Anesthesia as a Greenhouse Gas

How Hospitals and Anesthesiologists Can Become Climate Heroes
While Cutting Costs and Improving Patient Outcomes

- Since the 1840s anesthesia has helped manage pain during surgery.

- Most anesthesia gases leave the patient's body unchanged and enter the atmosphere.

- Now, with millions of operations a year the harm is noticeable – and yet we can fix this.
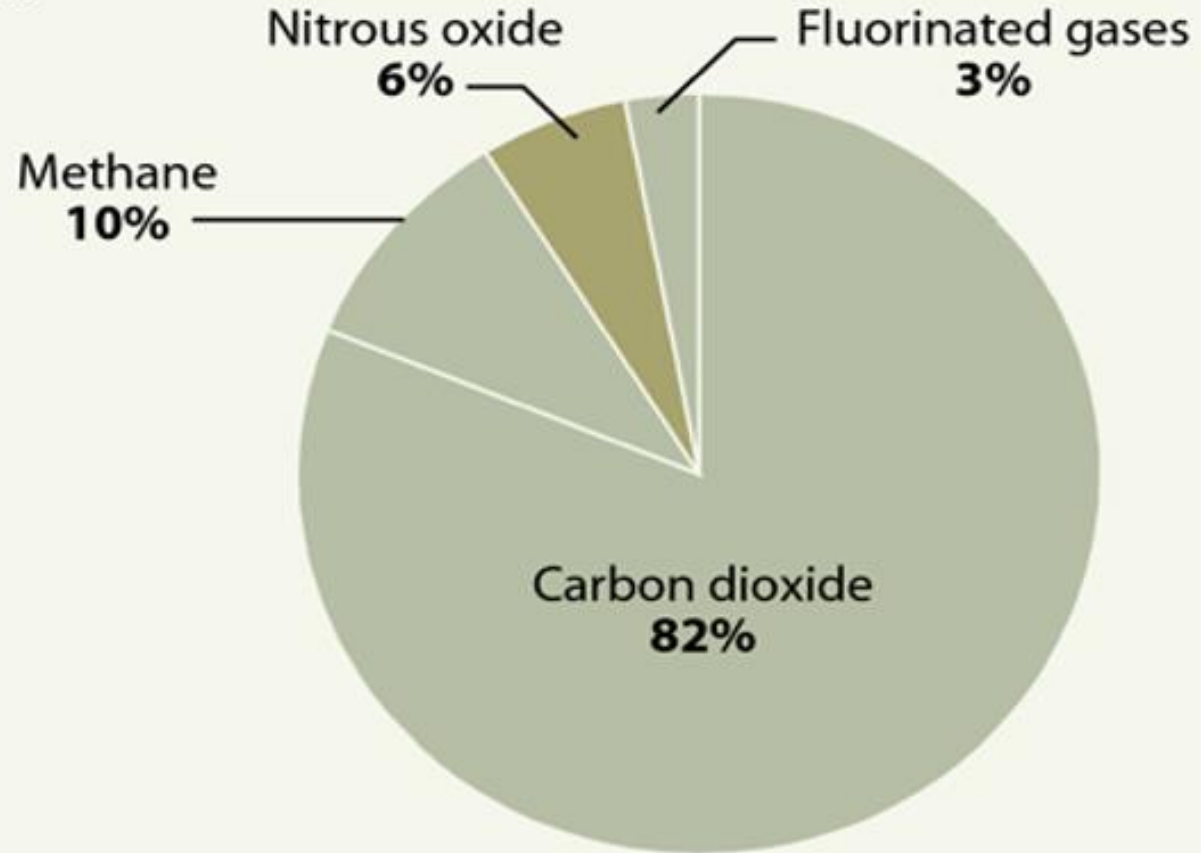
Some of my best friends are greenhouse gases.

Your thinking is SO out of date!

U.S. GREENHOUSE GAS EMISSIONS
2017

Nitrous oxide
6%

Fluorinated gases
3%

Methane
10%

Carbon dioxide
82%

NOTE: Does not total 100% due to rounding

SOURCE: EPA

PAUL HORN / InsideClimate News

Anesthesia is a major source for the 3rd and 4th largest greenhouse gases. Even though their volume is smaller, they cause more global warming than the leading greenhouse gases, partly because they do not degrade quickly.

	Year introduced	Years in the atmosphere	Global Warming Potential (over 100 yrs) compared to CO_2	Est emissions (tons/ year), in 2014
Halothane	1956	1	50 x	250
Isoflurane	1981	3.2	510 x	880
Desflurane	1992	14	2540 x	960
Sevoflurane	1993-5	1.1	130 x	1200
Nitrous oxide	1840s	114	298 x	5,300,000*

* Some of this is from agricultural use.

Use and emissions are expected to grow unless we take action:
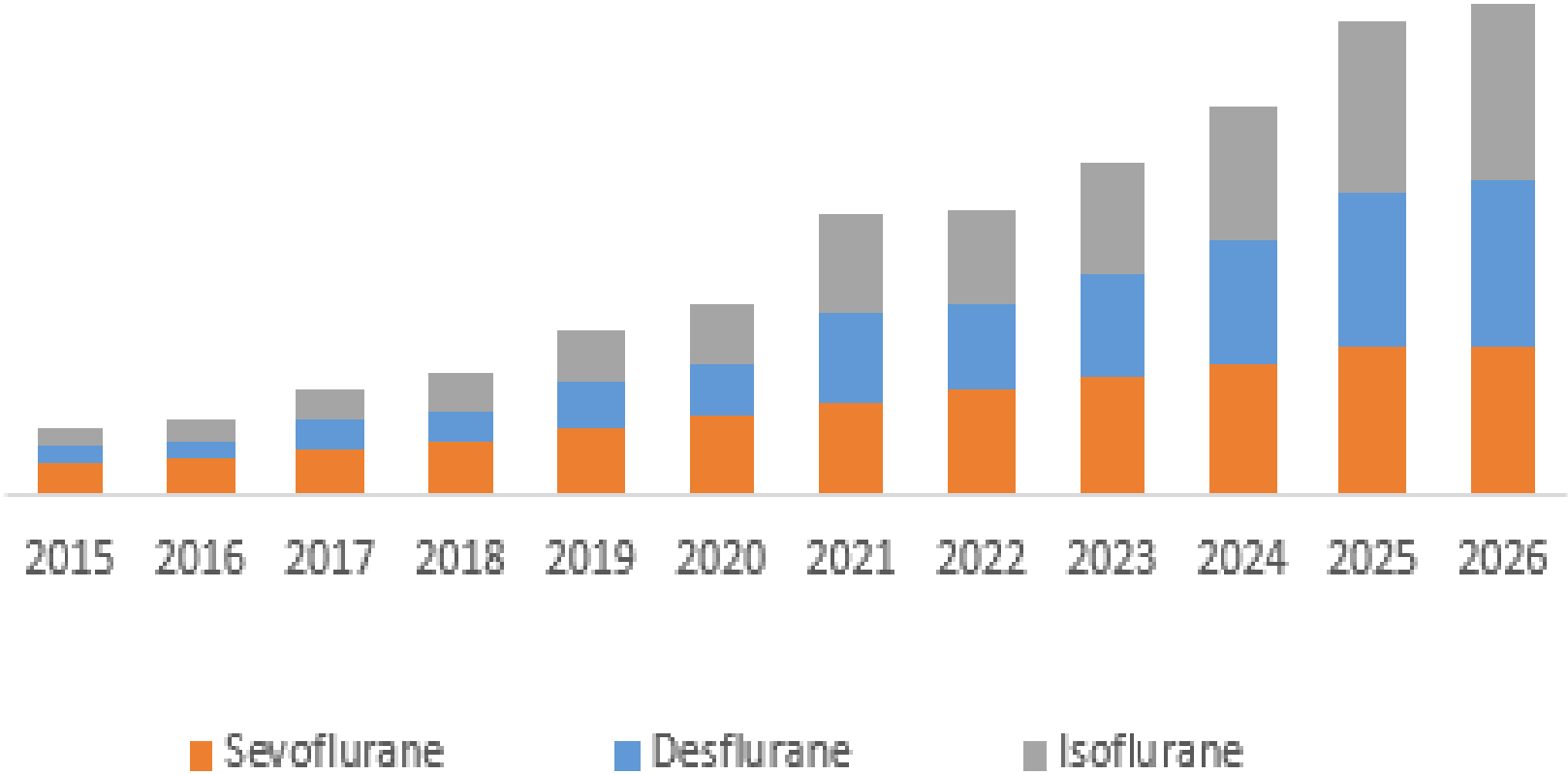
Global Inhalation Anesthesia Markets by Product, 2015-2026 (in million USD) – 3% compounded annual growth to $2.1 billion – *Estimated by market research firm Ameriresearch.*

Some forward-thinking health care systems in the US have begun to change their practices, with **excellent clinical results**:

- Providence Health & Services in Oregon reduced their anesthesia gas impact by 85% when they eliminated desflurane. Their patients **did not need more time** in the OR or the recovery room. This measure also cut gas costs by **more than half**.

- Yale-New Haven Health System removed desflurane from its formulary in 2013.
- Kaiser Permanente on the West Coast has been progressively eliminating desflurane since 2014.

Some individual clinicians have changed their practices, and if you know of any, we would love to hear their stories

Sherman et al, "Inhaled Anesthesia Challenge," *ASA Monitor,* April 2020.

Easy anesthesia substitutes to reduce environmental harm:

- Choose sevoflurane instead of isoflurane or desflurane where possible
- Use O_2/air mixture instead of N_2O/air mixture
- Reduce fresh gas flow rates
- Where possible, use propofol, IV anesthesia, neuraxial, regional or peripheral nerve blocks
- For childbirth, encourage natural birth techniques or epidurals

Equipment can also reduce environmental harm

- Use circle breathing systems to reduce fresh gas and emissions
- Set system alerts to warn if the flow rate exceeds a pre-set limit
- Add photochemical air purification system using UV light for ethers and N_2O
- Install capturing systems to reclaim volatile gases for reuse
- Install catalytic converters to eliminate waste N_2O
- Install anesthesia recycling systems
- Retrofit existing anesthesia equipment with supplemental waste gas trapping, destroying, scavenging or sequestering equipment
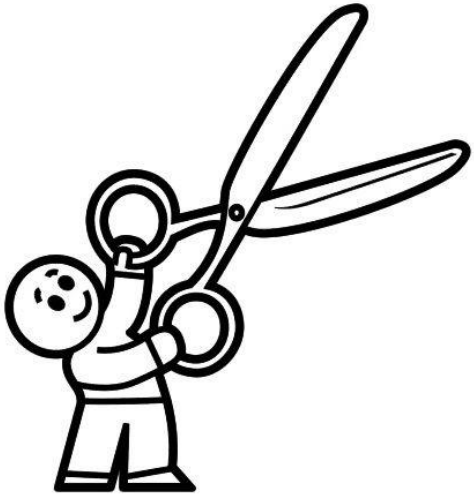
Voluntary cutbacks can be fast and effective. If not … the climate crisis is real, and if steps are not taken quickly enough, surgical centers may find governments stepping in. Possible results:

- Monitoring and regulation of use or emissions
- Site licenses required to use anesthesia gases with limits, inspections and audits
- Taxes on anesthesia gases
- Joint Commission might include sustainability equipment and techniques in their review process
- Medicare and Medicaid might start requiring sustainability measures

Wouldn't it be better to be proactive?

And you can **save money**, while reducing emissions and maintaining high standards of care!

- Oregon's Providence Health Systems saved $500,000 per year at its 8 hospitals
- Virginia Mason Hospital (Seattle) saved $30,000 a year
- The University of Wisconsin Hospital saved $120,000 annually by reducing though not eliminating desflurane
- University of Utah Hospital stopped using desflurane when desflurane cost $14 per hour while isoflurane cost only $0.53. Switching reduced the hospital's greenhouse gas emissions by 25%.

Suggestions for Making the Switch

- Create a working group to investigate methods for reducing waste anesthesia gas
- Have your working group include clinicians and be led by a clinician
- Begin monitoring the amount and type of anesthesia used by each clinician. Calculate the greenhouse gas tonnage resulting each month
- Make this data available so people can track the impact of their choices
- Publicly recognize progress made in reducing anesthesia waste emissions. This can be internal or shared with local media for wider recognition

Side effects of reducing waste anesthesia gas

- Cut back on global warming
- Create good will and credibility in your communities
- Reduced occupational risk for operating room personnel
- Money saved can be spent elsewhere
- Increased likelihood of a decent life for your children and grandchildren

Resources:

- A4CH White Paper on Anesthesia as a Greenhouse Gas
  https://www.a4ch.org/publications
- *ASA Monitor*'s Inhaled Anesthetic 2020 Challenge
  https://monitor.pubs.asahq.org/article.aspx?articleid=2763617
- Health Care Without Harm's Health Care Challenge https://noharm-uscanada.org/healthcareclimatechallenge
- Gassing Greener – a free smartphone app to estimate the greenhouse gas emissions of a particular anesthesia plan or purchase
  https://downloads.zdnet.com/product/2129-78391433/

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