Supplementary Table 1. Extraction table of included studies with data on year of publication, country, study objectives, study design, participants/setting, and outcomes

Title	Author(s)	Year	Country	Objectives	Research design	Participants/setting	Outcomes
Climate change and artificial intelligence in healthcare: Review and recommendations towards a sustainable future	Ueda et al.[25]	2024	Japan	To explore the intersection of climate change and AI in healthcare and the role of AI in healthcare workflows optimisation	Review	N/A	Waste resources reduction, patient waiting times minimisation, equipment use optimisation, imaging time reduction, improved diagnostic accuracy, tele-radiology and tele-consultatio
Environmental Sustainability and AI in Radiology: A Double-Edged Sword	Doo et al.[5]	2024	Canada	To discuss the dual role of AI in environmental sustainability and radiology; strategies and opportunities for AI-related emissions decrease and sustainability improvement in radiology	Review	N/A	Equipment use optimisation, scan time reduction, minimisation of low-value imaging, opportunistic screening for incidental findings, optimisation of contrast agents use, patient scheduling and no-show prediction
MRI Gadolinium-Based Contrast Media: Meeting Radiological, Clinical, and Environmental Needs	Bendszus et al.[26]	2024	Switzerland	To explore the optimisation of gadolinium contrast enhancement (CE) through cutting-edge MRI techniques and the application of AI	Review	N/A	Synthetic (virtual) CE MRI images generated from low-dose CE or non-CE images with the use of DL models, to reduce contrast
Reducing energy consumption in musculoskeletal MRI using shorter scan protocols, optimized magnet cooling patterns, and deep learning sequences	Afat et al.[37]	2025	Germany	To investigate MRI energy consumption and identify strategies for energy efficiency improvement on musculoskeletal MRI through AI incorporation	Observational study	Energy consumption measurements performed on 2 MRI scanners	Reduction in energy consumption: 72% with DL 31% with economic protocols 30% for the cooling system during non-scanning hours (Eco Power Mode) 18% (economic) ~ 71% (DL) scan time reduction 5422kg of CO_2 per scanner per year with DL projection
The effect of radiology on climate change: Can AI help us move toward a green future?	Ben Salem et al.[27]	2024	France	To discuss how AI can assist radiological departments to reduce their environmental impact	Review	N/A	AI systems for a) reduction of contrast agent doses in CT and MRI exams, b) reduction of MRI scan time (sequence optimisation), resulting in lower energy consumption per exam
Clinical applications, safety profiles, and future developments of contrast agents in modern radiology: A comprehensive review	Najjar[28]	2024	Australia	To highlight the environmental impact and the potential integration of AI on contrast agent management	Review	N/A	AI can be used for tailoring contrast agent dosage in each patient's characteristics, assuming a dose reduction through optimisation
The potential role of artificial intelligence in sustainability of nuclear medicine	Currie et al.[29]	2024	Australia	To explore how AI and emerging technologies can enhance the environmental sustainability of nuclear medicine practices.	Review	N/A	Identified AI's potential role in reducing waste, redundancy, enhancing energy efficiency, as well as supporting sustainability across 5 domains (social, human, economic, ecological, environmental)
Cardiovascular Imaging, Climate Change, and Environmental Sustainability	Gunasekaran et al.[30]	2024	Canada	To highlight the intersection of cardiovascular imaging with climate change, quantify its environmental impact, and propose strategies for sustainable clinical practice.	Review	N/A	Role of AI in shortening MRI scan times and energy use, helping reduce GBCA dose by creating synthetic images and AI-augmented low-dose imaging.
Use of AI in Cardiac CT and MRI: A Scientific Statement from the ESCR, EuSoMII, NASCI, SCCT, SCMR, SIIM, and RSNA	Mastrodicasa et al.[23]	2025	Netherlands	To summarise current evidence and provide a joint scientific consensus on the clinical use of Artificial Intelligence in cardiac CT and MRI.	Review	N/A	Role of AI on shortening cardiac MRI scan times with accelerated acquisition times, improving the operational efficiency of scanners to reduce idle time, optimising the use of decision support tools to reduce low-value imaging, and generating synthetic higher spatial resolution and signal images from low-field-strength MRI.
Environmental Sustainability and MRI: Challenges, Opportunities, and a Call for Action	Chaban[8]	2024	Canada	To explore environmental challenges associated with MRI and propose opportunities and strategies for reducing MRI's carbon footprint.	Review	N/A	Offers practical strategies, AI-based protocols as well as eco-mode, scheduling optimisation, contrast agent stewardship, helium reuse.
Considerations for environmental sustainability in clinical radiology and radiotherapy practice: A systematic literature review and recommendations for a greener practice	Anudjo et al.[40]	2023	UK	To explore and integrate existing evidence on environmental sustainability in clinical radiology and radiotherapy while providing guidance for greener practice	Systematic Review	14 included studies (qualitative, quantitative, mixed-methods)	AI used for image reconstruction in CT, to reduce energy needed for each scanning case.
Low-Carbon MRI: Acceleration Strategies to Reduce Emissions and Expand Imaging Capacity	Woolen et al.[38]	2025	USA	To evaluate how MRI acceleration techniques can reduce energy consumption, emissions, and imaging time, thereby improving sustainability and access. The paper explores how AI-based acceleration methods of DL reconstruction can reduce scan time and, by extension, energy use and carbon emissions in MRI practice.	Observational study	N/A	Up to 80% reduction in carbon emissions per MRI exam with DL-based acceleration. Increased scanner throughput. Maintained or improved image quality. DL can reduce scan times by 30–80%. Each reduction in scan time translates to proportional energy and CO_2 savings. Improved scanner throughput that leads to more efficient resource use.
The green and sustainable radiology department	Mariampillai et al.[31]	2023	UK	Explores strategies that reduce the environmental footprint of radiology departments, focusing on energy, water, materials and waste across imaging modalities. Highlights key issues and examples of sustainable practices to empower healthcare personnel to make a change within their department.	Review	N/A	Role of the NYU FastMRI Dataset to accelerate scans and reduce energy used.
Society for Cardiovascular Magnetic Resonance recommendations toward environmentally sustainable cardiovascular magnetic resonance	Hanneman et al.[24]	2025	USA	To review and recommend actions and strategies to allow for CMR operation with improved sustainability.	Review	N/A	Use of AI for accelerated imaging and reduced energy consumption. Improved efficiency and sustainability due to AI-powered low-field imaging.
Optimal Large Language Model Characteristics to Balance Accuracy and Energy Use for Sustainable Medical Applications	Doo et al.[39]	2024	USA	To explore differences in energy use when using different LLM types and sizes	Observational study	Five different billion parameter sizes of 2 open-source LLMs	Smaller fine-tuned LLMs were more sustainable than larger general-purpose LLMs, using less energy without compromising accuracy.
AI-driven assessment of over-scanning in chest CT: A systematic review and meta-analysis	Bani-Ahmad et al.[41]	2025	Ireland	To explore the role of AI in addressing manual over-scanning in chest CT imaging	Systematic Review	Five studies employing AI to assess over-scanning in chest CT	These models accurately determine the extent of over-scanning, demonstrating strong agreement with radiologist evaluations
Enhancing Environmental Sustainability in Diagnostic Radiology: Focus on CT, MRI, and Nuclear Medicine	Leswick et al.[6]	2025	Canada	To summarise energy and waste burdens of CT/MRI/nuclear imaging	Review	N/A	AI used to shorten scan times and decrease energy consumption in MRI, minimise doses in nuclear medicine via AI-based dosimetry, and benefit from AI-powered remote scanning and reading
Sustainable deep learning-based breast lesion segmentation: impact of breast region segmentation on performance	Narimani et al.[35]	2025	Norway	To investigate the impact of breast region segmentation on the performance of DL-based breast lesion segmentation in breast DCE-MRI	Observational study	59 DCE-MRI examinations, employing UNet++ architecture as the segmentation model	+50% accuracy and -450% energy consumption
The Environmental Impact of Medical Imaging Agents and the Roadmap to Sustainable Medical Imaging	Pichler et al.[32]	2025	The Netherlands	To review the environmental impact of contrast agents and propose sustainable design	Review	N/A	AI can be used for denoising of ultra-low-dose images and for minimising contrast doses
Deep Learning in Knee MRI: A Prospective Study to Enhance Efficiency, Diagnostic Confidence and Sustainability	Reschke et al.[36]	2025	Germany	To evaluate a combination of DL-reconstructed parallel acquisition technique and SMS acceleration imaging in comparison to conventional knee imaging	Observational study	34 participants who underwent knee MRI	Reduced scan time (-41%) and energy consumption when combining DL with SMS
Exploring environmental sustainability of artificial intelligence in radiology: A scoping review	Champendal et al.[42]	2026	Switzerland	To synthesise existing literature on the environmental sustainability of AI in radiology	Scoping review	13 articles (9 research articles and 4 reviews)	Reported metrics included emissions, training time, power use effectiveness, equivalent distance travelled by car, energy demands, and water consumption
Leveraging AI solutions for sustainable practice in pediatric radiology: a practical guide and an educational tool	Tsai[34]	2026	USA	To discuss AI-powered ways to enhance environmental sustainability in pediatric imaging	Review	N/A	A tree-pillar model was proposed as a sustainable practice in pediatric radiology
Beyond green: sustainability in nuclear medicine practice	Currie[33]	2025	Australia	To discuss different ways in which AI can even promote or threaten environmental sustainability	Review	N/A	AI to be used for workflow improvements, image denoising, scan acceleration, waste reduction

*Country of included studies has been reported according to the corresponding author's country and postal address. AI, artificial intelligence; MRI, magnetic resonance imaging; CT, computed tomography; CE, contrast enhancement; DL, deep learning; GBCA, gadolinium-based contrast agent; CMR, cardiovascular magnetic resonance; LLM, large language model; DCE-MRI, dynamic contrast-enhanced magnetic resonance imaging; SMS, simultaneous multislice; N/A, not applicable; CO_2, carbon dioxide.

Supplementary Table 2. Extraction table of included studies with data on AI purpose, AI system used, imaging modality, measured effect with units, comparators, and AI's own cost/energy

Study	Design	AI purpose	AI system type (e.g., LLM, DL, ML)	Modality (e.g., MRI, CT)	Measured effect with units (e.g., CO2, kWh)	Comparator (if applicable)	AI's own cost/energy (if measured)
Doo et al. (2024)[1]	Narrative review	• Patient scheduling and no-show prediction • Virtual CE images • DL-accelerated MRI sequences • Automatic scanner idle time • Assisted diagnosis • Training of LLMs	ML, DL, LLM	MRI, CT	n/a*	n/a	n/a*
Leswick et al. (2025)[2]	Narrative review	• Scan parameter optimisation to reduce scan time for energy saving • Radiopharmaceutical dose optimisation	ML, DL	MRI, CT, SPECT, PET	n/a*	n/a	n/a*
Chaban et al. (2024)[3]	Narrative review	• DL-accelerated MRI sequences • DL-enhanced 3D MRI sequence resolution • Automated MRI planning • Prediction of CE images using reduced GBCA dose • Automatic workstation idle time	ML, DL	MRI, workstations (e.g., PACS)	n/a*	n/a	n/a*
Mastrodicasa et al. (2025)[4]	Scientific statement	• Patient positioning and isocentre alignment • DL-accelerated CMR sequences • LLM-assisted CMR imaging reporting • Automation of scanning protocols • AI-assisted quantification functions • Image reconstruction	ML, DL, LLM	MRI, CT	n/a*	n/a	n/a*
Hanneman et al. (2025)[5]	Narrative review	• LLM-assisted CMR reporting • Image reconstruction • Contrast agent dose reduction in CMR • Virtual CE images	DL, LLM	MRI	n/a*	n/a	n/a*
Ueda et al. (2024)[6]	Narrative review	The authors point out that AI systems in healthcare can improve diagnostic accuracy, operational efficiency, workflows, and assist in treatment planning, with radiology being the primary adopter of AI.	n/a	Healthcare (general)	n/a*	n/a	n/a*
Bendszus et al. (2024)[7]	Narrative review	• Virtual CE brain images from reduced GBCA dose for brain imaging • Prediction of CE MS lesions from non-contrast sequences	DL	MRI	n/a*	n/a	n/a*
Ben Salem et al. (2024)[8]	Editorial	AI in radiology can help optimise MRI sequences to reduce scan times and reduce administered contrast agents in CT and MRI examinations.	n/a	MRI, CT	n/a*	n/a	n/a*
Najjar (2024)[9]significantly enhancing the visualisation of internal structures and improving diagnostic accuracy across X-rays, computed tomography, magnetic resonance imaging (MRI	Narrative review	AI-driven (ML and DL) technologies can help optimise the administered contrast agent doses in MRI and CT examinations, and predict and identify risk factors associated with contrast agent hypersensitivity reactions and other complications.	n/a	MRI, CT	n/a*	n/a	n/a*
Currie et al. (2024)[10]	Editorial	• Production of digital twins for radiation dosimetry and pre-clinical imaging • Pseudo-CT attenuation maps for radiation dose reduction or attenuation correction • Triaging of scans for priority reporting • Image AI-assisted interpretation • Patient information, student teaching and learning	DL, LLM, GANs	Nuclear medicine (PET, SPECT)	n/a*	n/a	n/a*
Gunasekaran et al. (2024)[11]the delivery of health care generates substantial\natmospheric greenhouse gas (GHG	Narrative review	• Synthetic and virtual CMR CE images • DL-accelerated CMR images • Automated planning of CMR • Enhancement of low SNR images in low-field CMR	n/a	MRI	n/a*	n/a	n/a*
Mariampillai et al. (2023)[12]	Narrative review	AI-accelerated MRI protocols	NYU FastMRI Dataset	MRI	n/a*	n/a	n/a*
Pichler et al. (2025)[13]	Narrative review	• Minimisation of contrast agent doses and scanning time • Advanced image reconstruction, denoising, artefact removal, and attenuation correction in low-dose imaging	ML, DL	MRI, CT	n/a*	n/a	n/a*
Currie (2025)[14]	Narrative review	• Real-time workflow and radionuclide demand forecasting for over-production minimisation • R&D using digital twins for in silico pre-clinical studies • Pseudo-CT attenuation maps, radiation dose reduction, and noise reduction • Reactive or predictive radiation dosimetry • AI-assisted reporting • Logistic scenario simulations • AI-assisted image acquisition, reconstruction, and post-processing	ML, DL, GenAI	Nuclear medicine (SPECT, PET), CT	n/a*	n/a	n/a*
Tsai (2026)[15]	Narrative review	• Scanner use optimisation and AI-assisted scheduling • AI-assisted guidance in performing examinations • Patient-specific imaging cost classifier • Automatic consumable ordering • Prediction of equipment failure, schedule maintenance • Administrative tasks streamlining • Patient information, report summaries, visual explanations • AI-assisted medical image post-processing	ML, DL, LLM, RAG, 3D UNet	MRI, CT, PET, X-ray, US	n/a*	n/a	n/a*
Anudjo et al. (2023)[16]	Systematic review	The authors point out that advanced reconstruction algorithms can reduce overall energy emissions per examination and eliminate the need for repeat scans.	n/a	CT	n/a*	n/a*	n/a*
Bani-Ahmad et al. (2025)[17]	Systematic review and meta-analysis	Over-scanning identification in chest CT scans	CNNs (2D ResNet, U-Net, NR)	CT	n/a*	n/a*	n/a*
Champendal et al. (2025)[18]	Scoping review	• Tumour segmentation and classification • Disease prediction and grading • Image denoising and reconstruction	ML, DL	MRI, CT, X-ray, Mammography	n/a*	n/a	n/a*
Narimani et al. (2026)[19]	Cross-sectional study	AI-assisted breast lesion segmentation (BLS) in MRI CE images	DL (UNet++)	MRI	Incorporating BRS into BLS model training for a targeted volume reduced carbon footprint by **78%**.	Compared to three other training approaches, either incorporating BRS into BLS or not, and including more imaging data.	Incorporating BRS into BLS model training for a targeted volume reduced computational time by approximately **79%**.
Reschke et al. (2025)[20]	Cross-sectional study	DL-accelerated sequences for knee MRI	DL	MRI	**DL-accelerated four-fold PAT imaging (P4):** 63% energy consumption reduction per exam (0.34 kWh energy saving), 1774.8 kWh annual energy saving (532.44€ cost saving) **P4 and two-fold SMS DL-accelerated imaging (P4S2):** 72% energy consumption reduction per exam (0.39 kWh energy saving), 2035.8 kWh annual energy saving (610.74€ cost saving)	Compared to conventional two-fold PAT imaging acceleration mode (P2)	n/a
Afat et al. (2025)[21]	Cross-sectional study	DL-accelerated sequences for musculoskeletal MRI (hip, knee, spine, shoulder)**	DL (DeepResolve, Siemens Healthineers)	MRI	**Hip:** 50 – 69% energy consumption reduction per exam (3.3 – 5.2 kWh energy saving and 1.3 – 2.0 kg CO_2 emission*** reduction) **Knee:** 45 – 89% energy consumption reduction per exam (2.3 – 6.3 kWh energy saving and 0.9 – 2.4 kg CO_2 emission*** reduction) **Spine:** 46 – 66% energy consumption reduction per exam (3.5 – 5.8 kWh energy saving and 1.3 – 2.2 kg CO_2 emission*** reduction) **Shoulder:** 51 – 76% energy consumption reduction per exam (3.6 – 6.5 kWh energy saving and 1.4 – 2.5 kg CO_2 emission*** reduction) **All body regions:** 31 – 72% annual energy consumption reduction per scanner (7032€ or 7617$ savings or 5422 kg CO_2 emission reduction projection)	Compared to economic and baseline scanning modes.	No standalone measurements for computational power demands of the DL reconstruction algorithm were performed. The authors state that any energy penalty from running the DL reconstruction algorithm was heavily outweighed by the massive savings of shorter scan times and scanner operations.
Woolen et al. (2025)[22]	Cross-sectional study	DL-accelerated MRI protocol	DL (DeepResolve, Siemens Healthineers)	MRI	**Annual % energy consumption reduction:** 10.7 – 46.1% or 141.1 – 867.1 MWh/year (all MRI scanners, working scenarios, and acceleration modes) **Annual CO_2eq emission**** reduction:** 98.6 – 606.1 MT/year (all MRI scanners, working scenarios, and acceleration modes) **Annual financial savings ($):** 18348 – 112719$/year (all MRI scanners, working scenarios, and acceleration modes)	Compared to conventional two-fold PAT imaging acceleration mode (P2)	n/a
Doo et al. (2024)[23]	Cross-sectional study	Identification of 13 CheXpert disease labels from chest X-ray reports	A specialised fine-tuned LLM (LMSYS Org's Vicuna 1.5)	Reporting	**Fine-tuned model (7 and 13 billion parameters):** 78 – 85% GPU energy consumption reduction (0.46 and 1.53kWh energy saving) per prompted task for disease label identification	A general-purpose LLM (Meta's Llama 2)	**Fine-tuned model (7 and 13 billion parameters):** 0.13 and 0.28 kWh per prompted task **General-purpose model (7 and 13):** 0.59 and 1.8 kWh per prompted task

BRS, breast region segmentation; CE, contrast-enhanced; CMR, cardiovascular magnetic resonance; GBCA, gadolinium-based contrast agent; MT, metric tons; PAT, parallel acquisition technique; R&D, research and development; SMS, simultaneous multi-slice; AI, artificial intelligence; LLM, large language model; DL, deep learning; ML, machine learning; MRI, magnetic resonance imaging; CT, computed tomography; SPECT, single-photon emission computed tomography; PET, positron emission tomography; PACS, picture archiving and communication system; MS, multiple sclerosis; GANs, generative adversarial networks; SNR, signal-to-noise ratio; NYU, New York University; GenAI, generative artificial intelligence; RAG, retrieval-augmented generation; US, ultrasound; CNNs, convolutional neural networks; BLS, breast lesion segmentation; GPU, graphics processing unit; EPM, Eco Power Mode; n/a, not applicable; 3D, three-dimensional; 2D, two-dimensional.
*Any energy consumption reduction percentages, CO_2 emissions reductions, financial or energy savings reported in these studies are not included in the table, since they do not constitute primary data of the specific studies.
**Energy consumption reduction from EPM is not included, as EPM is not reported as an AI technology. However, it could be mentioned in the discussion section as an additional measure for reducing energy consumption.
***385 g CO_2/kWh in Germany[22]
****699 g CO_2/kWh in the US (2021)[23]

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