government to take the next step and exploit this learning — the successes and challenges we have encountered — and embed it across the public estate and the Property Profession. There is a great opportunity here for the public sector to lead the way and support the creation of new value chains, build new skills and support economic growth.

Meeting the commitments in the Clean Growth Strategy, the Ten-Point Plan for a green industrial revolution, and the 25-year Environmental Plan, require total focus on transforming the public estate. This report, the work of the MEP programme, is a major part of that drive.

I hope you find it useful.

Introduction

Modern Energy Partners (MEP) is a ground-breaking innovation programme undertaken in collaboration with selected government departments and the NHS. MEP aims to develop a scalable and replicable methodology for the decarbonisation of campus-style sites based on the experience gained from a testbed of 42 sites.

The Energy Systems Catapult, under contract for the Department for Business, Energy & Industrial Strategy, has produced this report and derived independent recommendations based on its experience of running the MEP programme.

Over the past two years, our findings have demonstrated that it is possible for the public estate to achieve at least 50% non-traded or direct [1] carbon emission reduction by 2032 against a 2017 baseline. The public sector estate accounts for 2% of all UK emissions [2], and overall, emissions from the built environment direct account for 3% [3] of UK emissions. Through cross-government collaboration, the practicalities of decarbonising public sector estates have been tested at four pathfinder sites to underpin the methodology, while recording observations and insights and developing a wealth of information.

This chapter is the first of five that examine different aspects of our key learnings. There is also an overarching executive summary that provides a concise overview of those key learnings.

[1] Non-traded or direct carbon emissions are from sources that are owned or controlled by the reporting entity and do not fall within the scope of the EU ETS

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/862887/2018_Final_greenhouse_gas_emissions_statistical_release.pdf

[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/957887/2019_Final_greenhouse_gas_emissions_statistical_release.pdf

The chapters are as follows:

Chapter 1
Introduction and programme delivery summary

Chapter 2
Decarbonisation delivery strategy

Chapter 3
Finance and funding

Chapter 4
Capacity and capability

Chapter 5
Public sector decarbonisation in practice

MEP at a glance

Innovation programme from BEIS

£12.4m

Months duration

24

Covering a test bed of 42 sites and over 294,000 tCO_2e carbon emissions

42 sites

Testing out implementation

- ✓ 3 pathfinder sites (Sheppey prison cluster, HMS Collingwood and Goole and District Hospital)
- ✓ 3 programmes of works under way or complete, match funded by BEIS and the participating organisation
- ✓ Over 9 GWh saved annually, over 2,400 tCO_2e saved in 2032 and £970k saved next year and then onwards

LEDs replaced at pathfinder sites

20,000

Controlled with BMS

177,000m²

Equating to the following public sector estate coverage

	NHS England*	MOJ	MOD
Sub-metering only	2%	4%	3%
Sub-metering plus concept design	4%	13%	5%
Total coverage	**6%**	**17%**	**8%**

* In addition to coverage of NHS in Scotland, Wales and Northern Ireland

Developing a consistent scalable approach to appraising net zero potential

- ✓ Systematic approach developed and refined through doing
- ✓ Tools, templates, and assumptions recorded building a repository of information

Getting better data

- ✓ Rapid deployment approach developed

Sites with consistent decarbonisation plans

24

Average emissions reduction by 2032

70%

At a total capital expenditure cost of £303.1m

£12.6m

Typical per site

Fiscal meters connected

442

Sub-meters installed

951

Meter data monitored each week

50GWh

Half hourly benchmarks developed on building use and activity

*One pathfinder was made up of three prisons in the Sheppey prison cluster.

Programme context

The Department for Business, Energy and Industrial Strategy (BEIS) Clean Growth Strategy [2] was published in 2017. It set out the Government's proposals for decarbonising all sectors of the UK economy in line with legally binding carbon budgets. It had a particular focus on the 2020s, and the fifth Carbon Budget (set in 2019, covering the period 2028—2032).

The strategy included an ambition for the public sector to reduce direct emissions by 50%, against a 2017 baseline, by 2032. This reflects that the public sector is responsible for around 2% of total UK emissions [3] and must reduce these emissions to enable us to deliver our climate targets and show leadership to the wider economy.

Since 2017, the UK's commitment to tackling climate change has been strengthened further. In June 2019, the UK became the first major economy to pass laws requiring all of its greenhouse gas emissions to be brought to net zero by 2050. In April 2021, the level of the 6th Carbon Budget was set, committing the UK to reducing emissions even faster on its pathway to 2050 and achieving by 2035 a 78% [4] emissions reduction compared to 1990 levels.

Last year saw the publication of many key strategy documents. The Ten Point Plan [5] and the Energy White Paper [6] reaffirmed the Government's commitment to net zero.

Delivering net zero in the public sector, including a 50% reduction in direct emissions by 2032, requires a step-change in the level of adoption. Recognising this, the MEP programme was devised by BEIS, in collaboration with other departments, to test how this step-change could be achieved.

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf
[3] Final UK greenhouse gas emissions national statistics:1990 to 2019
[4] https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035#:~:text=change%20and%20energy-,UK%20enshrines%20new%20target%20in%20law,emissions%20by%2078%25%20by%202035&text=The%20UK's%20sixth%20Carbon%20Budget,to%20net%20zero%20by%202050
[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOOKLET.pdf
[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf

In more detail: what is MEP?

MEP is a ground-breaking collaboration across selected government departments and the NHS. It is an innovation programme that aims to develop a scalable and replicable method to decarbonise campus-style sites.

Over the past two years, it has been demonstrated that it is possible for the public estate to achieve at least 50% non–traded or direct carbon emission reduction by 2032 against a 2017 baseline in line with the fifth Carbon Budget.

In summary, it has focused on two themes looking to identify:

- An effective practical methodology to form the basis of a scalable and consistent approach; and
- Insights into practical delivery through deployment at testbed sites.

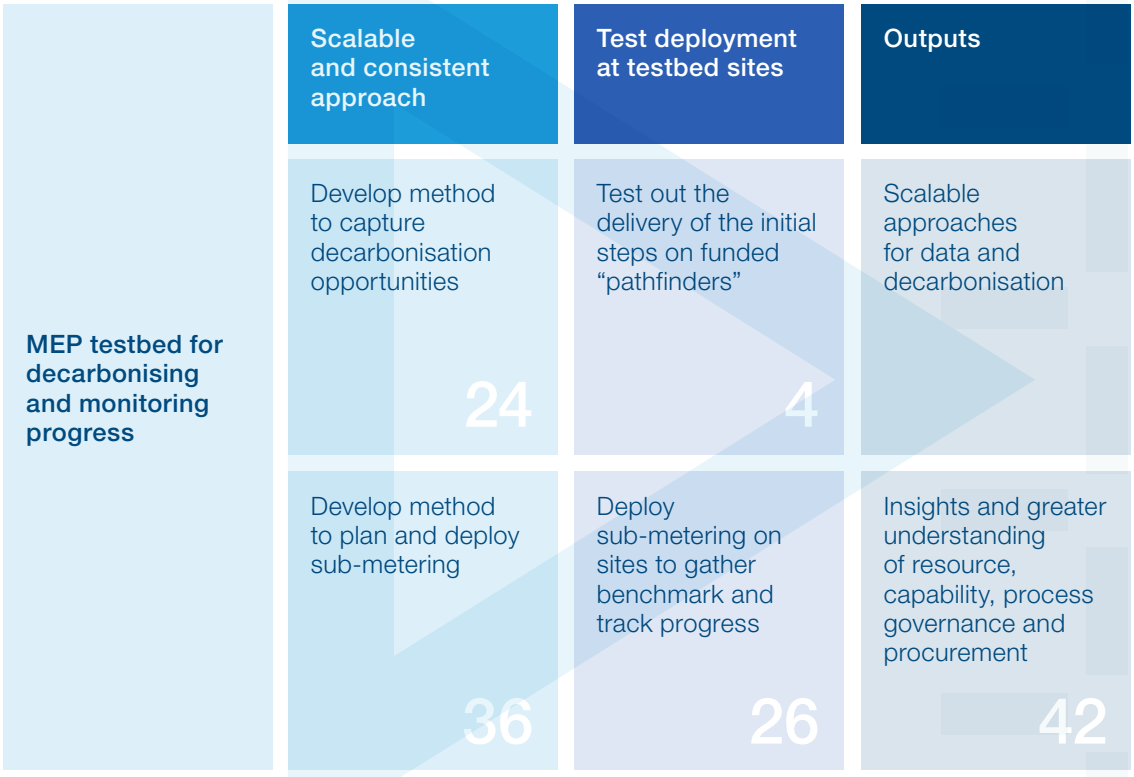


Figure 1: Testbed and numbers for the MEP programme

Who is driving MEP?

MEP has been driven by the Department for Business, Energy and Industrial Strategy (BEIS), and funded by BEIS's Energy Innovation Portfolio and its predecessor, which aims to accelerate the commercialisation of innovative clean energy technologies and processes through the 2020s and 2030s. The programme was designed to be collaborative with multiple organisations participating. Participating organisations are shown in Figure 2.

The programme has been overseen by BEIS alongside the Cabinet Office's Government Property Function, HM Treasury and the BEIS Public Sector Decarbonisation Team.

Also, the National Health Service (NHS), Ministry of Defence (MOD) and Ministry of Justice (MOJ) primarily have offered up testbed sites and participated in steering the programme.

Energy Systems Catapult provided programme delivery, analytical and technical support. They worked in collaboration with industry, shared learning and generated consistent thinking amongst the programme participants.

Several consultancies supported the concept design work. MEP recruited sub-metering installers, using CCS's Helga framework, and deployed sub-metering across the sites.

Figure 2: Organisations Participating in MEP

The MEP approach

The programme aimed to seek out the most cost-effective pathway for sites to decarbonise. It evaluated the decarbonisation levels to be achieved using the Green Book methodology. The programme also evaluated forward carbon emission projections alongside techno-economic appraisals to assess opportunity costs.

The MEP programme approach was to examine the whole system of the site and the surrounding area. It would consider the impact of actions up to 2032; forecasting what these actions would do to carbon emissions and predict when interventions would be most appropriate, given expected asset replacement dates.

On a technical level, the programme would consider all interventions. This included current, known, and innovative future technologies. They ranged from building fabric and energy efficiency to intelligent control, power management and heating system change. The programme would also consider the impact of electric vehicles and the matching of energy generation and demand profiles.

Understanding appropriate interventions, coupled with better data from a sub-metering system, would allow a site to reduce emissions and be able to monitor them as they dropped.

The MEP programme also supports several wider initiatives that the Office of Government Property are delivering for the Property Function. MEP have been key contributors to developing the Net Zero Playbook, helping shape consistent guidance to all public sector organisations for decarbonisation. The learning from the MEP programme has also been used to shape OGP's Sustainability Capability plan, informing interventions over the next few years. As part of the MEP legacy, the suite of tools developed by MEP will be made available to OGP, complementing those already available to public sector organisations on the Government property portal to help achieve Net Zero.

Understanding appropriate interventions, coupled with better data from a sub-metering system, would allow a site to reduce emissions and be able to monitor them as they dropped.

What does the public sector ambition mean?

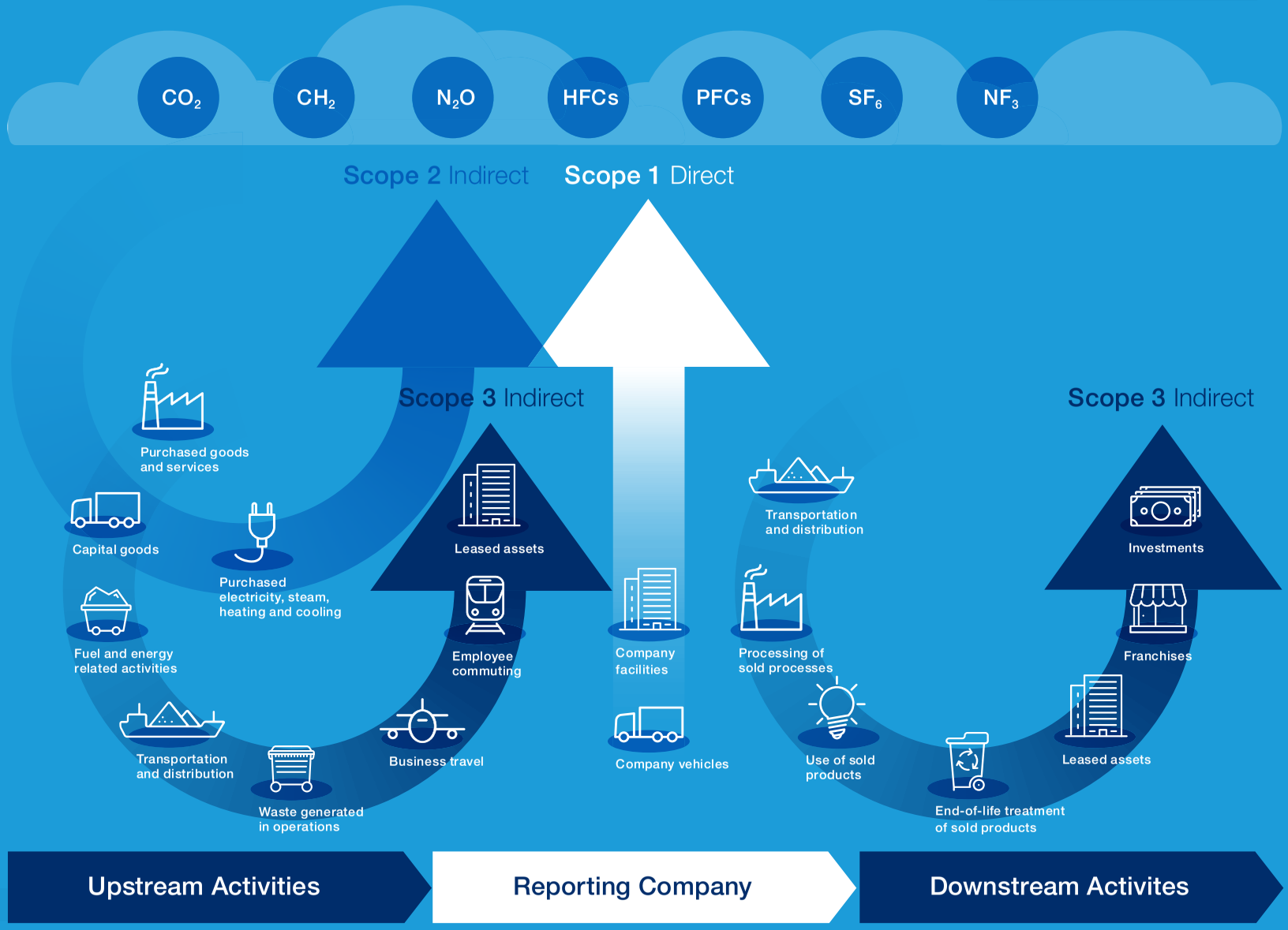
The public sector ambition in the Clean Growth Strategy focuses on the non-traded or direct element of emissions. These emissions are aligned to Scope 1 shown in Figure 3. The MEP programme has specifically targeted achieving non-traded or direct emissions reduction and associated activities to inform achieving the public sector ambition.

The programme aimed to put sites on a pathway to systematically achieve the 50% reduction in non-traded or direct emissions by 2032, as demanded by the fifth Carbon Budget. There was also an underlying commitment to reduce all emissions on sites and consider the impact that a site would have in the local area. Supporting local power networks was a particular consideration as a key provider of power for heat, and vehicle charging to everyone.

Therefore, the scope of the MEP programme broadened from just heat to account for many types of energy use associated with the campus-style estate. This included local generation potential to support additional demand and flexibility services such as demand side response.

The MEP programme has specifically targeted achieving non-traded or direct emissions reduction and associated activities to inform achieving the public sector ambition.

Figure 3: Scope Diagram*



*GHG protocol visit https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf page 7

What did the programme do?

Conceived originally in 2018, the MEP programme has been undertaken in several phases.

Phase 1 undertaken from April 2018 — March 2019 developed the initial decarbonisation plans for the six identified pathfinder sites (three of which were within the Sheppey Prison Cluster). This report covers the work carried out in phase 2 including the initial steps on four of the pathfinders.

The programme comprised of a series of pilots undertaken in collaboration primarily with the NHS, MOD and MOJ. In addition, HMRC and Cardiff University participated. In total 42 testbed sites were involved in the programme (shown below). All received a sub-metering strategy and a number had sub-metering installed.

			Breakdown			
Task	**Objective**	**Total sites**	**MOD**	**MOJ**	**NHS**	**Other**
Concept designs	Develop a systematic scalable approach and install	24	6	9	8	1
Pathfinders	Test onsite implementation, with three sites being taken forward for physical implementation (HMS Collingwood, Elmley, and Goole)	4 pathfinders, made up of six sites, where Sheppey prison cluster consists of 3 prisons.	HMS Collingwood and Catterick Garrison (2)	Sheppey Prison Cluster including HMP Elmley (3)	Goole and District Hospital (1)	—
Sub-metering	Develop systematic scalable approach and installation plans, capture fiscal meter data, collect and analyse data	42	12	15	13	2
	Take forward installation plans and install sub-metering	26				

The sites were selected to provide a representative sample of the types of sites that each organisation operates. The sites were distributed across the UK including Scotland, Wales and Northern Ireland as shown in Annex 1.

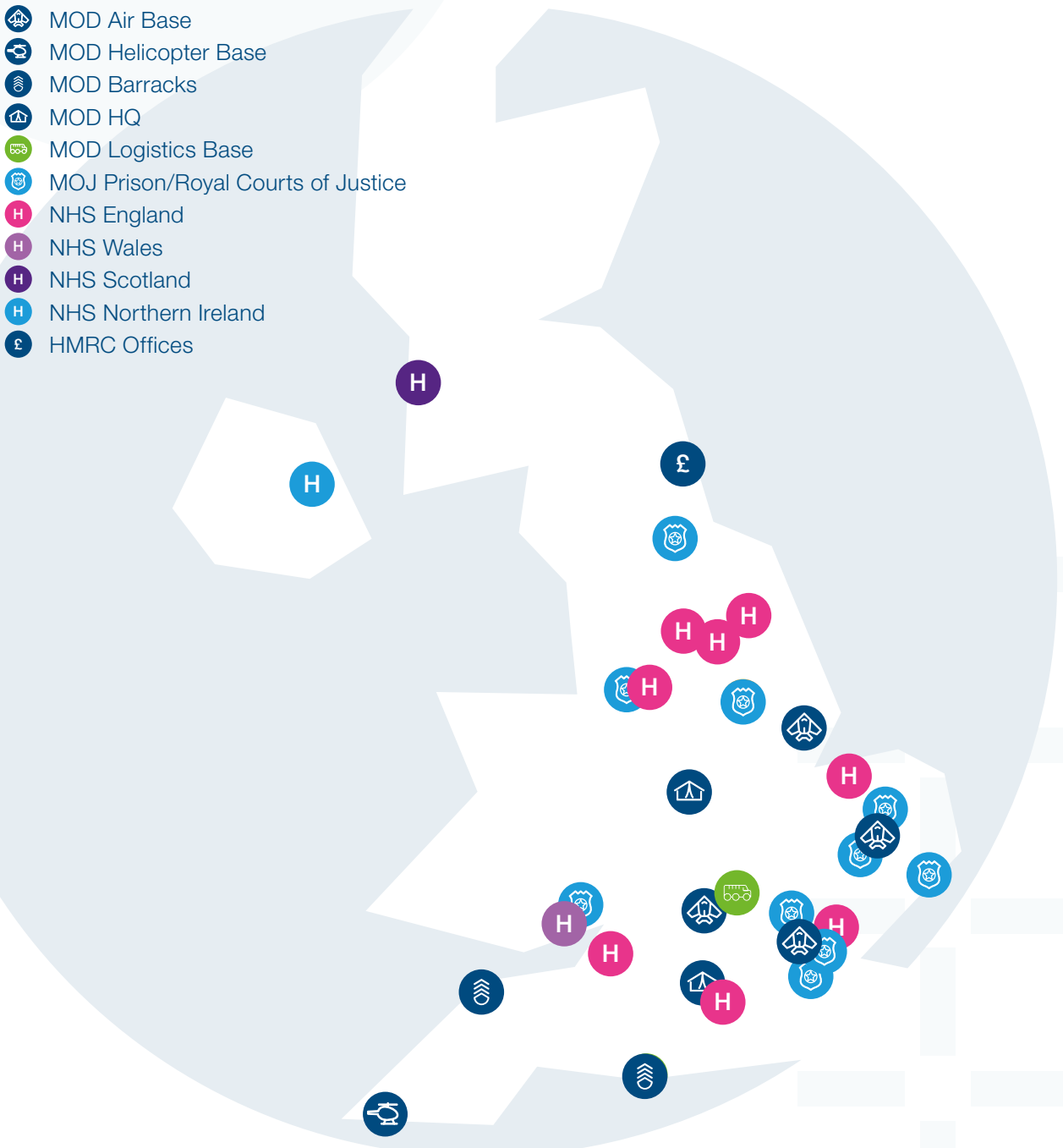


Figure 4: MEP Testbed Sites

Selecting the testbed sites

To understand the decarbonisation challenges that public sector sites will encounter, a selection of testbed sites were chosen that provided coverage of repeatable building archetypes. Working with participating organisations, MEP sought to ensure that a representative sample of sites were included.

The aim was to provide a broad indication of anecdotal evidence, whilst recognising that the sample size was not going to be statistically valid. A full list of participating sites is shown in Annex 1. A sample of the selection assessment criteria is shown in Figure 5.

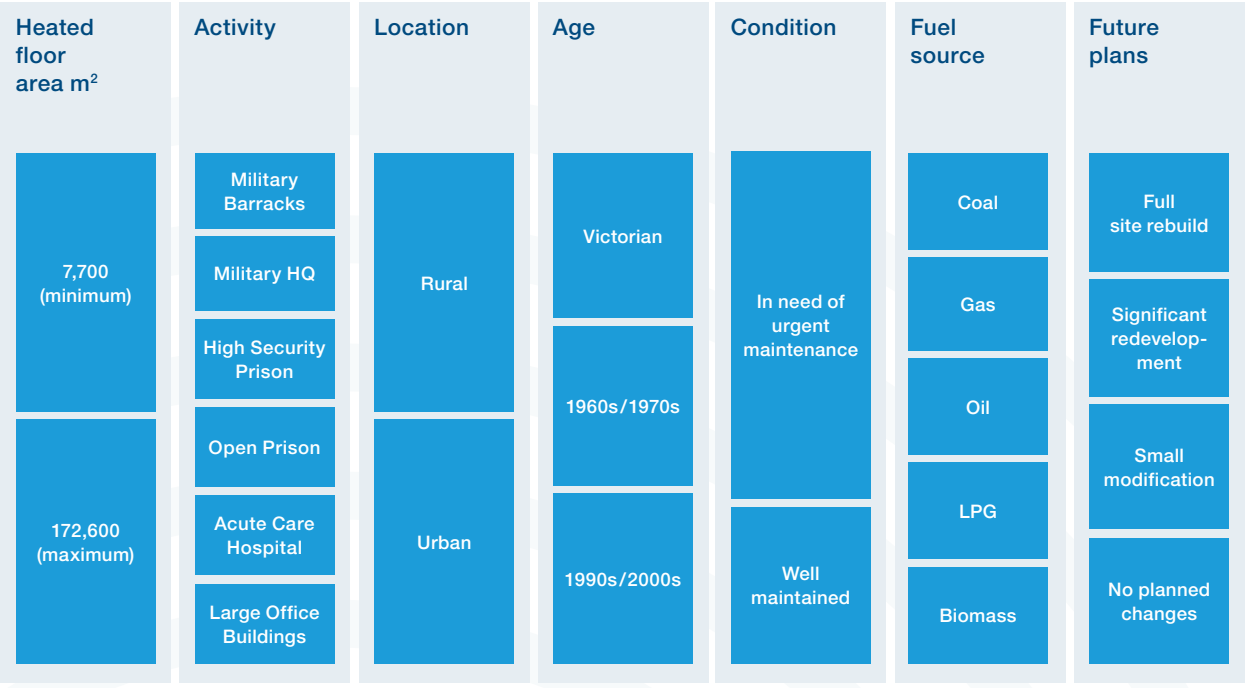


Figure 5: Shows the sample selection criteria.

The state of the estate now and going forward

Almost all sites had under-invested in maintenance and had not replaced ageing equipment, opting for a fix on fail maintenance approach in response to budgetary pressures.

This led to projects being delayed or cancelled. The NHS annually publish[7] their maintenance backlog costs which have annually increased. In 2019/20 the backlog was £9bn, a circa 40% increase from the 2018/19 figure which stood at £6.5bn, and double the level seen five years ago.

MEP found this was particularly acute for heat plant and heat distribution networks where the size of the investment necessary to upgrade or replace led to the adoption of maintenance strategies intended to extend their operating life.

This lack of investment has been prevalent over the past twenty years. This has been exacerbated further by budget cuts applied over the last decade in particular. Low investment led to minimal implementation of energy-saving measures, metering, and telemetry as this was viewed as a low priority, with a focus on short payback projects.

Going forward, consideration of upgrades and replacement technologies with public sector decarbonisation targets for the estate in mind offers a more effective lower cost way to achieve both objectives. Replacement with a more energy-efficient product will deliver higher energy savings faster than the older technology, particularly if it is well maintained and operated correctly. Practising whole life asset management, where investment is sustained and planned for its life, has been shown to ensure buildings and plant continue to work optimally. When they are well maintained and in good condition, they generate savings across their whole life, optimising payback and achieving targets.

[7] https://digital.nhs.uk/data-and-information/publications/statistical/estates-returns-information-collection/england-2019-20

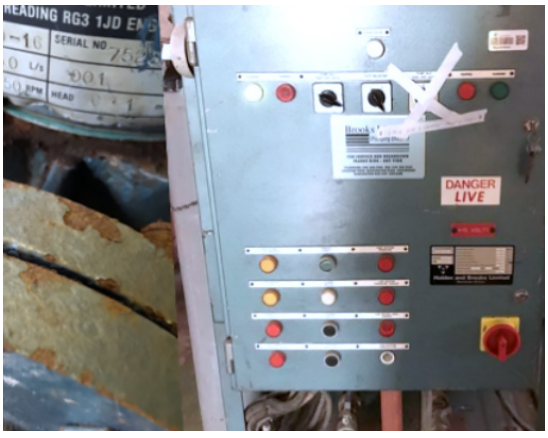


Figure 6: Typical Legacy Equipment.

Annex 1

Full list of participating sites

	Location		Number
MOD	○ Catterick Garrison (pathfinder) ○ Collingwood (pathfinder) ○ Bicester ○ HQ Andover ○ Bovington Camp ○ RM Chivenor	○ Whittington ○ RAF Honnington ○ RAF Northolt ○ RAF Coningsby ○ RAF Brize Norton ○ RNAS Culdrose	12
MOJ	○ Sheppey Prison Cluster (pathfinder) i. HMP Stanford Hill ii. HMP Elmley iii. HMP Swaleside ○ HMP Warren Hill ○ HMP Hollesley Bay ○ HMP Prescoed ○ HMP Usk	○ HMP Deerbolt ○ HMP Highdown ○ HMP Ranby ○ HMP Wayland ○ HMP The Mount ○ HMP Risley ○ HMP Highpoint ○ Royal Courts of Justice	15
NHS	○ Goole District Hospital (pathfinder) ○ Trafford Road General, Manchester ○ St James Hospital, Leeds Teaching Trust ○ University Hospital, Bristol ○ Freeman Hospital, Newcastle ○ Airedale General, Skipton ○ Royal Hampshire, Winchester	○ Queen Elizabeth Hospital, Kings Lynn ○ Homerton University ○ York Teaching Hospital ○ Wales: Royal Gwent ○ Scotland: NHS Ayrshire & Arran, Ayr Hospital ○ Northern Ireland, Antrim Area Hospital	13
HMRC	○ Benton Park		1
University	○ Cardiff University		1
Total sites			**42**

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