Dr Nicolas VIPHAKONE
19/05/2025

Supporting the journey of local GP practices to Net Zero 2050

Context:

The UK is committed to Net Zero emissions by 2050 to contribute to the global efforts of mitigating the effects of climate change and to embrace the opportunities of the energy transition. To be successful, this process requires each component of our economy and society to play its part. The NHS has set out targets to achieve a Net Zero health service for direct emissions by 2040 and indirect emissions by 2045.

GP practices are essential hubs in the community and assets that provide primary healthcare services, support for wellbeing initiatives and resources for local residents. Primary care contributes to ~25% of the CO2e emissions of the NHS, 40% of which are non-clinical and associated with the running of the practice (e.g. energy use, transport of staff and patients, business services and procurement). Since the majority of these non-clinical emissions arise from energy use, the NHS South Yorkshire Integrated Care Board (ICB) and its Estates Board consider supporting GP practices with reducing their energy use and switching to renewable energy a key priority.

As a first step towards delivering this support for primary care organisations, ICB has partnered with our community energy group Sheffield Renewables Ltd (community benefit society reg.no. 30736R). We channel investments from the community into funding and operating local renewable energy schemes for organisations and businesses that can benefit financially from the green electricity we generate. This way, we also support their decarbonisation and energy resilience. Revenues from electricity sales are reinvested into new schemes within Sheffield and its region. Our action also extends to energy efficiency consultancy, sustainability advocacy and financial support for local and international initiatives aligned to our environmental and social values.

With the support of a Northern Powergrid Net Zero Community Energy Fund, this joint project between ICB and Sheffield Renewables has consisted in:

- contacting GP surgeries within the wider Sheffield and systematically assess their suitability for the installation of rooftop solar PV.
- surveying the energy efficiency of several practices, covering various building types and providing them energy efficiency/fabric improvements advice.
- sharing the outcomes of our investigations with Sheffield GP practices via the ICB communication channels to inform future sustainability and decarbonisation measures.

53% of the GP surgeries that were sent our initial communication brief via ICB engaged in the project, which demonstrated a good level of interest. Subsequently, 37.5% stopped engaging while 62.5% continued to participate throughout the project.

This report synthesizes the common findings from our investigations and aims at sharing this knowledge with GP practices within the wider Sheffield and South Yorkshire to help them make informed decisions in line with the implementation of the NHS Net Zero strategy while simultaneously benefiting financially from adopting energy efficiency measures.

Dr Nicolas VIPHAKONE
19/05/2025

Our investigations have followed PAS 2035:2023's whole-building approach, by examining:

1. Practice managers concerns and aspirations
2. Building context & features
3. Electricity usage and cost insights
4. Suitability for solar PV
5. Recommendations

1. Practice managers concerns and aspirations

During our interactions, GP practice managers demonstrated an awareness of the NHS Net Zero strategy and a desire to implement it. However, they all underscored their **financial constraints** that can delay or hamper their ability to take action or make improvements. They also recurrently mentioned **staff and patient comfort issues due to sharp annual building temperature swings**, where practices tend be too hot in Spring/Summer and too cold in Autumn/Winter. This leads to unmonitored use of individual electric heaters, fans, cooling systems in parts of the building, contributing to overall energy costs.

Overall, GP practice managers have consistently expressed their wish to:

- Reduce their overall energy consumption and costs
- Support NHS/net-zero emission reduction targets
- Maintain or improve staff and patient comfort within the building.
- Ensure operational resilience.
- Integrate energy efficiency improvements with future building works.
- Implement realistic, budget-sensitive measures

2. Building context & features

The sample of Sheffield GP practices engaged in this project were located in urban/sub-urban areas and comprised purpose-built modern health centres (19%), buildings from the 1990s (25%) and a **mix of pre-1920 and pre-1900 re-purposed domestic properties representing the majority of surgeries (56%)**. Interestingly, 66% of GP practices from this older building stock have expanded with extensions and basement conversions, which can contribute in part to the difficulties associated with retrofitting them efficiently in a cost-effective manner.

Examples of GP practice buildings engaged in this project

Surprisingly, despite the old age of most of these buildings, **62% of the GP practices engaged in this project** had an **Energy Performance Certificate (EPC) rating of C or above**. Some extreme cases were rated B, G or had either an expired or no EPC (12.5%). While this is encouraging, it is worth bearing in mind the limitations of the current EPC rating system which does not always efficiently translate into energy and financial savings or improved user comfort.

Our site visits and discussions with practice managers confirmed as much, with most buildings showing **clear room for improvements regarding**:

Building insulation:

In the pre-1900/pre-1920 buildings surveyed, roof/loft/loft-hatch **insulation layers were either inadequate, scrambled by subsequent contractor work making them ineffective, or inexistent**. Cavity wall, ground-floor and hot water pipes insulation have not been systematically added, despite their importance to reduce thermal losses.

Scrambled loft insulation and uninsulated hatch

Windows and doors:

GP practices displayed a mix of single-glazing and old or newer double-glazing for windows and fire exit/external doors, with some **single-glazed elements** clearly contributing to **heat losses and discomfort** for building users, as reported by practice managers. By today’s standards, old double-glazed windows are almost as inefficient as single-glazed and also prone to condensation.

Left to right: newer double-glazed, old double-glazed, single-glazed windows, single-glazed fire doors.

GP practices hosted in pre-1920 and pre-1900 re-purposed domestic properties showed recurrent issues with old double-glazed wooden-frame Velux windows in roofs being prone to rain infiltration and contributing to seasonal thermal swings and discomfort in attic offices.



Ventilation:

Apart from modern health centres, most GP surgeries lacked ubiquitous active/passive ventilation systems. Moreover, trickle vents were rare, even on newer double-glazed windows. Therefore there is generally **little air circulation and staff tend to rely on window opening** to ventilate the building. It is worth mentioning that good internal ventilation can improve both heating and cooling strategies.

Heating solutions:

Gas boilers provide heating and hot water **for over 80% of the GP practices engaged in this project**. It is worth noting that the UK government is currently still providing £7500 grants towards the installation of heat-pumps for homes and non-domestic buildings until 2027. We only encountered one practice fully electrified and two health centres that used hybrid systems with Heating, Ventilation, and Air Conditioning (HVAC) for heating/cooling and gas boilers for hot water. Consequently, **a substantial part of a GP practice's carbon footprint is due to gas usage**. Among the GP practices surveyed, most lacked efficient centralised heating controls. **Gas boilers were also set at either maximum or high temperature flows (65°C-75°C)**, often in order to heat rooms that are furthest away from the boilers. This certainly **contributes to energy costs** and can unfortunately **limit the energy efficiency of condensing type boilers**. Nevertheless, we found a high heterogeneity of temperatures between various building sections (17°C-25°C, mid-day, Spring), consistent with staff feedbacks.

Lighting:

Among the GP practices surveyed, we noticed an **on-going transition** from traditional tubes/panels lights **to low energy consumption LEDs** as the former burn out. However, the **proportion of LEDs only reached 20% to 50% of all lights for most surgeries** (up to 90% for modern buildings).

Most GP practices have started to install motion detection sensors (Passive Infrared sensors, PIR) to help reduce energy use in some corridors, less frequently used spaces and for emergency lighting. However, we did not see PIRs activate/deactivate lights much, suggesting that their timing is not necessarily set properly to save electricity effectively.

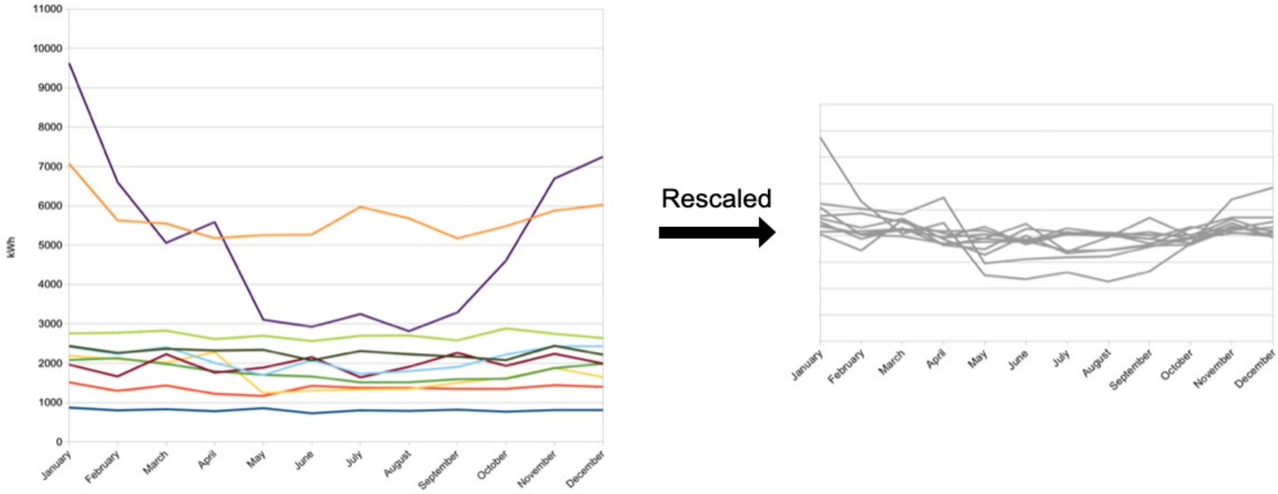
Moreover, despite these measures, we noticed a **significant reliance on artificial lighting during daytime hours throughout buildings**, mostly due to a combination of behavioural habits and at times the relative darkness in some parts of the practices. However, we found clear examples where natural daylight from windows or skylights can provide sufficient light at certain times of the day in multiple parts of the buildings. It is important to bear in mind that the **most savings are realised when unnecessary energy use is avoided, even from LED lights**.

Two examples from two different practices where
mid-day natural light is sufficient

3. Electricity usage and cost insights

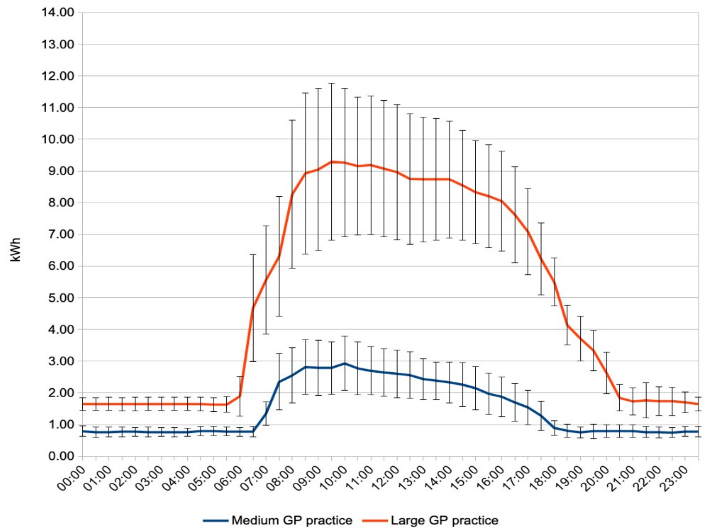
As a community energy group, Sheffield Renewables is currently mostly involved in helping organisations and businesses benefit from solar PV installations. Therefore we focus primarily on the electricity usage of a site.

On average, the GP practices surveyed had 20-25 rooms and were occupied Monday-Friday/Saturday, 8am-6:30pm, by 20-30 staff. Their buildings host essential medical equipment, refrigerators/freezers (e.g. for samples, medicines and vaccines) and IT servers. As discussed above, they also rely daily and heavily on lighting and in some instances HVAC. Consequently, these **buildings display high electricity usage all year round** (average 2544kWh/month) **with little monthly variation** (average 13.2%). Therefore a GP practice in Sheffield is using monthly almost as much electricity as an average UK household uses in a year.



Monthly electricity usage patterns from GP practices that provided their data.
Data also re-scaled showing a similar stable usage pattern among all GP practices overall.

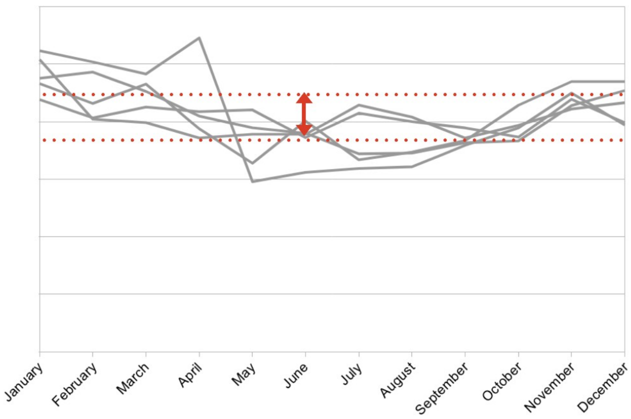
Only 31% of the GP practices engaged in this project had smart or half-hourly electricity meters. This contrasts with current national statistics that show 58% of non-domestic meters now operating in smart mode. From the 12.5% of surgeries that communicated half-hourly data, we could derive annual average daily profiles that helped understand their electricity usage and improve our solar PV assessments and system modelling (see “Renewables” section”). We detected substantial electrical base loads, particularly noticeable during night time (e.g. 1.5kW for a medium-sized surgery and 3.2kW for a large one, see figure opposite). These are presumably caused by equipments or appliances essential for medical services (fridge/freezers) or to run the practice (e.g. IT servers).



Annual average daily electricity usage pattern (half-hourly, kWh) for large and medium-sized GP practices during working days

We cannot exclude the possibility that individual computers or other non-essential pieces of electronics left constantly turned on might also contribute to this continuous load. Moreover, considering the low monthly variability of electricity usage among the GP practices of this project, **it is likely that most surgeries within Sheffield follow similar daily usage patterns that are ideal for solar PV** (see “Suitability for solar PV” section below).

While GP practices display low monthly variations in electricity usage (13.2%), **50% of them demonstrated 20–30% higher electricity usage in Autumn/Winter versus Spring/Summer**. Smart metering data from some surgeries suggest a surge of lighting and individual electric heating during the colder months of the year, with electric heating possibly contributing significantly since this surge in usage and substantial load mostly occurs 8am-12:30pm. Interestingly, we did notice sporadic individual electric heaters (oil or wall-mounted) throughout buildings during our visits. While it is expected that seasonal variations in lighting and heating needs may contribute to this seasonal swing (gas heating also requires electricity), it is very likely that the insulation, heating, user discomfort issues mentioned previously may also play a role in this phenomenon. These results also suggest that the electricity demand of the other 50% of GP practices is maintained constant by keeping equipments, appliances and lighting turned on throughout the day. For some practices, the use of HVAC for cooling in summer as well as heating in winter probably contributes to this constant electricity usage pattern throughout the year.



Autumn/Winter – Spring/Summer swing in electricity usage for a subset of GP practices

By delving into their bills, we obtained a clearer picture of how the electricity expenditure of Sheffield GP practices was structured during 2023-2024 (see table below). Overall, median tariffs, standing charge, usage and annual bills are in line with what is seen for medium-large businesses as of May 2025: £0.25/kWh, £0.57/day, ~25000kWh, £5.5k-£10k/year. Unsurprisingly, we found that the electricity bills of large health centres are 2 - 4 times higher than those of medium ones and nearly 6 times higher than small practices.

We noticed some **disparities in standing charges (£/day)**, as shown by an average of £1.08/day and a median of £0.57/day. This directly reflects the grid connection capacity of the building and **31% of the GP practices engaged in the project were paying more than the median standing charge**. In these instances, the standing charge was representing 5-10% of their annual electricity bill (itself 40-300% higher than the median annual bill).

During our investigations, we encountered the case of a modern GP health centre that is paying for a substantial grid connection capacity of which only a maximum of 35% is actually used during the year. Therefore, **we recommend that GP practices ensure with their energy supplier that the standing charge and grid connection capacity of the building match current or future/planned electrical needs of the surgery**.

	Elec. tariff (£/kWh)	Standing charge (£/day)	Annual elec. usage (kWh)	Annual elec. bill (£)	total £ spent / kWh used
min	£0.1587	£0.2639	9631	£2,961	£0.20
max	£0.3391	£6.04	68140	£23,877	£0.44
average	£0.2470	£1.0814	30531	£9,948	£0.32
median	£0.2504	£0.5683	24472	£7,328	£0.31

4. Suitability for solar PV and its impacts

As detailed above, on a working day basis the electricity usage of GP surgeries increases in the morning, then remains mostly constant and usually decreases at the end of the afternoon/evening. This pattern is reproduced throughout the year and matches sunlight availability. Consequently, **GP practices are well-suited to benefit from solar PV electricity generation**.

Our investigations have shown that **81% of the GP practices engaged in this project are theoretically compatible with solar PV**. This shows a great potential for energy and financial savings for primary care. Structural surveys from installers would obviously be needed to confirm the suitability of their roofs. 19% of surgeries were found early on incompatible with solar PV because of either limited roof space, or unsuitable roofs orientation or convoluted organisation, or because they were covered with large shadows.

However, issues exist even among the GP practices that are compatible. **The first most common issue (70% of cases) is existing or future potential shadows from surrounding buildings, roofs and mostly trees**. While shadows from buildings and roofs can be avoided when designing the solar PV installation, those from trees, sometimes already visible, can become an issue later on when they grow further. Therefore **having tree maintenance contracts or agreements in place is crucial**.

The **second most common issue is the lack of smart/half hourly metering**. This prevents from performing precise analyses (such as those presented above) of the practice's actual electrical load and tailor the solar PV system accordingly. Therefore there can be a risk of either under- or oversizing the installation, thereby reducing savings or impacting payback time respectively. Luckily, **smart metering can nowadays be deployed with minimum disturbance**: 45 minutes-1 hour on average for the whole process depending on the site and ~15 minutes interruption of supply.

Another potential issue for the deployment of solar PV on the roofs of GP practices is **building ownership**. Whether the practice is owned or leased, it is important to check with the corresponding mortgage or leasing companies if they would be supportive of solar PV installation (owned outright or leased from community energy groups for example) and how this might affect the practice's repayments or building value. Ultimately, every institution in the UK should support the country's transition to Net Zero and electrification to reinforce our energy independence and resilience. More information.

Once these hurdles are overcome, based on the current daily and annual electricity usage patterns of Sheffield GP practices, our investigations suggest that **solar PV can save on average ~30% on a surgery's annual electricity bill if the systems are owned outright**.

As a community energy group, Sheffield Renewables exists to support organisations that cannot afford the capital required to install solar PV. We provide partners with cheaper electricity generated by solar PV, use this income to repay the capital raised from our shareholders and ultimately handover the solar PV system for free to our partner once capital is repaid. A drawback of this approach is that we cannot establish financially viable partnerships with low electricity users, which happened once during this project.

Nevertheless, during this project we are pleased to have initiated solar PV partnership discussions with several GP practices and put some other surgeries and health centres on a path to install solar PV by themselves.

5. Recommendations

In order to provide essential services for their local communities, GP practices have to be open throughout the day, most of the year and often operate within complex inherited architectural contexts and constraints. Their activities lead to high annual electricity usage which adds to their financial pressure. Our investigations during this project have found that Sheffield GP surgeries have energy efficiency issues that stem from poor building insulation, a slow roll-out of smart energy monitoring, the absence of efficient centralised energy control systems in general, a slow transition to low-consumption LED lighting and which requires to implement behavioural changes around energy usage. Yet, the daily electricity usage pattern of GP practices matches sunlight availability and makes them well-suited for solar PV electricity generation. Our assessments suggest that **by gradually applying the recommendations below** and considering solar PV whenever possible, **GP practices could substantially reduce their energy usage, costs and carbon footprint over time**.

By starting with quick wins and then moving on to larger upgrades, GP practices can steadily make the building more efficient, sustainable and resilient. Several of the larger upgrades could be undertaken alongside future refurbishment works or extensions. Again, a “fabric-first, whole-building” approach is advised, combining no-/low-cost actions with medium- and longer-term investments:

A. Quick Wins:

1. Activate/commission **energy smart metering** to obtain half-hourly data that will help understand the building's usage patterns and help inform subsequent measures.
2. At night and during leaves, turn off non-clinical/non-essential equipment, for example using centrally-controlled timed smart sockets.
3. Check your current EPC. If older than 5 years, renew it with trusted assessor/company, known for quality report and realistic recommendations. **Study EPC report** and devise a plan to implement its recommendations gradually.
4. **Convert all lighting to LED** as soon as possible. Set **PIR motion sensor timings appropriately** to optimise their usage. **Take advantage of natural daylight** as often as possible.

5. **Set reminders to adjust boiler flow-temperatures seasonally**. For condensing boilers, ensure that temperatures chosen allow them to condense and work efficiently. Set thermostatic Radiator Valves (TRVs) correctly.
6. Implement **staff energy-awareness training, carbon-literacy sessions**, and encourage recycling behaviours.

B. Fabric Improvements:

1. **Replace single-glazed windows and doors with double-glazing and trickle vents**, retrofit trickle vents on newer double-glazed windows, replace old double-glazed Velux windows in roofs and add reflective window film where appropriate to reduce thermal comfort extremes.
2. **Top up loft and room-in-roof insulation** to ≥300 mm; insulate stud partitions.
3. Lag heating & hot-water pipework (≥19 mm).
4. Explore **cavity insulation** for relevant walls.

C. Systems & Controls:

1. Gradually **replace TRVs with smart TRVs** to provide centralised but modular time and room controls to the heating system.
2. Heating system optimisation: for now fit weather compensation to gas boilers and **consider phasing in air-source heat pumps** over time.
3. Ventilation upgrades: install humidity-controlled continuous extractor fans. Plan for subsequent deployment of mechanical ventilation with heat recovery (MVHR).

D. Renewables & Decarbonization:

1. If the practice is surrounded by trees (particularly South and West), investigate and **put in place tree maintenance contracts or agreements**.
2. **Seek expert advice on the site's suitability for solar PV** and **conduct structural roof surveys** for solar PV.
3. **Pursue solar PV installation** with own funds, grants, or partnerships with community energy groups.
4. **Phase in air-source heat pumps** to replace gas boilers under relevant grants
5. **Green energy tariffs**: while this is a good choice for any GP practice, this alternative is particularly attractive for those who cannot have solar PV. During this project, we noticed that **only 12.5% of surgeries had opted for green energy tariffs**, even though the most of their current suppliers also offer green tariffs for non-domestic customers.

E. Behavioural & Governance

1. The **most savings are realised when unnecessary energy use is avoided**: **turn off non-clinical/non-essential equipment** when appropriate for example using centrally-controlled timed smart sockets.
2. **Reduce reliance on artificial lighting** by optimising the use of natural light as often as possible.
3. Incorporate energy efficiency, **sustainability criteria and net zero commitments in procurement** and contractor selections.
4. Formalize and implement **staff sustainability engagement**/carbon-literacy programmes, **green-transport incentives** (e.g. onsite bike sheds, salary sacrifice for e-bikes or EVs, slow EV charging on car park).
5. **Establish a green champion role/green staff committee** within the practice that will support the implementation of the recommendations of this report and/or your own EPC-based improvements plan.
6. As building fabric enhancements are gradually implemented, **reduce reliance on unmonitored individual electric heaters, fans, cooling solutions**.

We would like to thank all GP practice managers and staff, our project partners from the NHS South Yorkshire Integrated Care Board and our funder Northern Powergrid for their participation, contribution and support throughout this project. We hope that the present report will provide useful insights and advice to support GP practices with reducing their energy use, make financial savings and become more sustainable.