

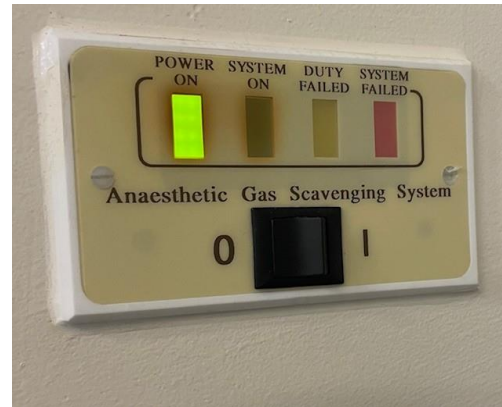


SUSQI PROJECT REPORT

Project Title: Turning off the anaesthetic gas scavenging equipment in the Royal United Hospital Bath (RUH), Day surgery theatre suite when not in use.

Start date of Project: 16/09/2024

Date of Report: 18/01/2025



Team Members:

- Thea Morgan Anaesthetist RUH - thea.morgan1@nhs.net
- Lauren Brain (Anaesthetist RUH) - lauren.brain1@nhs.net

Background:

Anaesthetics contribute to 2% of the NHS carbon footprint and 5% of acute hospitals carbon footprint. In reducing energy consumption and therefore carbon production within the Anaesthetics department we can help move forward with the NHS aim to be carbon net zero by 2040.

Operating theatres consume 3-6 times more energy than other hospital areas (NHS Scotland, 2023). A key contributor is Anaesthetic Gas Scavenging Systems (AGSS), designed to remove anaesthetic gases for staff safety. AGSS accounts for most anaesthetic-related energy use and is unnecessary during non-operational hours or when using intravenous anaesthetics (Green Surgery Report, 2023). The Green Surgery Report recommends adopting "switch off" checklists and safety protocols to ensure AGSS devices are turned off when not in use and reactivated safely when needed.

This project aims to reduce the energy consumption of the theatre complexes at the RUH by turning off high energy consuming devices when not in use. High energy devices include anaesthetic gas scavenging, ventilation and heating. Reducing the energy consumption reduces the carbon footprint of the theatre complex and also can assist with saving the trust thousands of pounds in energy usage. The Centre for Sustainable Healthcare has an anaesthetic gas scavenging

project which we will dovetail with to attempt to see if it is possible to turn off scavenging in the RUH system.

The team involved with this project are two anaesthetists who liaised with theatre teams, an Energy Manager liaising with estates and quality improvement practitioners to help guide us through the project.

Specific Aims:

Reducing the amount of time the scavenging system is on in the 5 Day Surgery theatres in RUH by the beginning of April 2025, reducing energy consumption and cost.

Methods:

Studying the system

We identified 3 main areas where we felt energy usage could be cut down. These included ventilation, heating and scavenging systems. We chose one area to focus on in the time period available for the project: scavenging.

Each theatre in the RUH has a scavenging system which is designed to safely remove anaesthetic waste gases and therefore reduces staff exposure to inhalational anaesthetic gases. They are attached to the anaesthetic machines via pipes and the piped networks work on a fan system. The fans pull the exhaled waste anaesthetic gases through a low pressure, high volume system and expel them into the atmosphere outside of the hospital.

This work involved the Estates team and identifying which theatres are interlinked, and how easy it is to turn off various systems. There are three main areas which contain theatres in the RUH and it was felt that starting in day surgery theatres would be a good starting point as each scavenging system can be individually isolated. Day surgery theatres are used in daytime hours Monday to Friday, meaning there are 118 hours a week on average that scavenging is operating when the theatres are not in use.

As part of the project it was highlighted that in certain theatres the gas scavenging could be turned off locally in each theatre using the switch in figure 1. It is a simple on and off switch with a control panel which shows whether the system is on or off. It has a clear light which shows if the system is working effectively.

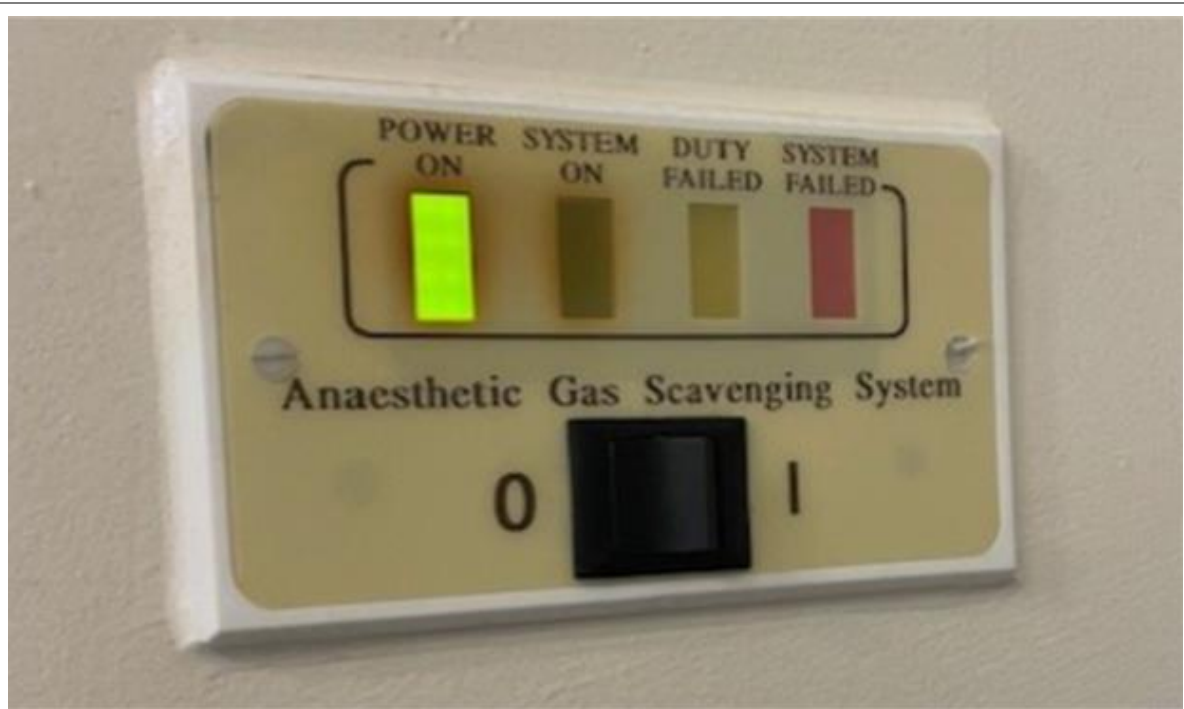


Figure 1: Photo of Anaesthetic Gas Scavenging System found in theatre 10 in day surgery

The Control of Substances Hazardous to Health (COSHH) is the regulatory body in the UK and they state that the removal of waste gases are an issue of health safety and a legal requirement. Anaesthetic gas scavenging should be turned on when a volatile anaesthetic is being used. In Day surgery as the system is turned on and off from the individual theatres it is hoped that savings of electricity and carbon could be generated whilst also adhering to the COSHH guidelines for staff.

The project was highlighted to the Theatre Services Group and needs to go through further governance channels but has been warmly received. The challenge has been identifying who will be responsible for turning the scavenging on and off around the theatre list.

The project has not resulted in the system being turned off during the night and the weekends to date but has highlighted other areas that teams can look into to try and reduce energy consumption alongside the scavenging systems. Other projects are underway at present to turn off heating and ventilation in areas that are not in use. Previously theatre checklists were in use at the beginning and the end of the list. These lists were routinely used but over time they are not being undertaken regularly. As part of a wider project beyond the scope of this, the checklists are looking to be reintroduced. The beginning of the list would include a question to check that the scavenging was turned on and then the end of the list checklist would refer to turning off the scavenging system. Other teams in theatre are looking at what other electrical items can also be switched off.

Measurement:

Patient outcomes:

We do not anticipate any change to patient outcomes or experience, based on similar case studies. We discussed the scavenging system with the team at Gloucester and they have opted for the system to be off all the time unless the anaesthetist specifies that they will be using anaesthetic gases. In recent years more anaesthetists have been moving to a type of anaesthesia called total intravenous anaesthetic (TIVA) which does not use anaesthetic gases. However, there are still cases where anaesthetic gases are used and therefore scavenging is still required. The system is turned off manually. If the system was turned off when anaesthetic gases were used it would have no effect on the patient but does pose a small risk to staff as the anaesthetic gases may be slightly higher in theatres than when the scavenging is in use. However, in practice, we operate on much lower flows of anaesthetic gases than when the systems were introduced so would hopefully have minimal impact on staff.

We will monitor incident reporting after implementation to ensure no risks to patients and staff. Patients will be unaffected by the shutdown of AGSS out of hours.

Environmental sustainability:

To calculate emissions for the AGSS, we utilised the toolkit from the Anaesthetic Gas Scavenging System Project (2019) available from the Centre for Sustainable Healthcare. The kWh/pump was multiplied by the 2024 UK electricity emissions factor - 0.27522 kgCO₂e / kW (taken from *Government emission conversion factors for greenhouse gas company reporting 2024* [Greenhouse gas reporting: conversion factors 2024 - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/publications/government-emission-conversion-factors-for-greenhouse-gas-company-reporting-2024)) then multiplied by run hours per annum. Wasted kgCO₂e could then be calculated by looking at potential unoccupied run hours. We calculated average daily unoccupied run hours of 14 hours a day (Monday to Friday) and 48 hours over the weekend.

Economic sustainability:

Each anaesthetic gas scavenging uses around 5kW per hour so if turned off for 14 hours a day (Monday to Friday) and 48 hours over the weekend, and if the cost of electricity is around £0.20 per kW per hour.

There are no investment costs for the project, other than staff time.

Social sustainability:

Due to the delay in implementing the switch off protocol we were unable to record staff feedback. We plan to obtain this information through the QR audit too once implemented. Whilst there is a potential risk of exposure to anaesthetic gases if the AGSS was not turned back on, this risk is mitigated through alerts provided by the anaesthetic machines and visual prompts. We will re-audit compliance with the project after implementation to ensure this is being adhered to. Wider health benefits could be predicted through the impact of the reduction in carbon emission in the atmosphere as a result of this project. The trust would also have more money to spend on other



improvements. Highlighting the project within the hospital will hopefully encourage others to think about what can be turned off when not in use.

Results:

Patient outcomes:

No results currently, once established we intend to monitor incident reporting.

Environmental sustainability:

Table 1. Estimated carbon data from switching off 1 and 5 AGSS pumps

	kgCO2e when AGSS switched on 24hrs	KgCO2e when AGSS switched on during occupied hours only	Potential KgCo2 savings if switched off during unoccupied hours
1 day surgery unit	12,054.64 kgCO2e	3,616.39 kgCO2e	8,428.25 kg CO2e
x 5 day surgery units	60,273.18 kgCO2e	18,081.95 kgCO2e	42,191.23 kgCO2e

It is estimated that if each theatre in day surgery turned off the anaesthetic gas scavenging for 14 hours a day (Monday to Friday) and 48 hours on the weekend when unoccupied, there would be approximately **42,191.23kg** of carbon dioxide emissions saved per annum. This is equivalent to driving **124,315km** in an average car.

Economic sustainability:

Table 2. Estimated financial savings from switching off theatre AGSS pumps based on 1 and 5 units

	Financial cost/annum when AGSS switched on 24hrs	Financial cost/annum when AGSS switched on during occupied hour only	potential financial saving/annum if AGSS switched off during unoccupied hours
1 day surgery unit	£8,760	£2,628	£6,132
x 5 day surgery unit	£43,800	£13,140	£30,660

Each anaesthetic gas scavenging uses around 5kW per hour so if turned off for 14 hours a day (Monday to Friday) and for 48 hours on a weekend and if the cost of electricity is estimated at £0.20 per kW per hour then per theatre the savings to the hospital could be around £6,132 per year. This would have an annual saving over the 5 theatres of around **£30,660**. It is difficult to get an accurate estimate as the electrical meters are not isolated so it has to be estimated.

Social sustainability:

Due to the delay in implementing the switch off protocol we were unable to record staff feedback. We plan to obtain this information through the QR audit as we implement. We will re-audit compliance with the project after implementation to ensure this is being adhered to.

Once established we intend to monitor incident reporting to review any safety incidents and the checklist may need to be altered.

Wider health benefits could be predicted through the impact of the reduction in carbon emission in the atmosphere as a result of this project.

Discussion:

This has been an interesting project to start but has been slow to implement due to the number of stakeholders involved. The project has been widely well-received in principle and all staff involved understand the importance of reducing energy consumption in theatres. The project must be implemented safely and sustainably. As mentioned, the project also forms a smaller part of a wider project to re-introduce the start up and close down checklists which will involve turning off other items of electrical equipment.

It is hoped after a successful trial in day surgery it could be rolled out to the other theatre complexes successfully. They use a slightly different system so will require further planning for their successful roll out. It is unlikely that this can be fully rolled out across all theatres as some theatres are designated emergency theatres and therefore need to be able to easily use anaesthetic gases at all times.

Conclusions:

It was hoped that the project would have been implemented and tested by this point but it is important that we ensure it is safely introduced and the project receives the necessary approvals.

The lasting change for the project will hopefully come from embedding this within a wider project to reduce energy consumption within theatres and to ensure the legacy continues.



References and Resources

- Centre for Sustainable Healthcare. (2019) Anaesthetic Gas Scavenging System Project. Retrieved from The Anaesthetic Gas Scavenging System (AGSS) Project | Centre for Sustainable Healthcare
- Green Surgery Report 2023, Green Surgery Report – UK Health Alliance on Climate Change
- NHS Scotland. (2023). National Green Theatres Programme: Automated switch off out of hours heating ventilation air conditioning (HVAC) within operating theatres- opportunity for change. Retrieved from: [ngtp-automated-switch-off-hvac-ofc-updated-website-version-no-hb-data-v20-12-sep-2023.pdf](#) (nhscfsd.co.uk)



Critical success factors

Please select one or two of the below factors that you believe were most essential to ensure the success of your project changes.

People	Process	Resources	Context
<input type="checkbox"/> Patient involvement and/or appropriate information for patients - to raise awareness and understanding of intervention <input type="checkbox"/> Staff engagement <input type="checkbox"/> MDT / Cross-department communication <input type="checkbox"/> Skills and capability of staff <input type="checkbox"/> Team/service agreement that there is a problem and changes are suitable to trial (Knowledge and understanding of the issue) <input type="checkbox"/> Support from senior organisational or system leaders	<input type="checkbox"/> clear guidance / evidence / policy to support the intervention. <input type="checkbox"/> Incentivisation of the strategy – e.g., QOF in general practice <input type="checkbox"/> systematic and coordinated approach <input type="checkbox"/> clear, measurable targets <input type="checkbox"/> long-term strategy for sustaining and embedding change developed in planning phase <input type="checkbox"/> integrating the intervention into the natural workflow, team functions, technology systems, and incentive structures of the team/service/organisation	<input type="checkbox"/> Dedicated time <input type="checkbox"/> QI training / information resources and organisation process / support <input type="checkbox"/> Infrastructure capable of providing teams with information, data and equipment needed <input type="checkbox"/> Research / evidence of change successfully implemented elsewhere <input type="checkbox"/> Financial investment	<p>aims aligned with wider service, organisational or system goals.</p> <input type="checkbox"/> Links to patient benefits / clinical outcomes <input type="checkbox"/> Links to staff benefits <input type="checkbox"/> ‘Permission’ given through the organisational context, capacity and positive change culture.

This template is adapted from [SQUIRE 2.0](#) reporting guidelines.

Template References

- [SQUIRE | SQUIRE 2.0 Guidelines \(squire-statement.org\)](https://www.squire-statement.org/)
- [Home | Sustainable Quality Improvement \(susqi.org\)](https://www.susqi.org/)

