

# Fostering Low-Carbon Healthcare in Europe

## A Carbon Footprinting Pilot Project



# PRESENTATION OVERVIEW

- Introduction
- Why Anaesthetic Gasses?
- Benchmarking information
- Recommendations
- What can I do?
- Extra resources

# INTRODUCTION

Healthcare organisations have a responsibility to reduce their impact on climate change just like other industries.

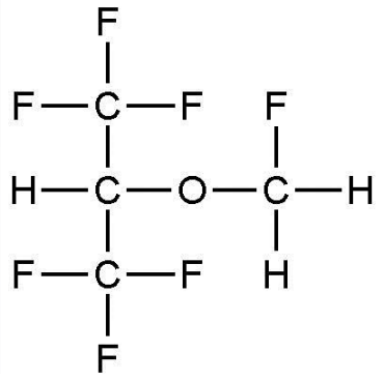
The health sector can reduce environmental impacts whilst improving quality of care.

Reducing carbon emissions can also contribute to improving health in communities and staff.

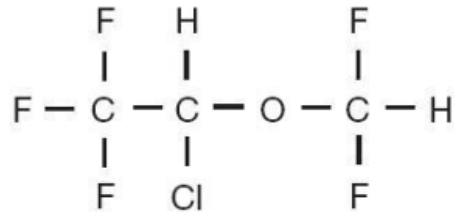
The sector makes up an estimated 5% of the European carbon emissions and has a significant role to play in contributing to the European 2030 climate and energy targets.

Anaesthetic gases are potent greenhouse gases: comparing with energy use (measured in many acute hospitals) anaesthetic gases are an additional 15% of carbon equivalent emissions.

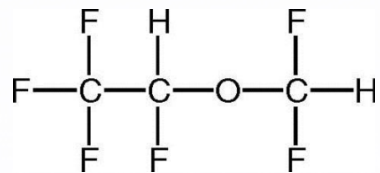
# WHY ANAESTHETIC GASES?



*Sevoflurane* - GWP 130  
Bottle (250ml) 49 kg CO<sub>2</sub>e



*Isoflurane* - GWP 510  
Bottle (250 ml) 191 kg CO<sub>2</sub>e



*Desflurane* - GWP 2540  
Bottle (240 ml) 893 kg CO<sub>2</sub>e



*Nitrous oxide* - GWP 298  
Cylinder (3.4 kg) 1013 kg CO<sub>2</sub>e

# RELATIVE POTENCY OF ANAESTHETIC GASES

	IR absorption range ( $\mu\text{m}$ )	Tropospheric lifetime (yr)	GWP 100	Standard container	kg CO <sub>2</sub> e for container	Amount needed (MAC <sub>40</sub> )	Relative CO <sub>2</sub> e (per MAC <sub>40</sub> )
<b>Sevoflurane</b>	7-10	1.1	130	250ml	49	1.8	1
<b>Isoflurane</b>	7.5-9.5	3.2	510	250ml	191	1.2	2.6
<b>Desflurane</b>	7.5-9.5	14	2540	240ml	893	6.6	72
<b>Nitrous oxide</b>	4.5, 7.6, 12.5	110	298	Cylinder size G	5066	104	132

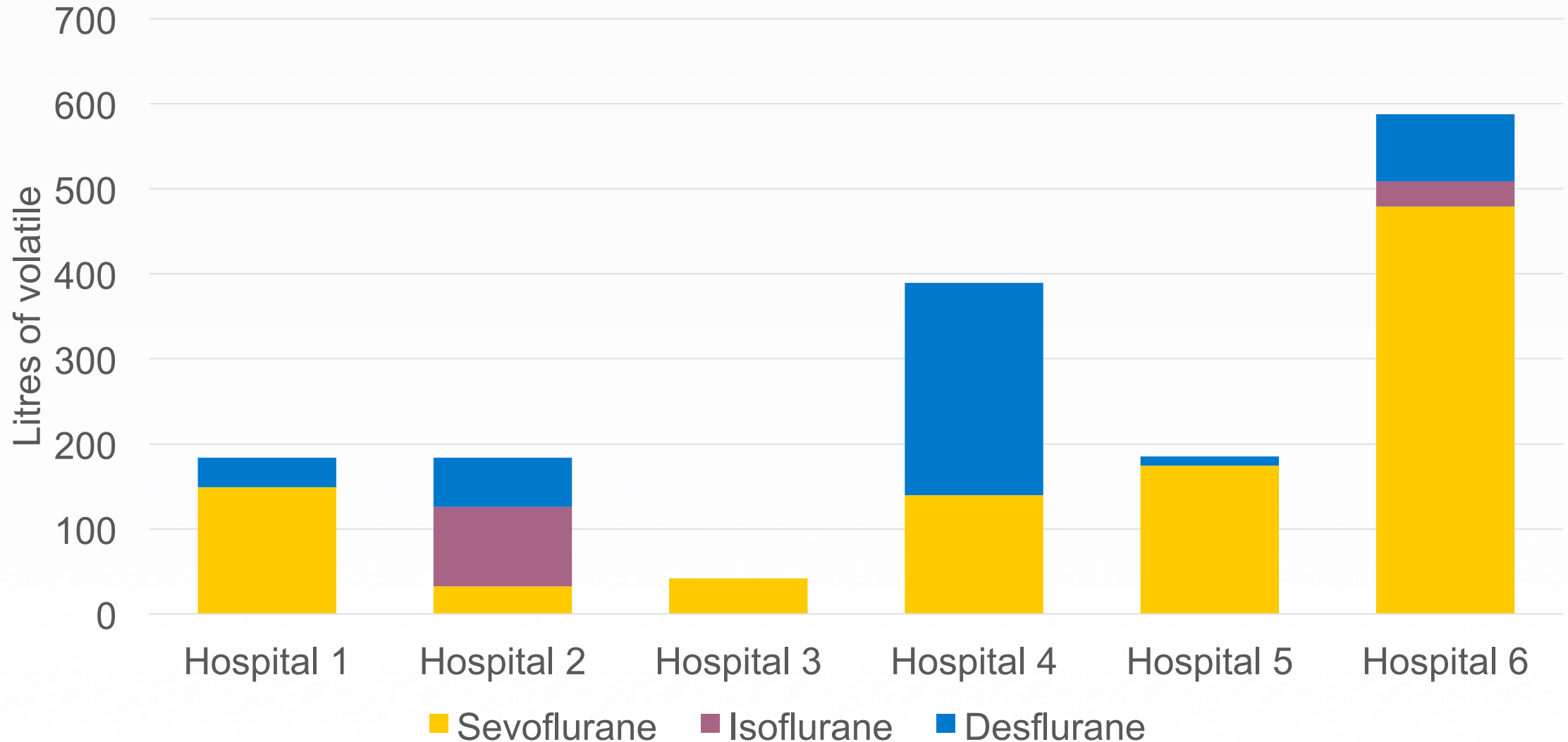
References:

Lifetimes calculated from JPL <http://jpldataeval.jpl.nasa.gov>

GWP 100 from Sulbaek Andersen 2012 <http://dx.doi.org/10.1021/jp2077598>

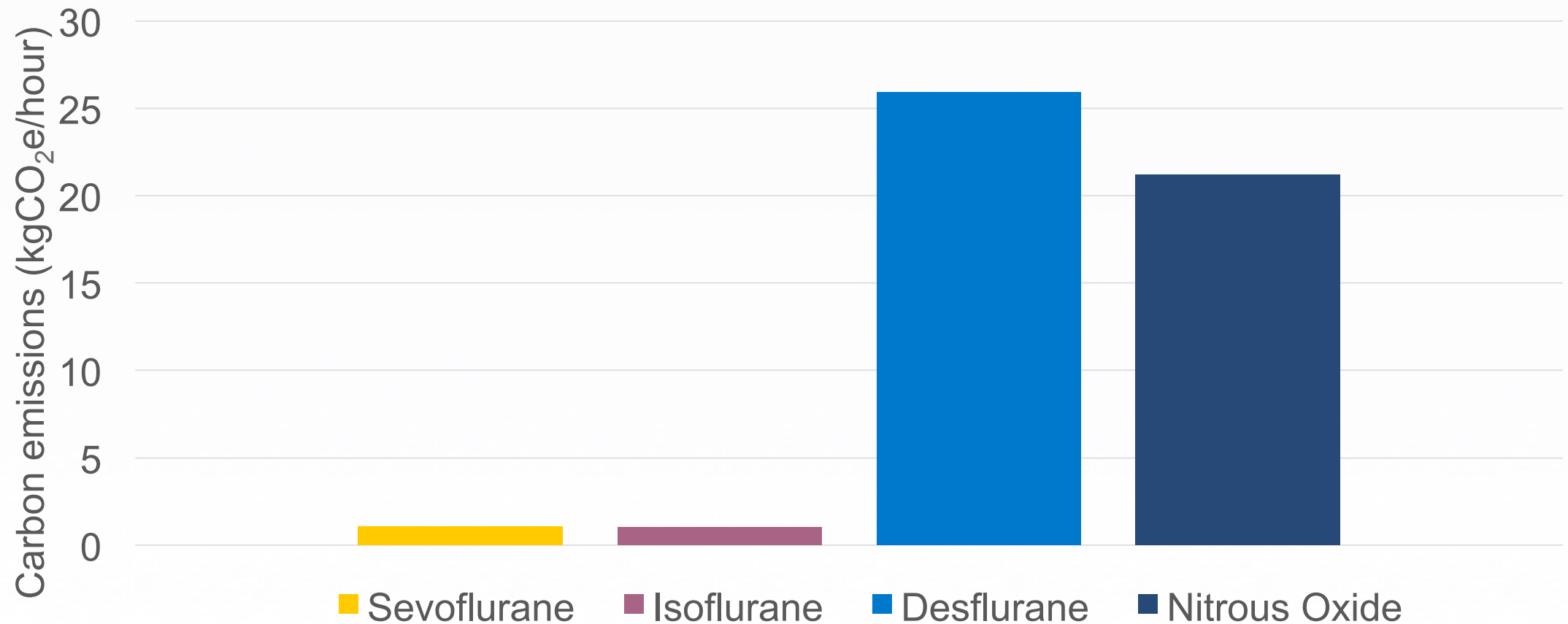
MAC<sub>40</sub> from Tom Pierce, Environmental Advisor to the Royal College of Anaesthetists, UK

# ANAESTHETIC GASES VOLUMES FROM EUKI PROJECT



# ANAESTHETIC CARBON EMISSIONS PER HOUR

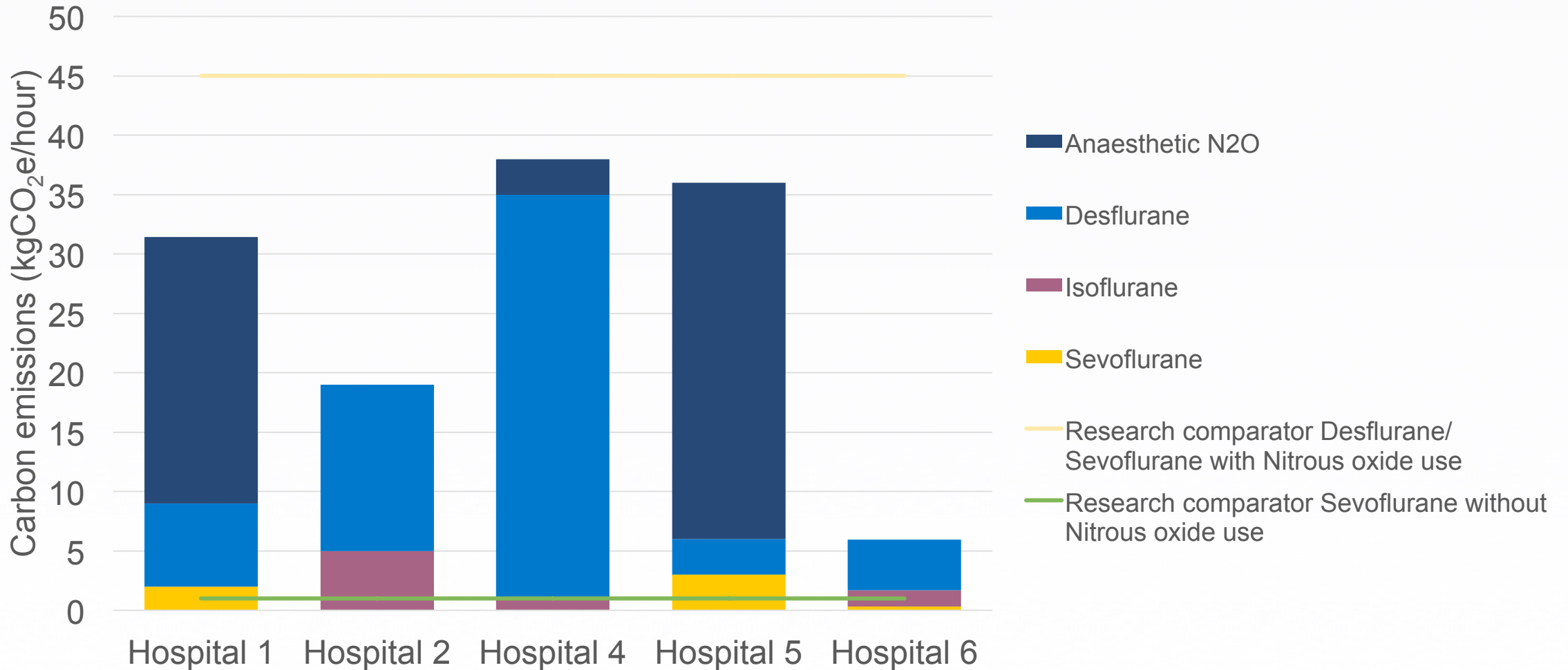
Research comparator carbon emissions per hour of anaesthesia



Ref: Research comparator carbon emissions from anaesthesia: [https://journals.lww.com/anesthesia-analgesia/fulltext/2012/05000/Life\\_Cycle\\_Greenhouse\\_Gas\\_Emissions\\_of\\_Anesthetic.25.aspx](https://journals.lww.com/anesthesia-analgesia/fulltext/2012/05000/Life_Cycle_Greenhouse_Gas_Emissions_of_Anesthetic.25.aspx)

# ANAESTHETIC GASES BENCHMARKING RESULTS

Benchmarked anaesthetic use per hour of surgery



Ref: Research comparator carbon emissions from anaesthesia: [https://journals.lww.com/anesthesia-analgesia/fulltext/2012/05000/Life\\_Cycle\\_Greenhouse\\_Gas\\_Emissions\\_of\\_Anesthetic.25.aspx](https://journals.lww.com/anesthesia-analgesia/fulltext/2012/05000/Life_Cycle_Greenhouse_Gas_Emissions_of_Anesthetic.25.aspx)



# SUSTAINABLE ANAESTHETIC PRACTICE

- The key messages for anaesthetic practice are:
  - 1) Whenever possible use Sevoflurane and only use Desflurane when clinically necessary.
  - 2) Reduce or eliminate the use of nitrous oxide during surgery.
  - 3) Reduce flow rates and train in the use of Closed Circuit Anaesthesia which confers clinical benefits as well as saving costs and reducing carbon emissions.
  - 4) Consider the use of intravenous and regional anaesthesia whenever possible.

# ANAESTHETIC GASES POTENTIAL SAVINGS

- Estimate of potential carbon savings on implementing changes in anaesthetic practice
- 20% of potential savings and 40% of potential savings would be achievable
- 40% of potential savings would be equivalent to an average of 3% reduction in building energy use for these four hospitals
- 393 tCO<sub>2</sub>e is 3 million km in a new car
- Equivalent to 166 cars off the road for these four hospitals (assuming average of 20 thousand km per year)
- If half of European hospitals had similar savings this would be 700 kilotonnes of carbon dioxide savings equivalent to 300,000 cars off the road

<b>Tonnes of CO<sub>2</sub>e</b>	<b>Hospital 1</b>	<b>Hospital 2</b>	<b>Hospital 4</b>	<b>Hospital 5</b>	<b>Grand Total</b>
<b>20% of potential savings</b>	90	56	169	77	393
<b>40% of potential savings</b>	180	75	339	155	749
<b>Potential savings as a proportion of energy emissions</b>	4%	0%	17%	8%	3%



# Whenever possible use Sevoflurane; only use Desflurane when clinically necessary

Global Warming Potential (GWP) is standardised to CO<sub>2</sub> = 1



**Sevoflurane**  
GWP = 130



**Desflurane**  
GWP = 2540



Source: RCoA



Saving a conservative 40% of potential CO<sub>2</sub>e savings from anaesthetic gases for four hospitals would be equivalent to 166 fewer cars on the road

Scaling this up to half of Europe's hospitals could equate to **300 000** cars





# Reduce flow rates through training in closed circuit anaesthesia (CCA)



Closed circuit anaesthesia reduces CO<sub>2</sub>e emissions, and can also benefit patients



**Consider the use of intravenous and regional anaesthesia when possible**



# Reduce or eliminate the use of nitrous oxide in anesthesia

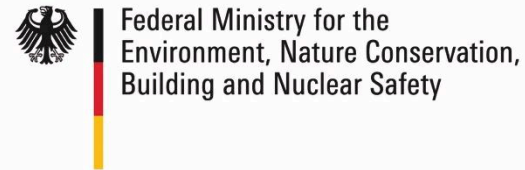


# RESEARCH FOR SUSTAINABLE ANAESTHESIA

Recommendations for further project research:

- 1) Research anaesthetic practice for more hospitals across Europe
- 2) Research into the change for these six hospitals in 1 year
- 3) Further exploration of benchmarking possibilities
- 4) Tighten the current definitions to make them more robust
- 5) Monitoring changes over time 3-5 years





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# Extra Resources:

Healthcare Without Harm, Hippocrates carbon footprinting tool: <http://www.greenhospitals.net/hippocrates/>

GHG Protocol, Accounting Standard, scopes (available in various languages): <http://www.ghgprotocol.org/corporate-standard>

Sustainable Development Unit for the NHS, public health and social care system in England, Carbon Hotspots - breakdown of carbon footprint for different types of health services:

<https://www.sduhealth.org.uk/policy-strategy/reporting/hcs-carbon-footprint/carbon-hotspots.aspx>

Sustainable Development Unit for the NHS, public health and social care system in England, Detailed carbon footprint methods paper - detailed methods for calculating energy, travel, goods and services carbon footprint

[https://www.sduhealth.org.uk/documents/resources/Carbon\\_Footprint\\_carbon\\_emissions\\_2008\\_r2009.pdf](https://www.sduhealth.org.uk/documents/resources/Carbon_Footprint_carbon_emissions_2008_r2009.pdf)

Sustainable Development Unit for the NHS, public health and social care system in England, Wedges - which show the level of change needed to reduce emissions for energy, travel, goods and services

<https://www.sduhealth.org.uk/policy-strategy/reporting/hcs-carbon-footprint/wedges.aspx>

Sustainable Development Unit for the NHS, public health and social care system in England, Marginal Abatement Cost curve (MACC) - for investment and return in finances and carbon

<https://www.sduhealth.org.uk/policy-strategy/engagement-resources/financial-value-of-sustainable-development.aspx>