green Radiotherapy Framework (gRTF)

The green Radiotherapy Framework (gRTF) contains actions that all healthcare professionals in radiotherapy can take to contribute to the NHS response to climate change.

This framework is broken down into 3 levels of action:

	**Gold actions:** Actions that carry a weight of 3
	**Silver actions:** Actions that carry a weight of 2
	**Bronze actions:** Actions that carry a weight of 1

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Hypofractionation of radiotherapy when evidence based

Hypofractionated or shortened radiation regimens (including SABR) have been documented to attain similar efficacy and safety as conventional and longer radiation courses for multiple tumour sites. By **reducing the number of treatments, patient travel and machine time are reduced**, thereby **decreasing carbon emissions and energy demands** of radiotherapy[1-7].

Example actions

- Regular review and appropriate implementation of hypofractionated radiotherapy treatments, where clinically appropriate as per recommended practice at the time.
- Incorporation of boosts as simultaneous rather than sequential treatments where safe and clinically effective to do so, e.g. IMPORT HIGH – SIB in breast radiotherapy.
- Single fraction of radiotherapy rather than a fractionated course for painful bone metastases.
- Consider trial options which promote sustainability, e.g. FAST-FORWARD BOOST.

Resources/case studies

FAST Forward (breast) and PACE-B (prostate).

Saving - 300 kgCO_2e per patient[8,9]

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Patient travel

Reduce patient travel miles related to radiotherapy service delivery and **boost sustainable travel**[10,11].

Example actions

Implementation of ways to reduce the carbon footprint of patient transport (see also Silver award for *review*):

- Provide the option for virtual visits if feasible, safe and clinically appropriate, e.g. for post radiotherapy check.
- Optimise hospital visits to minimise the number of trips to hospital for patients, e.g. imaging and treatment on the same day where possible.
- Reduce patient journey length, e.g. through reviewing opportunities to deliver treatment more locally to reduce patients travelling out of area; or reviewing referral boundaries to ensure patients are not directed to a longer journey.
- Promote active travel (e.g. cycling and walking), where safe and feasible.
- Promote public transport, such as shuttle buses.

Resources/case studies

Review your Trust/Health Board Green Plan to understand the action your Trust/Health Board is taking to reduce emissions from travel and transport.

The NHS Net Zero Travel and Transport Strategy outlines the NHS strategy to reduce emissions from travel and transport, and examples of action which can be taken.

In Sheffield a cancer charity provides daily minibuses from three locations around the catchment area: https://www.westonpark.org.uk/transport-service

Saving - 100 $kgCO_2e$ per patient[8]

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Building design and infrastructure[10,12]

Example actions

- Review existing infrastructure and interventions that could have improved sustainability (e.g. insulation).
- Any new building design to be net zero compatible.
- LED lighting, air conditioning and cooling, building fabric, space heating and ventilation.
- On-site renewable energy and use of green space.
- Work with estates to implement sustainable measures.

Resources/case studies

https://bregroup.com/ - for certification

Sustainable bunkers. Reuse old material, optimise shape and construction to minimise material use, e.g. https://www.veritas-medicalsolutions.com/verishield-modular-shielding/

Saving - Between **14 kgCO_2e** and **56 kgCO_2e** per patient is possible[8,10]. With a **0.1%** reduction in footprint for LED lighting[8].

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Time in job plan for green radiotherapy department

Example actions

- Clinical Lead for green radiotherapy in the department.
- Protected time to focus on sustainability.
- Engage with the Trust-wide/Health Board-wide sustainability team, gather and respond to patient and staff suggestions, celebrate and share achievements.
- Integrate green initiatives into governance and reporting (this might include aligning with Trust/Health Board green plan priorities, e.g. for travel)

Resources/case studies

Training with the Sustainable Healthcare Network

OR

Fellowship at sustainablehealthcare.org.uk

Saving – No appropriate literature to quantify

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Sustainable procurement models[10]

Example actions

- Ensuring that procured items are from appropriately sustainable companies.
- Award contracts to suppliers using a scoring system. Ensure sustainability is part of any scoring matrix and is used to robustly evaluate contracts and suppliers.
- Embedding net zero into business cases / tendering – question a company's environmental sustainability.
- Procurement colleagues in the radiotherapy department familiar with requirements in the net zero supplier roadmap.

Resources/case studies

A useful website for this is the sustainability section within the NHS supply chain: https://www.supplychain.nhs.uk/sustainability/

Saving – The supply chain represents over **60%** of health care's carbon footprint[10] but this is likely lower in radiotherapy. Considering all possible savings on consumables, construction and maintenance of linacs and scanners would give a maximum saving of **145 kgCO_2e** per patient[8].

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Staff travel[10,13-15]

Example actions

- Review and encourage active transport schemes – establish a green travel plan with a set departmental target based on this review.
- Online/at home and flexible working where (clinically) appropriate.
- Encourage non-flight based options for conference travel, e.g. virtual attendance, rail travel.
- Cycling and car-share schemes.
- Cycle hubs.

Resources/case studies

Promotion of electric vehicles (car/bikes), e.g. Greener NHS.

Flexibility of working hours to allow use of public transport. The NHS has a Flexible working toolkit.

Saving – 1 staff member who lives 10 miles way choosing to go via bus rather than a car would save **10 kgCO_2e** over 5 working days[16].

1 staff member from Birmingham choosing to travel to and from Amsterdam by train rather than plane would save **150 kgCO_2e**[16].

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Patient travel[8,10,11]

Example actions

- Review of patient transport and routes (see also Gold award for *implementation*).
- Promotion of public transport/shuttle buses.
- Research into patient options for travel and public transport routes.
- Review of referral boundaries.
- Coordinate appointments on the same day, where possible, to reduce patient travel.

Saving – 1 patient who lives 15 miles way choosing to go via train rather than a car would save **130 kgCO_2e** over 20 fractions[16]

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LINAC energy use and SF_6 leakage[17,18]

Example actions

- Reduce LINAC idle/stand-by time (see also *measure and review* in Bronze action).
- Turn off the linac when it is not in use and ensure efficient use of time it is switched on.
- Review hours of LINAC operation, e.g. evening operation. LINAC evening operation may reduce the hours it is turned on/on stand-by mode.
- Review SF_6 regulations to ensure compliance - these require management of gas leakage, capture and reprocessing.
- Consider the carbon emissions and energy requirements associated with imaging to ensure energy efficiency and sensible use of the machines.

Resources/case studies

https://www.hey.nhs.uk

Saving – SF_6 captured gives ~ **3 kgCO_2e** reduction per patient[17]. 50% reduction in linac energy → reduction of 0.4% ~**2kgCO_2e per patient**[8].

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Audit/QiP

Example actions

- Consideration of sustainability impact into departmental audits and Quality Improvement Program (QiP).
- Participate in a Centre for Sustainable Healthcare (CSH) Green Team Competition.
- Building workforce capability through training (e.g. driving uptake of training offers available to all NHS staff on climate change and health).

Resources/case studies

Use of SusQI framework

Sustainable healthcare toolkit: https://sustainablehealthcare.org.uk/susqi

https://sustainablehealthcare.org.uk/

Saving – If Green Team projects were implemented **~1.5kgCO_2e** per patient[19,20]

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Regular communication with staff

Example actions

- Promotion of sustainability within the radiotherapy department. Meetings with sustainability as a regular agenda item and to set up a departmental sustainability group - set up a multidisciplinary working group for green radiotherapy.
- Staff bulletins and incorporation into induction programme for new staff.
- Consider key stakeholders, align with national groups, e.g. Greener NHS, and importantly engage with the Trust/Health Board wide sustainability team.

Resources/case studies

- Incorporate sustainability as a standing item on agendas.
- Gather and respond to patient and staff suggestions, celebrate and share achievements of sustainability related actions.
- Pathways for raising problems with Trust/Health Board estates.

Saving – No appropriate literature to quantify

Medical waste[10,21,22]

Example actions

- Replace disposable with reusable devices/materials (device reuse/reduce single-use plastics).
- Encourage patients to bring their own reusable bottles for pre-hydration.
- Made-for-reuse PPE items.
- Reusable sharps bins.
- Use reusable or recyclable immobilisation devices. Review circular economy practices, e.g. tungsten is recyclable.

Resources/case studies

GOSH cutting down use of plastic gloves: Greener NHS » Great Ormond Street Hospital – reducing single use plastics case study (england.nhs.uk)

Saving – If a reusable apron is worn instead of a single use apron and is used 10 times ~**0.7 kgCO_2e** would be saved[21]

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Concomitant chemotherapy and radiotherapy[23]

Example actions

- Reduce waste and correct disposal of non-used oral chemotherapy and other medications when given alongside radiotherapy treatments.
- Review medications to ensure no unused medications prescribed – conservative prescribing.
- Encourage patient to bring in any unused medications to dispose of safely.

Resources/case studies

Reduction in medicine waste – see case studies from the resources section of networks.sustainablehealthcare.org.uk (apply filter to medicines theme).

Deprescribing medicine reviews: Deprescribing Medication Reviews | Sustainable Healthcare Networks Hub

Saving – Limited literature to quantify. Strategies to reduce drug wastage have been estimated to reduce drug spending by 17%[24]

LINAC idle time

Example actions

- Measure and review LINAC idle/stand-by time (see also reduce in silver action).
- Record and review LINAC energy use[17].

Saving – No savings made by measuring and reviewing only

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Electricity use minimised[8,25,26]

Example actions

- Monitor and reduce energy use within the department, e.g. through use of NightWatchman.
- Computer electricity use minimised. Equipment and lighting off when not in use.
- Embed actions from the Technology Code of Practice, e.g. ensuring device circularity, cloud-based storage used.
- Delete data when safe to do so. A recent study has found that servers' emissions represent 4.7 % of the total emissions, mainly due to the large amount of data stored for long periods of time[14]. Currently, the average amount of data stored is 3 GB per treatment.

Resources/case studies

- Switch off overnight and at weekends. Also consideration of other devices, e.g. fans/air-conditioning.
- Occupancy-based light switches.
- Nightwatchman link: https://help.1e.com/NWE/en/818710-828078-nightwatchman-release-notes.html
- Reduce data storage on computers – The Royal College of Radiologists recommends keeping radiotherapy records for a minimum of 8 years after death. Statement on the retention of oncology records (amended November 2023) | The Royal College of Radiologists (rcr.ac.uk)
- Automated email every Friday to remind people to turn off electronics for the weekend.

Saving – A PC and monitor turned off for 3 nights over a weekend saves ~ **1kgCO_2e** a month[27]

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Review and reduce non-medical waste

Example actions

- Review/reduce use of paper where possible and use recycled paper when needed.
- Digital leaflets for patient information and electronic communication systems for patients. Consider use of QR codes.
- Electronic consent forms/paperless plan sign-off.

Resources/case studies

For information on paper-lite or paperless working see here: https://www.bmj.com/content/382/bmj.p2050:

Saving – Sending a letter uses about **0.2 kgCO_2e** whereas an email uses about **0.004 kgCO_2e**, 50 times less[28]

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