SPECIAL REPORT

Improving Healthcare Sustainability - The Drive Towards Helium-Free MRI Operations

- Impact of Global Helium Shortage on Medical Imaging and Healthcare Delivery
- Cost Savings and Operational Simplicity – A Winning Combination for University Hospital Marburg
- Environmental Impact of Medical Imaging and Healthcare Delivery
- Increased MRI Throughput and Exceptional Image Quality at Potsdam
- Economic Opportunities in Adopting Helium-Free Operations For MRI Systems
- BHRUT (UK) Finds Speed, Quality, and Ease-of-Use at an Attractive Total-Cost-of-Ownership with Philips BlueSeal MR
- Towards a More Sustainable Healthcare System with Adopting Helium Free Operations In MRI
- Saint-Augustin Clinic Increases Imaging Capacity, Reproducibility and Patient Satisfaction

Published by Global Business Media

GLOBAL BUSINESS MEDIA

PHILIPS

Feel the freedom with BlueSeal MRI

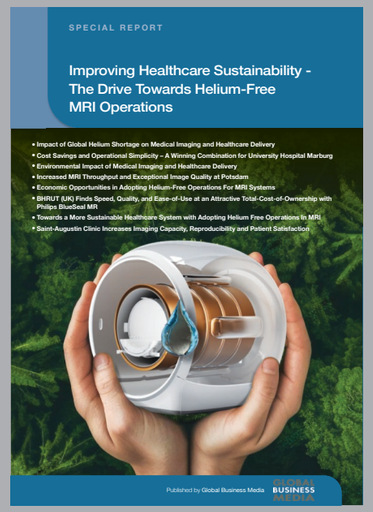
By taking away helium, there is so much we can give back.

Set the new standard in MRI with Philips BlueSeal MRI. With industry's first and leading helium-free technology, superior image quality and streamlines workflows, BlueSeal MRI frees you from the weight of daily demands. It's a decision that saves time and helps you give more patients better care.

Get ahead
with future-proofed, helium-free MRI

Be confident
with outstanding clinical performance

Feel at ease
with optimized experiences for everyone



Published by Global Business Media

Global Business Media Limited
62 The Street Ashtead Surrey KT21 1AT
United Kingdom

Switchboard: +44 (0)1737 850 939
Fax: +44 (0)1737 851 952
Email: info@globalbusinessmedia.org
Website: www.globalbusinessmedia.org

Publisher
Kevin Bell

Business Development Director
Marie-Anne Brooks

Editor
Dr. Jonathan D. Agnew, PhD, MBA

Senior Project Manager
Steve Banks

Advertising Executives
Michael McCarthy
Abigail Coombes

Production Manager
Paul Davies

For further information visit:
www.globalbusinessmedia.org

Contents

IMPROVING HEALTHCARE SUSTAINABILITY - THE DRIVE TOWARDS HELIUM-FREE MRI OPERATIONS

Foreword

The global helium shortage presents a significant challenge for healthcare systems worldwide, particularly affecting magnetic resonance imaging (MRI) operations that traditionally rely on this increasingly scarce resource. As healthcare facilities face rising costs, supply chain vulnerabilities, and growing pressure to adopt sustainable practices, innovative solutions for helium-free MRI operations have emerged as a transformative opportunity. This collection of articles examines multiple facets of this critical issue, offering evidence-based insights into both the challenges and promising technological developments reshaping medical imaging.

The series begins by exploring the impact of global helium shortages on healthcare delivery, highlighting how geopolitical factors and resource depletion have disrupted the stability and affordability of essential diagnostic services. This is followed by real-world evidence from University Hospital Marburg demonstrating how adopting new MRI technologies can achieve significant cost savings while streamlining operations. The environmental impact of medical imaging is then examined, revealing opportunities to reduce healthcare's ecological footprint through resource optimization and innovative technology adoption.

Subsequent articles showcase practical implementations of these technologies, with Potsdam's experience illustrating how helium-free operations can enhance throughput and image quality. The economic opportunities presented by these innovations are analyzed, demonstrating how healthcare facilities can reduce operational costs, minimize infrastructure demands, and enhance system reliability. BHRUT's implementation in the UK provides further evidence of performance improvements at attractive total-cost-of-ownership.

The collection concludes with a forward-looking examination of sustainable healthcare systems enabled by helium-free MRI operations, followed by Saint-Augustin Clinic's success in increasing capacity, reproducibility, and patient satisfaction through these technologies.

Taken together, these articles provide a comprehensive overview of how sealed-magnet and helium-free MRI technologies are addressing critical challenges facing healthcare providers. As the industry continues to balance clinical excellence with environmental responsibility and economic sustainability, these innovations offer promising pathways toward resilient, accessible, and high-quality imaging services. The transition toward helium-independent operations represents not merely a response to resource constraints, but an opportunity to fundamentally improve healthcare delivery for patients, providers, and the planet.

Dr. Jonathan D. Agnew
Editor

Jonathan D. Agnew *PhD, MBA, is a medical writer and Adjunct Professor in the Faculty of Medicine at the University of British Columbia. He holds a PhD in health services research from the University of California, Berkeley, an MBA with distinction from the University of London, and an AB (hons.) in community health from Brown University.*

Impact of Global Helium Shortage on Medical Imaging and Healthcare Delivery

Jonathan D. Agnew, *PhD, MBA, Adjunct Professor, Faculty of Medicine, University of British Columbia*

The global helium shortage presents significant challenges for medical imaging departments worldwide, particularly affecting magnetic resonance imaging (MRI) operations. The medical sector, consuming approximately one-fifth of global helium supplies, faces mounting pressure to adapt while maintaining quality patient care. This has spurred innovation in helium-efficient and helium-free MRI technologies.

The United States historically supplied approximately 90% of global helium demand, but geopolitical shifts and resource depletion have altered this dynamic substantially

Introduction

The medical imaging industry is experiencing unprecedented challenges due to global helium supply constraints. Research indicates that MRI and nuclear magnetic resonance (NMR) equipment consume a significant portion of global helium supplies.[1] Combined with increasing demand for medical imaging services, this has created a critical situation for healthcare providers worldwide. In addition to supply chain vulnerabilities – exacerbated by events such as the Qatar blockade, which disrupted 30% of the world's helium supply[2] – the year-over-year rise in helium costs presents a major short-term challenge for MRI manufacturers and healthcare providers (Figure 1).[3]

The industry's traditional reliance on a limited number of helium-producing countries, primarily the United States, Qatar, Algeria, and Russia, further heightens supply chain risks, threatening the stability and affordability of medical imaging services (Figure 2).

The United States historically supplied approximately 90% of global helium demand, but geopolitical shifts and resource depletion have altered this dynamic substantially.[4] This changing landscape has forced healthcare providers to reevaluate their helium dependency and seek alternative solutions. As healthcare systems worldwide face rising costs and resource constraints, the need for sustainable solutions has become increasingly urgent, particularly in medical imaging departments where helium is essential for MRI operations.[5]

Medical Industry Impact

The impact on medical imaging operations has been substantial, with data showing significant operational challenges across multiple domains. Approximately 100-150 million Magnetic Resonance Imaging (MRI) scans are performed

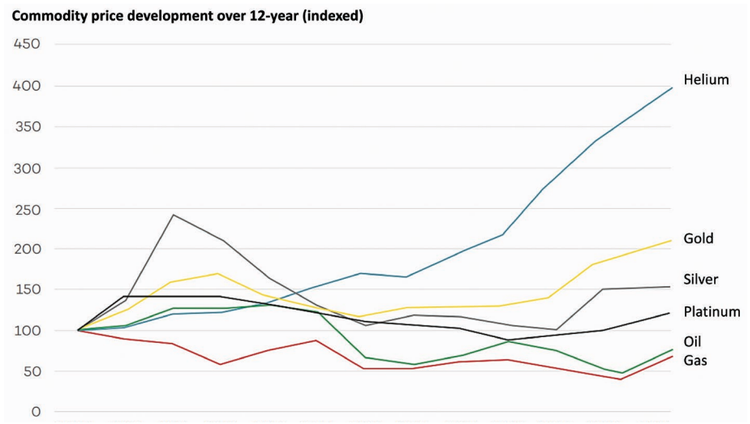


Figure 1: Commodity Price Development, 2009 – 2021 (indexed)

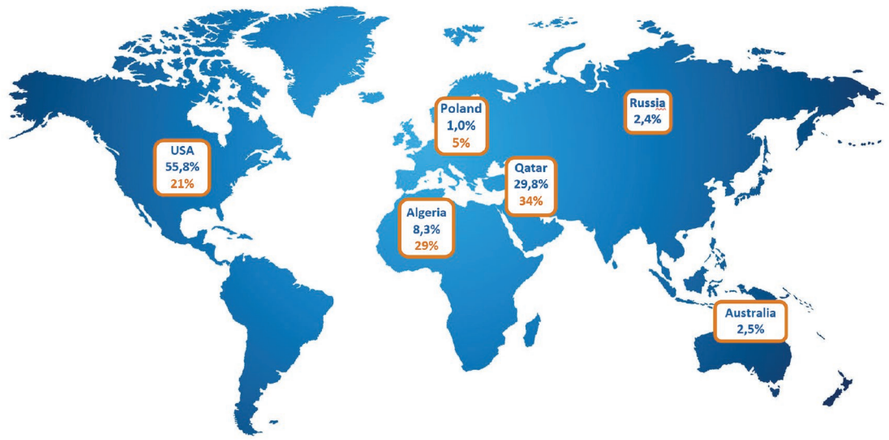


Figure 2: Global Helium Producers
Blue data: share of global helium production.
Yellow data: coverage of EU demand.
Sources: European Commission Directorate-General for Intern Market, Industry, Entrepreneurship and SMEs, Grohol, M. and Veeh, C.; Study on the critical raw materials for the EU 2023 – Final report, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2873/725585.

worldwide each year, with the United States accounting for nearly 40 million of these scans annually. The MRI industry continues to grow steadily, with approximately 5,000 new MRI units sold worldwide each year.[6] This growing demand for MRI services, coupled with helium supply constraints, has created a critical need for adaptation strategies that can ensure continuous service delivery while managing resource limitations. At the same time, there is rising attention to sustainability benefits in public tenders for healthcare solutions across Europe, with procurement processes increasingly favouring technologies that reduce helium consumption and improve environmental efficiency. These shifting priorities underscore the need for innovative solutions that address both resource constraints and sustainability goals.

Supply chain disruptions have significantly impacted healthcare facilities in regions without direct access to helium production, leading to higher costs and frequent supply interruptions that may affect patient care.[7] The medical imaging sector's reliance on stable helium supplies has highlighted vulnerabilities, particularly in resource-limited areas and those geographically distant from major production centres.[8]

The challenge extends beyond immediate operational concerns to long-term strategic planning for healthcare facilities. Medical centres must now consider helium availability and cost fluctuations when planning facility expansions or equipment upgrades. This additional layer of complexity affects budgeting, resource allocation, and even the types of medical services that can be reliably offered to patients.[9]

Alternative Technologies and Solutions

In response to these challenges, several technological solutions have emerged, each offering different approaches to reducing helium dependency thus allowing for helium-free operations (Table 1).

1. **Closed loop or sealed magnets**
   - **a. Low-Helium Inventory or Closed Loop Magnets:** Some MRI systems operate with a significantly reduced helium inventory, requiring a small helium vessel for cooling. However, these magnets still rely on helium for servicing or emergency field shutdowns, meaning they continue to depend on future helium availability.[9] While they help reduce helium consumption, they do not eliminate the need for helium entirely. Moreover, this technology's imaging capabilities do not yet match traditional MRI systems.
   - **b. Sealed Magnets:** A more advanced solution involves sealed MRI magnets, such as Philips' BlueSeal technology, which contain only a very small amount of helium within a permanently closed pressure vessel. These magnets are fully self-contained, eliminating helium loss during operation and servicing. Since they do not require helium refills, they effectively remove future dependency on helium, offering a sustainable alternative for medical imaging.[9] This BlueSeal technology is on the market since 2018.

These magnets are fully self-contained, eliminating helium loss during operation and servicing. Since they do not require helium refills, they effectively remove future dependency on helium

Table 1: Summary of Alternative Technologies and Solutions

	Traditional MRI technologies		New MRI technologies allowing for helium free operations			
			Sealed or closed loop magnets		Conductive Cooled or dry magnets	
Magnet type	**Positive boil off 1.5T**	**Zero boil off (ZBO) 1.5T**	**Sealed Magnet 1.5T**	**Closed Loop Magnet 1.5T**	**Dry magnet HTS*** 1.5T**	**Dry magnet MgB2 0.5T only**
Bore size	60-70 cm	60-70 cm	70 cm	60 cm 70cm **WIP***	60 cm 70cm **WIP***	Open
Helium content	>1500 l	750-1500 l	7 l	0.7 l	zero	Zero
Helium vessel	Boil off magnet	ZBO	sealed	closed loop	not applicable	not applicable
Vent pipe needed	Vent pipe	Vent pipe	No vent pipe	No vent pipe	No vent pipe	No vent pipe
Helium loss during use	Continuously vents Helium	zero boil off during normal conditions	zero	zero	zero	zero
Industrialization stage	Mature	Mature	Mature (>1700 Philips BlueSeal MRIs installed world-wide)	Feasible technology, in start-up 70 cm announced RSNA2024 **WIP***	60 cm feasible technology, in start-up 70 cm announced RSNA2024 **WIP***	Niche 0.5T open MRI, feasible technology, in start-up extremely heavy
Operational benefits against traditional MR technology	[base line]	[base line]	High thermal capacity**	Relative low thermal capacity expected**	Relative low thermal capacity expected**	Relative low thermal capacity expected**
Clinical benefits against traditional MR technology	[base line]	[base line]	Medium/high gradient performance	Low /medium gradient performance 60cm only	Low /medium gradient performance 60cm only	Limited clinical applications at 0.5T Weight bearing, upright position
Economic benefits against traditional MR technology	[base line]	[base line]	No Helium use, lightweight	No Helium use, lightweight	No Helium use, Very heavy	No Helium use, Lower power use, extremely heavy

This overview is based on publicly available data per 1 March 2025, focusing on industry standard 1.5T magnet field strength covering most clinical applications.
This technology overview is intended to provide general information and insights based on available data at the time of publication. While we strive for accuracy and completeness, we cannot guarantee that all relevant developments, data points, or perspectives are included. The information presented should not be considered exhaustive or relied upon as the sole source for decision-making. We encourage readers to conduct further research and consult relevant professionals where necessary.
Red fonts indicate a compromise against traditional MRI technologies, dark coloured colums mark available and mature 1.5T 70cm with new MRI technology
*WIP = Works-in-progress, limited data available as these systems are only recently announced
**Thermal capacity directly affects the ride through time (this is the period when the magnet is cool enough for it not to lose field or auto-discharge when power or cooling is lost) Consequently, a high thermal capacity allows an MRI to stay longer in operations after power or cooling is lost.
***HTS = High Temperature Superconductive magnet technology

The economic analysis must consider not only direct equipment costs but also the broader implications for healthcare delivery and operational efficiency

2. Conductive Cooled or Dry Magnets

a. High temperature superconductive (HTS) technologies: The development of completely helium-free MRI systems represents a paradigm shift in medical imaging. These systems operate without cryogenic helium cooling and instead utilise alternative superconductors and cooling technologies. While the first commercial examples are emerging, they often require trade-offs in image quality, field strength, magnet field of view, and gradient power. The feasibility of widespread adoption remains under evaluation.[10]

b. MgB_2 Superconducting Magnets: Research into high-temperature superconductors such as magnesium diboride (MgB_2) has shown promise for MRI applications, particularly for 1.5T head/extremity imaging systems.[8] Unlike conventional low-temperature superconductors (NbTi and Nb_3Sn), HTS materials operate at higher temperatures, enabling complete elimination of helium in MRI systems. This also results in significantly lower power consumption due to improved cryocooler efficiency.

While MgB_2-based magnets contribute to helium-free MRI technology, they are just one of several approaches being explored for reducing helium dependency.

Economic and Implementation Considerations

The transition to helium-efficient technologies requires careful consideration by healthcare providers. Initial implementation costs must be weighed against long-term operational savings and supply chain stability benefits.[3] The economic analysis must consider not only direct equipment costs but also the broader implications for healthcare delivery and operational efficiency. A crucial factor in implementation is compatibility with the current industry standard, which consists primarily of 1.5T and 3.0T MRI systems, accounting for 99% of all medical MRI systems worldwide. Solutions that align with these standards without compromising imaging performance will face minimal implementation challenges, whereas alternative technologies that deviate from these standards may encounter greater barriers to adoption.

IMPROVING HEALTHCARE SUSTAINABILITY - THE DRIVE TOWARDS HELIUM-FREE MRI OPERATIONS

Studies suggest that while the healthcare sector's upfront investments in these new technologies may be substantial, the long-term cost savings and reduced supply chain risks justify the transition.[11] Healthcare facilities must consider multiple factors in their implementation strategies:

- Infrastructure requirements for new systems, including facility modifications and support equipment
- Comprehensive staff training needs and ongoing education requirements
- Potential service interruptions during transition periods and strategies to minimise impact on patient care
- Long-term maintenance considerations and technical support requirements
- Patient care continuity requirements and quality assurance measures
- Supply chain resilience and backup systems
- Environmental impact and sustainability considerations

The economic impact extends beyond individual healthcare facilities to affect the broader healthcare ecosystem. Insurance providers, equipment manufacturers, and helium suppliers must all adapt to the changing landscape, creating both challenges and opportunities for industry innovation.[7]

Future Outlook and Recommendations

The future of medical imaging requires a coordinated approach to address helium dependency while ensuring continued access to essential diagnostic services. Research indicates that successful adaptation strategies can include multiple complementary approaches, depending on the specific MRI technology in use. For example, systematic implementation of helium recycling systems is relevant for traditional MRI magnets[7] but not necessary for sealed MRI technologies, such as Philips' BlueSeal.

The transition toward sustainable medical imaging practices requires careful consideration of both immediate needs and long-term sustainability goals. Healthcare systems must balance economic viability with environmental considerations while maintaining high standards of patient care.[5] Success will depend on coordinated efforts across multiple stakeholders, including healthcare providers, equipment manufacturers, researchers, and policy makers.

Medical centres must now consider helium availability and cost fluctuations when planning facility expansions or equipment upgrades

References:

1 Study on the critical raw materials for the EU 2023 - Publications Office of the EU. Accessed March 28, 2025. https://op.europa.eu/en/publication-detail/-/publication/57318397-fdd4-11ed-a05c-01aa75ed71a1

2 Marc Reisch. Helium shortage looms. CEN Glob Enterp. 2017;95(26):11-11. doi:10.1021/cen-09526-notw11

3 Cao Q, Li Y, Fang C, Liu R, Xiao H, Wang S. Status quo and utilization trend of global helium resources. Front Environ Sci. 2022;10:1028471. doi:10.3389/fenvs.2022.1028471

4 Feder T. Government handling of helium gets report card: Think again. Phys Today. 2010;63(3):28-30. doi:10.1063/1.3366234

5 Lim YC, Mohamed Ismail R. The shortage of helium supply in industry. Published online 2013.

6 MRI:Facts and Figures • Magnetic Resonance in Medicine – The Basics – by Peter A. Rinck | NMR MR MRI | Essentials, introduction, basic principles, facts, history | The primer of EMRF/TRTF. Accessed March 28, 2025. https://www.magnetic-resonance.org/ch/21-01.html

7 Smith DM. Challenges to the Worldwide Supply of Helium in the Next Decade. In: AIP Conference Proceedings. Vol 710. AIP; 2004:119-138. doi:10.1063/1.1774674

8 Nazir A, Ali Chaudhry M, Nadeem B, Qadeer A, Junaid Dar A. Global helium shortage leading to the shutting of imaging modalities is the world's next medical crisis-driving factors, future of helium-free magnetic resonance imaging systems, and alternatives to magnetic resonance imaging. Int J Surg Glob Health. 2023;6(4). doi:10.1097/GH9.0000000000000155

9 Wilkinson S, Gerth F. A Review of the Sustainability of Helium: An Assessment of Its Past, Present and a Zero-Carbon Future. Reg Sci Environ Econ. 2024;1(1):78-103.

10 Kara DC. Production of a viable product in magnetic resonance imaging using MgB2. Published online 2014.

11 Wilkinson S, Gerth F. A Review of the Sustainability of Helium: An Assessment of Its Past, Present and a Zero-Carbon Future. Reg Sci Environ Econ. 2024;1(1):78-103. doi:10.3390/rsee1010006

Traditional magnet
~1500 liters of liquid helium

BlueSeal magnet
~7 liters of liquid Helium, fully sealed

Traditional versus BlueSeal Magnet

Cost Savings and Operational Simplicity – A Winning Combination for University Hospital Marburg

Prof. Dr. Med. Andreas H. Mahnken, MBA, MME, EBIR
Director of the Clinic for Diagnostic and Interventional Radiology
UKGM, University Hospital Marburg,
Rhoen-Clinics as part of Asklepios-Clinics
Marburg, Germany

Alexandra Rausch
Head of Medical Technology
UKGM, University Hospital Marburg,
Rhoen-Clinics as part of Asklepios-Clinics
Marburg, Germany

Because no helium can escape, BlueSeal magnets do not need a vent pipe, thus reducing construction costs

University Hospital of Giessen and Marburg (UKGM) is the third largest university hospital in Germany, offering top-class medicine to more than 460,000 patients annually. To meet its goal of offering top-quality medicine at an affordable price for everyone, UKGM needs state-of-the-art medical imaging equipment that is efficient and effective.

In 2020, UKGM chose to install a Philips BlueSeal Ambition X MRI into the University Hospital Marburg. "We needed an MRI system to provide us with outstanding image quality and optimized workflows," says Prof. Dr. med. Andreas H. Mahnken, Director of the Clinic for Diagnostic and Interventional Radiologyat University Hospital Marburg. "The benefits of BlueSeal technology were obvious. The magnet is lighter than traditional MRIs and fits into small spaces. This has saved us money, both during installation because it doesn't require a vent pipe[1] and operationally because it does not require helium refill. And obviously, I want to ensure high clinical quality for every patient. The Philips BlueSeal Ambition X does just that."

Easy Siting at a Lower Cost

Philips BlueSeal technology uses micro-cooling which requires only a negligible amount (less than 0.5% (in liters) of previous systems[2]) of liquid helium for cooling, which is placed in the magnet during manufacturing and then fully sealed. Because no helium can escape[2], BlueSeal magnets do not need a vent pipe[1], thus reducing construction costs. It has also been designed to be lightweight, requiring a minimum siting capacity of only 3,700 kg.

"The fact that a vent pipe is unnecessary has really simplified installation, as our radiology department is located in the middle of the university hospital building," says Alexandra Rausch, Head of Medical Technology. "Another advantage is the reduced weight of this BlueSeal magnet, which is about 900 kilograms lighter than conventional Philips MRI magnets[2]. This reduced weight simplified the location selection and minimized the reconstructions needed in the building, which was particularly important to us since the MRI room is on the floor directly above the ORs. And this BlueSeal system requires less space, which allowed for a flexible integration into our existing infrastructure. The installation of the Philips MRI with BlueSeal technology has proven beneficial not only in planning and execution but also in ongoing operation and service."

Prof. Mahnken concurs, "It was not only the lower installation costs, but also the long-term operating costs which were key considerations we made beforehand. These cost savings, along with the fact that no quench pipe needs to be installed for a BlueSeal system, were the arguments we used to convince UKGM management to choose an equipment provider different from our usual vendor."

The Importance of Managing a Scarce Resource

Helium prices have increased in recent years due to its scarcity[4]. This non-renewable resource is used in roughly 50,000 mostly conventional MRI scanners around the world, which lose helium over time and thus need regular refills of helium. A conventional MRI system can also quickly and unexpectedly lose its helium during a quench.

"The European Commission classified helium as a critical raw material in 2023," notes Ms. Rausch. "We anticipate that acquiring helium will become even more challenging and more expensive over the next 10–15 years. This underscores the importance of BlueSeal technology for us."

Compelling Real-Life Events Demonstrate Cost Saving Advantages

"The BlueSeal magnet contains very little helium, that is fully sealed so that none can escape[3]. We've experienced two incidents that demonstrate the advantages this has brought. Two years ago, a cleaning staff member accidentally triggered the emergency magnet off button while cleaning all contact surfaces. The BlueSeal system was back in operation within two days and at a cost of only around 8,000 euros, thanks to Philips' quick response.

"Then just a few weeks ago we experienced an urban power outage. Remarkably, the BlueSeal Ambition X remained on field for 24 hours without power before it autonomously shut down in a controlled manner. Philips responded promptly, and the system was back in service after a short downtime, again with very manageable costs.

"With a conventional MRI, these two incidents would have cost us significantly more. Given current helium prices, lead times, and service costs, we would have faced economic losses exceeding €100,000 in both cases, not to mention equipment downtime and the need to reschedule many patient appointments. These experiences affirm our decision to go with the BlueSeal magnet – it offers tremendous advantages."

Exceptional Image Quality

Apart from the physical advantages of BlueSeal, it is image quality that of course remains top priority. "With this system, we get exceptionally good image quality," says Prof. Mahnken. "I love the system's T2 sequences – the quality is simply wonderful. And with Philips Compressed SENSE, we achieve drastically improved speed without any loss of quality."

The BlueSeal magnet has a leading homogeneous field-of-view of 55 cm for a 1.5T 70 cm system and B0-stability over time. The Compressed SENSE speed engine meaningfully speeds up scans while delivering virtually equal image quality.

BlueSeal MRI system at UKGM

Apart from the physical advantages of BlueSeal, it is image quality that of course remains top priority

Philips uses cutting-edge BlueSeal technology to reduce the environmental footprint, while meeting clinical demands of quality and performance

By intelligently compressing data, it accelerates existing MR scans up to 50%[5] and can provide up to 60% higher resolution[6] to enhance diagnostic confidence.

Ease-Of-Use Workflow Features Support a Streamlined Procedure

For Prof. Mahnken, easy operation is important and helps radiographers get up to speed and work easier and faster. "The BlueSeal system includes several workflow features that influenced our decision to purchase. For example, VitalEye allows for a continuous and robust respiratory trigger signal without the need to position a respiratory belt. This touchless workflow feature is very important for our radiographers." The quality of the physiology signal detected by VitalEye is better than a belt-based approach providing superior image quality, for a broad range of patient sizes. It shifts the operator's focus from the technology to the patient.

"What I personally appreciate are the features that help patients lie comfortably in the scanner. The system uses audio and visuals to create an engaging environment where they can remain calm and compliant. It offers entertainment while also informing them with a progress bar, breath-hold guidance, and AutoVoice. AutoVoice automatically informs patients of scan duration and announces table movements. "This definitely helps patients. And AutoVoice adds a new level of communication without requiring the operator to manage it, which simplifies workflow even further. We use these automated smart features every day with every patient."

A Cost-Conscious Solution Without Compromise

Healthcare providers today must do more with less. Imaging systems must be more efficient in their operational and material costs. Philips uses cutting-edge BlueSeal technology to reduce the environmental footprint, while meeting clinical demands of quality and performance. At UKGM, the ability to easily site a new system, reduce operational costs, and still maintain the level of service their patients have come to expect, addresses the hospital's goal to offer top-quality medicine at an affordable price for everyone.

References:

1 Due to closed magnet system

2 Compared to the Ingenia 1.5T ZBO magnet

3 Even in the rare case of the magnet becoming unsealed, the negligible amount of helium escaping would not materially affect the oxygen level within the room

4 January 2022 onwards
https://www.innovationnewsnetwork.com/helium-shortage-4-0-what-caused-it-andwhen-will-it-end/29255/

5 Compared to Philips scans without Compressed SENSE

6 In isotropic 3D MSK VIEW scans, compared to Philips scans without Compressed SENSE.

Disclaimer:
Results from case studies are not predictive of results in other cases. Results in other cases may vary.

IMPROVING HEALTHCARE SUSTAINABILITY - THE DRIVE TOWARDS HELIUM-FREE MRI OPERATIONS

Environmental Impact of Medical Imaging and Healthcare Delivery

Jonathan D. Agnew, *PhD, MBA, Adjunct Professor, Faculty of Medicine, University of British Columbia*

The healthcare sector faces mounting pressure to reduce its environmental footprint while maintaining high-quality patient care. Medical imaging departments contribute significantly to healthcare's environmental impact through energy consumption, resource utilisation, and waste generation. While only one-third of the global population has access to imaging diagnostics, recent research indicates that comprehensive strategies for environmental sustainability in medical imaging can effectively reduce ecological impact while preserving diagnostic quality and extending the availability and accessibility of imaging services.

Introduction

The environmental impact of medical imaging has emerged as a concern for healthcare systems worldwide (Figure 1). Studies indicate that imaging departments, particularly those utilising advanced technologies, represent a substantial portion of healthcare facilities' environmental footprint.[1] Increasingly, healthcare providers seek to balance growing imaging service demands with environmental responsibility and resource constraints. Healthcare administrators are now recognising that sustainable practices must be integrated into long-term strategic planning to address these environmental concerns effectively.

The complexity of medical imaging's environmental impact extends beyond direct energy consumption to encompass equipment lifecycle, waste management, and scarce resource usage. Research has shown that out-of-hospital energy consumption associated with imaging services can be significantly higher than in-hospital use, with one study finding it to be 260% greater.[2] This finding highlights the need for comprehensive approaches that consider both direct and indirect environmental

Comparative analyses have revealed that certain imaging technologies carry substantially different environmental burdens

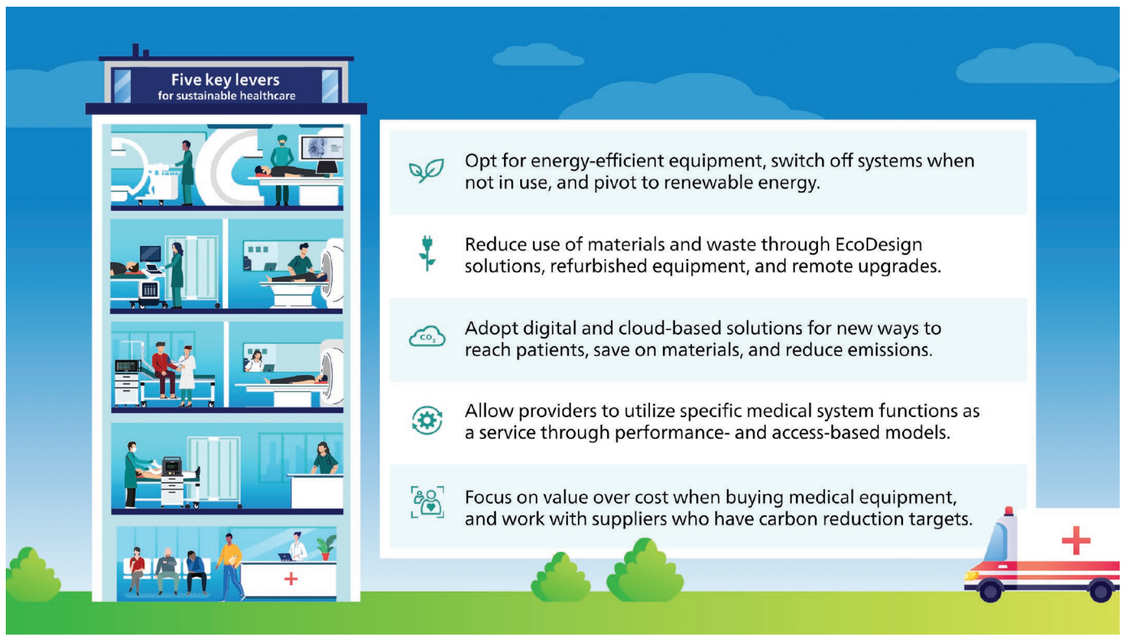


Figure 1: Sustainability in Healthcare

Healthcare practitioners also have a role to play in advancing sustainability by embracing circularity in procurement

impacts of imaging services. Recent assessments of imaging facilities have revealed that implementing systematic sustainability measures can lead to substantial reductions in both energy consumption and operational costs, while maintaining high standards of patient care.[3]

Core Environmental Impact Areas

The environmental impact of medical imaging operations manifests across multiple domains. Recent studies provided detailed quantification of these effects. In radiology departments, greenhouse gas emissions can reach substantial levels, with one U.S.-based study documenting 4.6 kt CO2e over a decade (equivalent to the annual emissions of approximately 1,000 passenger vehicles), primarily attributed to MRI and CT operations.[1] These findings underscore the significant contribution of imaging technology to healthcare's overall carbon footprint.

Energy consumption patterns vary significantly across imaging modalities, with important implications for environmental impact. Comparative analyses have revealed that certain imaging technologies carry substantially different environmental burdens. For instance, echocardiography demonstrates a notably lower environmental impact, ranging from 1-20% of the impact associated with cardiac magnetic resonance and single-photon emission computed tomography scanning.[4] This variation in environmental impact across modalities presents opportunities for strategic technology selection when clinically appropriate.

The environmental footprint of medical imaging extends beyond energy consumption to include resource utilization and waste generation. Studies have identified clinical consumables – such as scarce natural resources that are finite and expensive to supply, like helium for MRI – as major contributors to imaging's environmental impact.[5] For instance, a traditional MRI system requires up to 1,600 litres of helium and may need regular replenishment over its lifetime, contributing to resource depletion. Furthermore, standby power consumption – when imaging systems remain powered on while not actively scanning patients – represents another significant source of environmental burden that could be addressed through operational improvements.

Beyond resource utilisation, waste generation remains a critical concern. Many medical devices, including imaging equipment, end up in large 'device graveyards' in resource-constrained settings, where they often remain non-functional due to a lack of supplies, inadequate maintenance, or insufficiently trained personnel to operate them.[6] Furthermore, public procurement policies in developing healthcare systems frequently mandate the purchase of new imaging systems to qualify for reimbursement, effectively preventing opportunities for circularity – where refurbished systems could provide the same quality as new while significantly reducing waste and environmental burden. Addressing these systemic inefficiencies through sustainable procurement, improved device lifecycle management, and optimised operational practices presents a crucial opportunity for reducing the environmental impact of medical imaging.

Implementation Strategies

Recent research has identified several effective approaches to reducing the environmental impact of medical imaging while maintaining diagnostic quality. The implementation of these strategies requires careful consideration of both technical and operational factors. A systematic review of environmental sustainability in clinical radiology and radiotherapy has highlighted the importance of a multi-faceted approach that simultaneously addresses energy consumption, waste management, and resource optimisation.[5] Beyond operational efficiencies, eco-design of medical equipment plays a crucial role in sustainability efforts. Designing imaging systems to use fewer materials, consume less energy and scarce resources, and facilitate circularity – through modular upgrades, extended hardware lifetimes, de-materialisation, and material reuse – can significantly reduce the environmental burden of imaging technology.

Healthcare practitioners also have a role to play in advancing sustainability by embracing circularity in procurement. The adoption of sustainable procurement practices, such as circular buying models that prioritise refurbished and upgradeable equipment over single-use systems, can contribute to long-term environmental and economic benefits. The integration of these eco-design and procurement strategies has demonstrated measurable improvements in both environmental and operational outcomes across multiple healthcare settings.

In the realm of energy management, acceleration techniques in MRI, particularly those utilising Artificial Intelligence (AI) or Deep Learning (DL), have shown promise in reducing scan duration and energy consumption while maintaining image quality.[7] These technological innovations

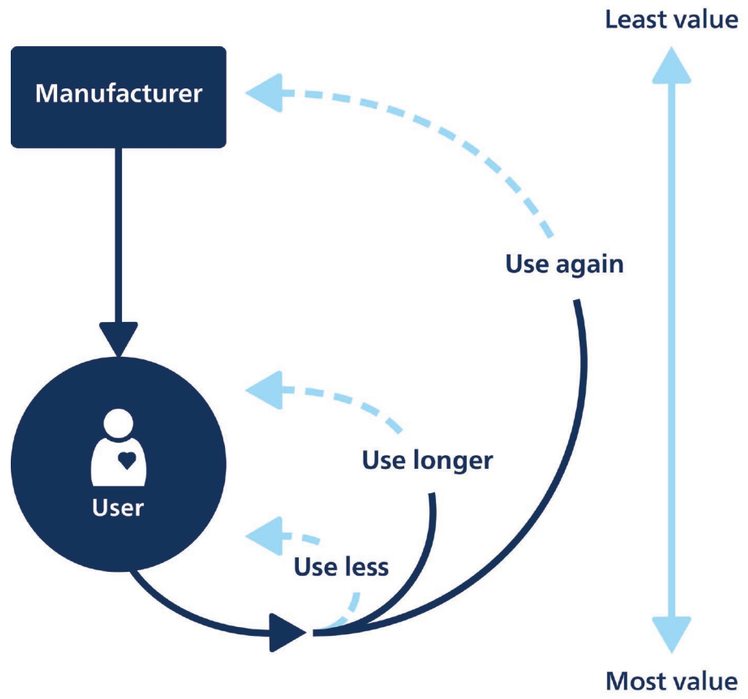
IMPROVING HEALTHCARE SUSTAINABILITY - THE DRIVE TOWARDS HELIUM-FREE MRI OPERATIONS

demonstrate the potential for reducing environmental impact without compromising diagnostic accuracy. The development of MRI acceleration techniques represents a significant advancement in sustainable imaging practices, as it addresses one of the most energy-intensive aspects of medical imaging.[7]

Beyond scan acceleration, other significant MRI innovations contribute to sustainability. Technologies such as BlueSeal have drastically reduced helium consumption – by a factor of 200 – compared to conventional MRI systems, addressing concerns over the depletion of this critical resource. Additionally, advancements in MRI system design now allow for the reuse of existing magnets through on-site upgrades, enabling healthcare facilities to transition to state-of-the-art capabilities without the need for full system replacement. These innovations not only extend the lifespan of MRI systems but also improve power consumption management, further reducing the environmental footprint of imaging services. Recent implementations of these approaches have demonstrated potential cost savings of up to 30% in energy consumption while maintaining diagnostic precision.

Waste management initiatives have emerged as another crucial area for environmental improvement. Research indicates that comprehensive waste reduction programmes, when properly implemented, can significantly reduce environmental impact while maintaining operational efficiency.[8] These programmes typically integrate waste sorting infrastructure with staff training protocols to optimise resource utilisation. The importance of waste management is particularly evident in medical imaging departments, where both general medical waste and specialised imaging-related waste must be carefully managed.

Resource optimisation strategies have evolved to include innovative approaches such as remote monitoring and teleconsultations. These solutions not only reduce environmental impact but also potentially increase healthcare accessibility.[9] Additionally, novel metrics such as the "environmentally sustainable performance" (ESPer) have been developed to integrate environmental impact considerations with diagnostic performance, particularly in AI applications for pathology.[9] This integration of environmental metrics with performance measures represents a significant advancement in sustainable healthcare practices. Studies indicate that facilities implementing these integrated approaches achieve superior outcomes in both environmental sustainability and clinical effectiveness.[9]



These innovations not only extend the lifespan of MRI systems but also improve power consumption management, further reducing the environmental footprint of imaging services

Notably, facilities that adopt comprehensive sustainability programmes often report enhanced operational efficiency and decreased waste management costs

Practical Considerations

The transition to environmentally sustainable medical imaging practices requires conscientious consideration of resource requirements and implementation challenges. Research indicates that successful implementation typically demands:

- **Healthcare facilities must consider multiple factors when implementing environmental strategies.** Infrastructure modifications often require significant investment, while staff training needs extend beyond initial implementation to include ongoing education and updates. Studies suggest that while upfront investments may be substantial, long-term benefits can justify these expenditures through reduced operational costs and improved resource efficiency.[8] Notably, facilities that adopt comprehensive sustainability programmes often report enhanced operational efficiency and decreased waste management costs within the first three years of implementation.
- **Innovative breakthroughs in medical imaging technology are further expanding opportunities for sustainability.** Sealed MRI systems use only 7 liters of helium (vs 1600 liters in traditional systems). Dry magnets that use no helium at all, such as portable MRI units on wheels, offer a transformative approach by eliminating reliance on scarce helium resources while enhancing accessibility and reducing infrastructure demands. Similarly, spectral CT technology allows for enhanced image quality with lower radiation doses, improving both patient safety and environmental efficiency by reducing repeat scans and contrast agent usage. Additionally, tablet-based ultrasound systems have emerged as a compact, energy-efficient alternative to traditional ultrasound devices, providing high-quality imaging while significantly lowering power consumption and resource requirements. The integration of these cutting-edge technologies into clinical practice not only advances sustainability efforts but also enhances flexibility and accessibility in medical imaging services, particularly in resource-limited settings.
- **Quality assurance remains paramount in sustainable imaging practices.** The implementation of environmental strategies must incorporate robust quality control measures to ensure that diagnostic accuracy is maintained. Research has shown that ensuring imaging studies are clinically necessary – by minimising unnecessary scans, optimising imaging protocols, and adhering to evidence-based guidelines – can significantly reduce environmental impact while preserving diagnostic quality.[10] Selecting the most appropriate imaging technology for each clinical indication further enhances efficiency and reduces resource consumption. Life cycle assessment frameworks provide a comprehensive approach to evaluating both environmental impact and quality assurance measures.[11] Regular monitoring and assessment of these frameworks enable healthcare facilities to optimise their sustainability initiatives while maintaining the highest standards of patient care.

References:

1 Thiel CL, Vigil-Garcia M, Nande S, et al. Environmental Life Cycle Assessment of a U.S. Hospital-based Radiology Practice. Radiology. 2024;313(2):e240398. doi:10.1148/radiol.240398

2 Esmaeili A, McGuire C, Overcash M, Ali K, Soltani S, Twomey J. Environmental impact reduction as a new dimension for quality measurement of healthcare services: The case of magnetic resonance imaging. IJHCQA. 2018;31(8):910-922. doi:10.1108/IJHCQA-10-2016-0153

3 Roletto A, Zanardo M, Bonfitto GR, Catania D, Sardanelli F, Zanoni S. The environmental impact of energy consumption and carbon emissions in radiology departments: a systematic review. European Radiology Experimental. 2024;8(1):35.

4 Barratt AL, Li Y, Gooroovadoo I, et al. Environmental impact of cardiovascular healthcare. Open Heart. 2023;10(1):e002279. doi:10.1136/openhrt-2023-002279

5 Anudjo MNK, Vitale C, Elshami W, et al. Considerations for environmental sustainability in clinical radiology and radiotherapy practice: A systematic literature review and recommendations for a greener practice. Radiography. 2023;29(6):1077-1092. doi:10.1016/j.radi.2023.09.006

6 Piffoux M, Delpon G, Ducrot C, et al. Insights on the carbon footprint of radiotherapy in France. Cancer/Radiothérapie. 2023;27(6-7):487-490. doi:10.1016/j.canrad.2023.07.009

7 Becker A, Martin A, Deshpande V, et al. Investigating Data Acquisition Strategies for High Efficiency Clinical MRI and a More Sustainable Future in Radiology. In: ; :4579. doi:10.58530/2024/4579

8 Ghotra SS, Champendal M, Flaction L, Ribeiro RT, Sá Dos Reis C. Approaches to reduce medical imaging departments' environmental impact: A scoping review. Radiography. 2024;30:108-116. doi:10.1016/j.radi.2024.08.002

9 Lan YC, Strauch M, Pilva P, et al. Ecologically sustainable benchmarking of AI models for histopathology. npj Digit Med. 2024;7(1):378. doi:10.1038/s41746-024-01397-x

10 Roletto A, Savio A, Marchi B, Zanoni S. Towards a Greener Radiology: A Comprehensive Life Cycle Assessment Framework for Diagnostic Imaging. Environmental and Climate Technologies. 2024;28(1):303-311. doi:10.2478/rtuect-2024-0024

11 Roletto A, Savio A, Zanoni S. Life Cycle Assessment Framework for Diagnostic Imaging. CONECT. Published online May 29, 2024:42. doi:10.7250/CONECT.2024.026

IMPROVING HEALTHCARE SUSTAINABILITY - THE DRIVE TOWARDS HELIUM-FREE MRI OPERATIONS

Increased MRI Throughput and Exceptional Image Quality at Potsdam

Dr. Med. Tobias Schröter, MD

MRI Radiologist at MRT-Praxis Potsdam, Germany

With SmartSpeed on his BlueSeal Ambition S, Dr. Tobias Schröter was astonished at the great potential of this technology. It sets the stage for rapid, high quality MRI exams in his practice. He points out that across all anatomies, he discovers that shorter scan times and exceptional detail means faster, more confident diagnoses. Patient throughput has improved by about 20 percent.

Making a Difference with Fast, Powerful Technology

Dr. Tobias Schröter, MD, has been a radiologist since 2000. After running a 24/7 radiology practice for 16 years, he took over MRT-Praxis Potsdam, specializing in MRI diagnostics. "After the takeover, I completely redesigned the premises and exchanged the older MRI machine for a 1.5T Philips Ingenia Ambition S with sealed magnet."

Recently, the MRI Practice in Potsdam acquired AI-based Philips SmartSpeed of which Dr. Schröter has found that it makes a significant difference. "We had already been using Compressed SENSE from Philips to accelerate our cartesian scans and increase throughput. SmartSpeed now allows us to further reduce scan times and artificial intelligence (AI) makes the image quality even better compared to images we acquired using Compressed SENSE."

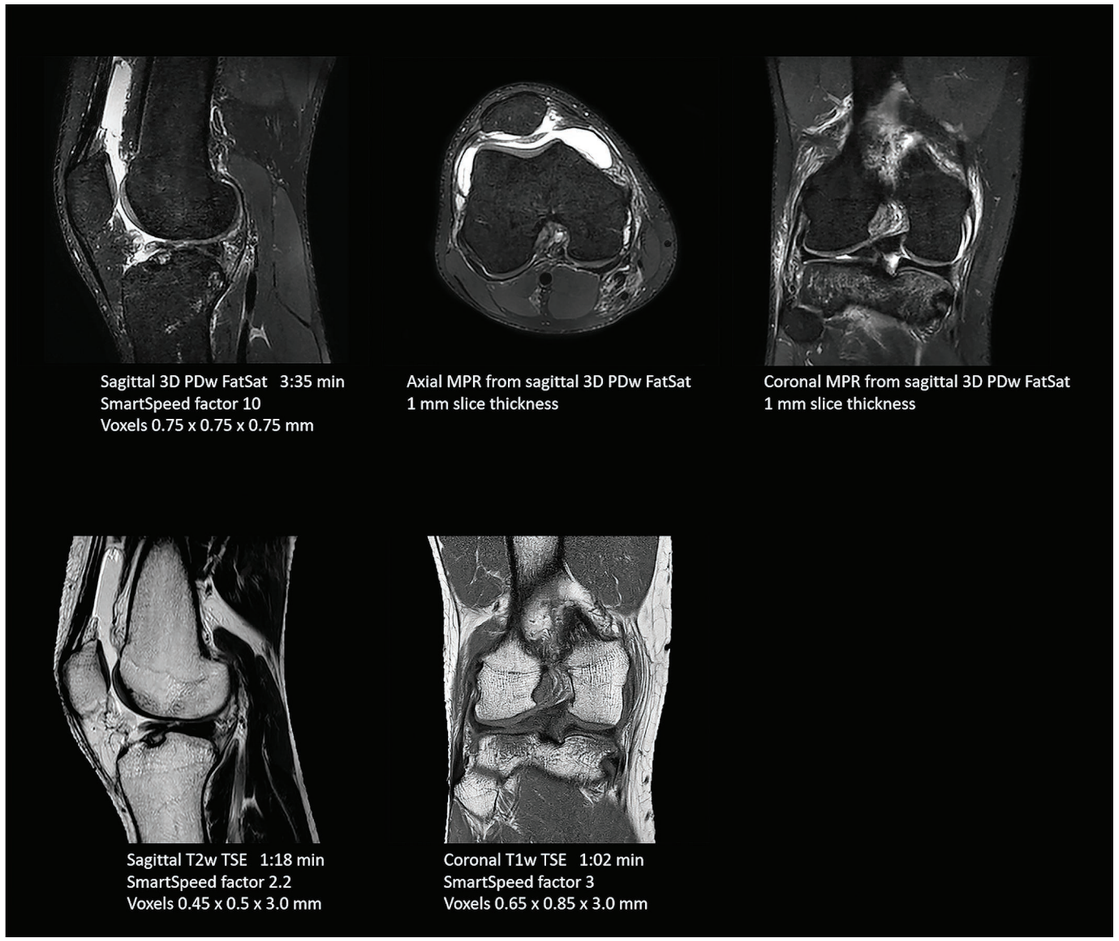
Faster Scans, Faster Diagnoses[1], High Productivity

MRT-Praxis Potsdam mostly focuses on neuro imaging and musculoskeletal examinations. They also perform prostate examinations, and occasionally some abdominal MRI. Adding SmartSpeed to the BlueSeal system brought significant advancements.

"Philips SmartSpeed really helps us scan more patients per day," Dr. Schröter says. "We achieve higher throughput and better productivity without compromising on image quality. We used to scan 32 to 35 patients per day, but now with SmartSpeed added to our BlueSeal system we can perform significantly more examinations in less time. We went from 160 to 170 exams per week before SmartSpeed to up to 200 per week, or about 40 patients per day.

"The short MRI scan times that we realize with SmartSpeed also provide better comfort

"Better productivity is important in a private imaging center like ours. And it is essential that we achieve this higher throughput without compromising image quality"



Traumatic Knee Injury
SmartSpeed is used to reduce scan times. All three PDw orientations were obtained with only one 3D sequence using SmartSpeed. Performed with 1.5T Ambition S, 16ch dS Knee coil.

"Motion artifacts no longer play a major role because patients' time in the magnet is shorter and SmartSpeed reduces motion artifacts better than before"

for all our patients. Not everyone is comfortable lying in the scanner. Even normal, healthy individuals often cannot lie still for that long, which may lead to motion artifacts. So, being able to image faster is an obvious benefit. Our average examination time is now about 10 minutes. Only a few of our exams need more than 20 minutes."

SmartSpeed also brought options for motion-free imaging, so motion artifacts no longer play a major role like before. Dr. Schröter says the team sees fewer repeat scans when using SmartSpeed, "Firstly, because patients' time in the magnet is shorter, and secondly because SmartSpeed MotionFree reduces motion artifacts better than before."

Helium-Free Operation Helps Saving Costs

When Dr. Schröter initially planned to replace the old MRI system, he learned that safety requirements for the quench system had become so strict that the existing vent pipe could no longer be used and costs for updating it in the heritage-protected building were excessive.

Choosing the Philips Ambition S with its BlueSeal magnet allowed Dr. Schröter to avoid the expensive conversion, as this magnet does not require a vent pipe, because the helium is permanently enclosed within the sealed magnet. The seven-liter helium content of the BlueSeal magnet is also significantly lower than the roughly 1500 liters of other magnets.

"With the BlueSeal magnet we don't need to concern ourselves with helium anymore. Refills are not needed, so there's no time or cost wasted with that.

Sustainability was also an important aspect for me when deciding for BlueSeal. Helium is a resource that is not infinitely available on earth, that's why I think it's good that

we have a closed system that only includes seven liters.

As a radiologist I can't see any difference between images from a sealed system and a system that requires regular helium refill. The image quality and the handling are virtually the same."

Effects of a Patient-Friendly Atmosphere

"In our MRI room we have the Ambient Experience lighting and In-bore experience, which enable us to create a feel-good atmosphere for our patients," says Dr. Schröter. "They feel more comfortable with this experience than in MRI machines without. Our patients love it. It helps many to successfully tolerate the examination. When inside the bore, patients can see the remaining scan time and breath hold guidance on the display. This is very popular. It improves patient engagement and ultimately image quality.

Many patients tell us that if they had known how nice it was in our device, they wouldn't have been afraid of the exam. Patients often say that they will recommend us to others if they ever need an MRI.

Thanks to image quality and a relaxing environment we have been able to scan a higher number of patients. I can emphasize that with the Ambition system, our patient throughput and exam scope have grown."

Large Screen and Easy Operation

The Philips BlueSeal system is operated via MR Workspace, the large-screen operator console that empowers the technologist with integrated AI protocol selection.

"The big 27-inch 4K high resolution screen makes a total difference. It shows the large planning images with much higher resolution than we were used to. Anatomic landmarks can be more easily identified, which advances the process. Now it is much easier and faster to plan the new sequences and it's easier for us to find lesions," says Dr. Schröter.

"MR Workspace is a tool to operate the system more seamlessly. The user interface is designed in a very advanced way. Operation is intuitive. Many actions can be executed via drag and drop. It is really easy to use and self-explanatory. There are small features and tools that improve the work significantly. For example, being able to copy the geometry of one sequence to the next, without having to make any major adjustments.

We also use the new Day manager. During an ongoing examination it allows us to load and adjust the planned examinations for upcoming patients at the same time."

Everybody Wins

Dr. Schröter believes that adding SmartSpeed to his BlueSeal system is really a step forward. "It is almost incomprehensible that scanning can be so fast. And the images are brilliant. I'm excited. For all of our examinations the scanning time was drastically shortened – particularly the switch to 3D sequences makes a difference. Our practice is now able to use some sequences that were hardly used before because of their long scan time.

SmartSpeed is a real game changer. The decisive factor is that we can now achieve this speed and this high resolution on our BlueSeal Ambition S. And I can only say yes to the question on consistency of the picture quality. We can always produce brilliant images with SmartSpeed, so it is not necessary to repeat sequences.

Faster scanning means less possibility for motion artifacts, less rescans, and a much better result. We gain more confidence during reporting, so patients are getting a much better diagnosis. Everybody wins."

SmartSpeed is a real game changer. The decisive factor is that we can now achieve this speed and this high resolution on our BlueSeal Ambition S

[1]Compared to their way of working before having SmartSpeed
Results of case studies are not predictive of results in other cases. Results in other cases may vary.

Economic Opportunities in Adopting Helium-Free Operations for MRI Systems

Jonathan D. Agnew, *PhD, MBA, Adjunct Professor, Faculty of Medicine, University of British Columbia*

The rising costs and supply chain vulnerabilities associated with helium-dependent MRI systems pose significant challenges for healthcare providers. MRI systems allowing for helium-free operations offer a transformative solution, reducing operational costs, minimizing infrastructure demands, and enhancing system reliability. These systems not only ensure diagnostic quality but also align with sustainability goals, positioning healthcare facilities to better manage future supply disruptions.

Industry and providers of medical imaging are at a crossroads, as traditional helium-dependent MRI systems face mounting challenges in operational continuity, cost control, and sustainability

Introduction

Industry and providers of medical imaging are at a crossroads, as traditional helium-dependent MRI systems face mounting challenges in operational continuity, cost control, and sustainability. With global helium supplies becoming increasingly scarce and costly,[1,2] healthcare providers are seeking innovative solutions to maintain essential diagnostic capabilities while reducing operational costs. The emergence of MRI systems with new types of magnets represents a transformative shift in medical imaging technology, promising to address both environmental concerns and economic pressures while maintaining diagnostic quality.[3,4]

The Helium Challenge in Traditional MRI Systems

Supply Chain Vulnerabilities

Healthcare facilities across Europe increasingly face challenges in maintaining helium-dependent MRI systems, with helium delivery delays ranging from one to three days, particularly affecting regions with limited distribution networks in Eastern and Southern Europe.[1] These supply chain disruptions create operational uncertainties and potential service interruptions. The US Geological Survey reports growing concerns about helium cost and availability, highlighting the vulnerability of healthcare providers to market fluctuations and geopolitical factors affecting supply.[3] Similar reports have been published in Europe (Figure 1).

Figure 1: European Publication on Critical Raw Materials

Operational Costs and Challenges

Traditional MRI systems present multiple operational challenges centered around helium dependency. Regular helium refills impose significant recurring costs, because natural boil-off results in continuous losses requiring frequent replenishment.[4] The risk of sudden helium loss during quench events can lead to substantial financial impacts, requiring emergency refills and causing extended system downtime. A quench event results in the loss of several hundred liters of helium, necessitating costly helium refills and disrupting patient care schedules.[5]

These operational challenges are compounded by rising helium prices and environmental concerns. The extraction and refinement of helium alongside natural gas contributes to carbon emissions, adding environmental costs to the economic burden.[6] Healthcare facilities must balance these increasing operational expenses against budget constraints while maintaining essential diagnostic services.

Infrastructure and Installation Considerations

Traditional MRI Requirements

The installation of conventional helium-cooled MRI systems demands significant infrastructure modifications and specialized facility requirements. These systems require quench pipes for emergency helium venting, adding complexity and cost to installation projects.[4] The substantial weight of traditional systems, primarily due to their cryogenic components, often necessitates structural reinforcement, particularly in facilities not originally designed for heavy medical equipment.[5] (Westbrook et al., 2018).

Facility Design Constraints

Healthcare facilities must address multiple design constraints when installing traditional MRI systems. Beyond structural requirements, facilities need specialized ventilation systems and safety zones to manage potential helium-related hazards. These requirements often limit placement options and increase installation costs, particularly in retrofit situations where existing buildings must be modified to accommodate the systems.

MRI Solutions Allowing for Helium-Free Operation: Market Overview

Current Technology Leaders

The medical imaging industry has introduced innovative solutions to address helium-related challenges, focusing on reducing or eliminating helium dependency. Among these advancements are helium-free operated systems designed with reduced infrastructure requirements and lightweight construction.

Philips has led in this area with the 2018 launch of the Ingenia Ambition (1.5T) and its subsequent successors enabling helium-free operation. Its key feature is the BlueSeal magnet that contains only 7L of helium, in a sealed magnet, ensuring the minimal amount of helium can never escape. These developments demonstrate the industry's commitment to improving MRI system efficiency and sustainability.[4,7]

EasySwitch Technology

Philips' EasySwitch technology represents a key innovation in MRI systems with the BlueSeal magnet. This technology allows hospital personnel to easily discharge and re-energize the magnet from behind the MR console. So, if a magnetic item becomes stuck in the bore, EasySwitch allows resolving these incidents in just a few hours. Additionally, EasySwitch enables proactive magnet discharge in preparation for natural disasters or other emergency situations. These capabilities enhance system resilience, increase operational flexibility, and minimize downtime in critical scenarios without requiring specialized external service teams.[7]

Operational Benefits of Helium-Free Systems

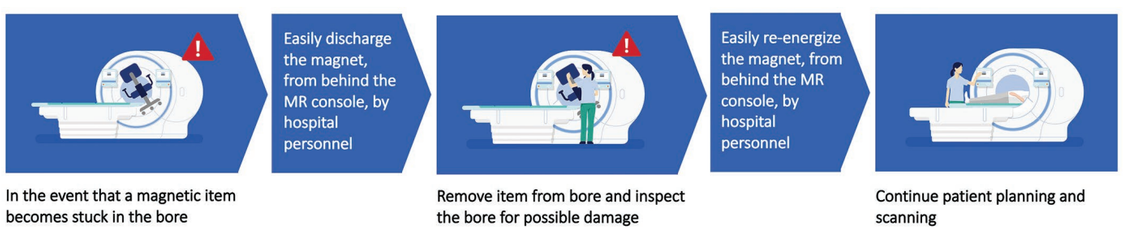
Helium-free MR systems operation offers significant benefits through simplified facility management. The elimination of the need for helium-related maintenance reduces complexity and specialized support requirements for cryogen management.[4] The lighter weight of these systems, including those using conduction-cooled designs, minimizes structural requirements and enables more flexible installation options. The absence of quench pipes further streamlines facility planning and reduces infrastructure costs.[8] The elimination of helium-related downtime and maintenance requirements contributes to improved operational efficiency.

Economic Impact Analysis

Direct Cost Savings

The adoption of helium-free MR systems presents multiple avenues for cost reduction that impact both immediate and long-term operational expenses. Healthcare facilities can eliminate significant costs associated with

The medical imaging industry has introduced innovative solutions to address helium-related challenges, focusing on reducing or eliminating helium dependency



Philips EasySwitch helps to resolve small incidents in just a few hours, independent on scarce helium supply and preventing additional helium costs

The significant weight reduction of sealed systems vs traditional systems allows more flexibility in siting

regular helium refills, specialized maintenance requirements, and emergency response protocols for quench events.[9] Sealed MRI systems deliver speed and image quality comparable to traditional helium-cooled systems, ensuring similar clinical capabilities, diagnostic quality, and productivity levels. These systems maintain diagnostic efficacy while offering operational advantages, contributing to sustainable healthcare delivery without compromising clinical performance or patient throughput.

Indirect Benefits

Beyond direct cost savings, helium-free systems offer broader economic advantages through multiple channels of value creation. The elimination of helium dependency protects facilities from increasingly volatile supply chain disruptions, with European delivery delays ranging from 1-3 days and particularly affecting facilities in Eastern and Southern Europe.[1,10] Healthcare providers benefit from reduced infrastructure requirements, including the elimination of costly quench pipes and specialized room modifications.[4] The significant weight reduction of sealed systems vs traditional systems allows more flexibility in siting. The simplified maintenance procedures and reduced reliance on specialized support for cryogen management contribute to long-term operational savings.[6]

These systems also position healthcare providers to better manage future challenges in helium availability while maintaining essential diagnostic capabilities.[1] As global helium supplies become increasingly scarce and prices continue to rise due to geopolitical instability and production limitations, the transition to helium-free systems offers a hedge against future cost increases.[3] The improved operational efficiency and reduced downtime further enhance the economic benefits through increased patient throughput and improved resource utilization.[6] Additionally, the environmental benefits of reducing helium consumption align with broader sustainability goals, potentially offering advantages in markets where environmental considerations impact healthcare funding and regulation.[3]

References:

1 April 4, 2023. Accessed February 19, 2025. https://www.innovationnewsnetwork.com/helium-shortage-4-0-what-caused-it-and-when-will-it-end/29255/

2 Romanelli J. Hunt is on for helium; rising cost has some hospitals turning to new MRI models. Healthy Debate. July 4, 2022. Accessed February 19, 2025. https://healthydebate.ca/2022/07/topic/helium-shortage/

3 Mineral commodity summaries 2023 | U.S. Geological Survey. January 31, 2023. Accessed February 19, 2025. https://www.usgs.gov/publications/mineral-commodity-summaries-2023

4 The new reality in MR is operating helium-free. Philips. Accessed February 19, 2025. https://www.philips.com/a-w/about/investor-relations/in-the-know-with-philips-ir/the-new-reality-in-mr-is-operating-helium-free.html

5 Stephens K. Healthcare Has a Helium Problem. Here's One Solution. AXIS Imaging News. Published online 2024.

6 Wilkinson S, Gerth F. A Review of the Sustainability of Helium: An Assessment of Its Past, Present and a Zero-Carbon Future. Reg Sci Environ Econ. 2024;1(1):78-103. doi:10.3390/rsee1010006

7 Philips' BlueSeal helium-free MR operations magnet wins Best New Technology Solution for Radiology award. Philips. Accessed February 19, 2025. https://bit.ly/3E7pmZT

8 Qu H, Wu H, Feng Z, et al. Thermal Analysis of the 4 K Cryostat Within a 1.5 T Conduction-Cooled Superconducting Magnet for Whole-Body MRI Application. IEEE Trans Appl Supercond. 2024;34(8):1-5. doi:10.1109/TASC.2024.3420212

9 Kara DC. Production of a viable product in magnetic resonance imaging using MgB2. Published online 2014.

10 Nazir A, Ali Chaudhry M, Nadeem B, Qadeer A, Junaid Dar A. Global helium shortage leading to the shutting of imaging modalities is the world's next medical crisis-driving factors, future of helium-free magnetic resonance imaging systems, and alternatives to magnetic resonance imaging. Int J Surg Glob Health. 2023;6(4). doi:10.1097/GH9.0000000000000155

IMPROVING HEALTHCARE SUSTAINABILITY - THE DRIVE TOWARDS HELIUM-FREE MRI OPERATIONS

BHRUT (UK) Finds Speed, Quality, and Ease-of-Use at an Attractive Total-Cost-of-Ownership with Philips BlueSeal MR

Christiane Zelenyanszki PhD
Programme and Service Development Lead- Community Diagnostics for BHRUT
Barking, Havering and Redbridge University Hospitals NHS Trust (BHRUT)
Community Diagnostic Centre (CDC) at Barking Community Hospital, UK

Zivio Mascarenhas
Procurement and Programme Specialist for BHRUT
Barking, Havering and Redbridge University Hospitals NHS Trust (BHRUT)
Community Diagnostic Centre (CDC) at Barking Community Hospital, UK

Ronnie Hernandez
Cross Site MRI Lead Radiographer for BHRUT
Barking, Havering and Redbridge University Hospitals NHS Trust (BHRUT)
Community Diagnostic Centre (CDC) at Barking Community Hospital, UK

Zivio Mascarenhas (l), Ronnie Hernandez (m), Christiane Zelenyanszki (r)

A BlueSeal magnet eliminates the need for liquid helium refill. There's no helium loss, no refills, and no unexpected costs

For Barking, Havering and Redbridge University Hospitals NHS Trust (BHRUT) in the UK, reducing wait times and providing quick access to exceptional care is paramount. In February 2023, plans for a new Community Diagnostic Centre (CDC) at Barking Community Hospital were announced to help meet growing demand for diagnostic testing and to reduce healthcare inequalities. The CDC, opened in March 2024, provides scans away from the hospital for northeast London residents.

According to Christiane Zelenyanszki PhD, Programme and Service Development Lead-Community Diagnostics for BHRUT, "In order to increase the capacity, all non-urgent diagnostics need to move out of the acute departments into the community. The whole idea is to try to address inequality and bring diagnostic services directly into the community, making it easier for our patients."

Crucial to the decision making process was finding the proper MRI system to meet

Barking CDC

To further mitigate unwanted downtime issues, Philips BlueSeal qualifies as the first magnet driven by an adaptive intelligence functionality called EasySwitch

BHRUT's strategic requirements. After careful, competitive analysis, the Trust selected a system powered by Philips exclusive BlueSeal magnet technology for helium-free operations. A BlueSeal magnet eliminates the need for liquid helium refill. There's no helium loss, no refills, and no unexpected costs. The lightweight system sites easily and incorporates AI-driven technology to simplify and automate complex clinical tasks. Most importantly it offers a total-cost-of-ownership that reflects positively for a publicly funded institution such as BHRUT.

Procurement and Programme Specialist for BHRUT, Zivio Mascarenhas, recalls the search effort, "Not only did we look at the total-cost-of-ownership of the equipment, but also at longevity associated benefits and efficiency, in terms of equipment maintenance, and supplier responsiveness. We considered design innovation, image quality, maintenance needs, and the footprint of the system. We looked at whether the system was patient friendly, and its ease-of-use for our clinicians. Taking all this into consideration, we chose the Philips BlueSeal MR 5300 system."

Simplified Placement with the Unique Characteristics of a BlueSeal System

The BlueSeal magnet can dramatically reduce installation costs. Because no liquid helium can escape, a BlueSeal magnet does not need a vent pipe[1], along with the associated expenses and installation limitations it involves. Thanks to this unique advantage, the BlueSeal magnet can be installed in locations where it was previously very difficult.

Additionally, the system is very light. With a minimum siting limitation of 3,700 kg, the magnet is around 900 kg lighter than its predecessor[2] a decrease in weight that can potentially facilitate easier siting, reduce floor adaptations and further lower construction costs.

At BHRUT, this was of critical importance. "Ease of installation was key to us," says Mascarenhas. "The Barking CDC was going to be of modular design, constructed off site and then brought to the permanent location. Collaboration between the equipment supplier and the modular building company was essential to integrate the BlueSeal system seamlessly into the building design. Not needing a vent pipe was a key factor in this regard. And with a much lighter system, final siting was considerably simplified."

Increased Operational Efficiency Makes for a More Sustainable Future

At Philips, a clear focus is placed on asset lifecycle management as key to reducing the environmental impact of technological development. Use less, use longer and use again is the philosophy that guides this approach. Every BlueSeal magnet at the heart of a Philips MRI system is designed for increased energy efficiency and continued peak performance through upgrades that can be easily applied to extend its life.

"BlueSeal demonstrates the convenience of a modern solution – it is truly plug-and-play," says Mascarenhas. "Once powered on, the BlueSeal MRI runs seamlessly and consumes significantly less energy compared to Philips systems without PowerSave functionality. By procuring this permanent, energy-efficient solution, we've been able to reduce associated expenses substantially, providing both a financial and operational benefit."

Ronnie Hernandez, Cross Site MRI Lead Radiographer for BHRUT, adds, "The system is in line with BHRUT's green plan 2022-25, to play an active and leading role in the greener NHS agenda. That's one of the major factors that attracted us to the Philips BlueSeal MR 5300."

BHRUT Realizes Tangible Cost Benefits Through Innovative System Design

System downtime negatively affects operations, clinical efficiency, and patient throughput. This is a situation staff at BHRUT is all too familiar with. As Christiane Zelenyanszki explains, "We have five MR scanners throughout the Trust that require a regular helium refill or 'topping up'. It costs a lot of money and the scanner needs to be down at least a day or two. That puts a lot of pressure on us. In comparison, BlueSeal's helium-free operations offers a significant reduction in our planned downtime which adds to our improvement in both efficiency and capacity."

To further mitigate unwanted downtime issues, Philips BlueSeal qualifies as the first magnet driven by an adaptive intelligence functionality called EasySwitch. This technology offers a quick and easy way to power down the system from behind the MRI console. Ronnie Hernandez describes the benefits, "With the EasySwitch, a radiographer can temporarily ramp down the magnet and then put it back on field again. In comparison, traditional MRI scanners need a full set of engineers, a helium-refill and a lot of system down time."

Meeting The NHS KPI With Faster Throughput and Outstanding Image Quality

Barking CDC patient throughput is driven by adherence to the NHS Diagnostic Waiting Times and Activity (DM01[3]) KPI. This goal is exactly what the Trust was planning to address with the implementation of the new Centre. According to Hernandez, "We're meeting our target and smashing it. We used to scan 2 patients per hour, or even 45 minutes for each. Now it's easily 3 per hour. We are over performing because the scanner can do it. I think we're the only Trust within Northeast London that achieved DMO1 compliance."

How is this accomplished? The BlueSeal system employs SmartSpeed acceleration technology where images can be acquired up to 3 times faster with no loss in quality[4], providing up to 65% greater resolution[4], and is compatible with 97% of clinical protocols[5].

"This high throughput is really excellent," says Mascarenhas. "There's been a huge backlog since COVID-19 and this BlueSeal system has helped us reduce the number of patients who are waiting for scans."

Ease-Of-Operation Benefits Staff and Patients Alike

Ronnie Hernandez and his team enjoy working with the new system. "We chose the BlueSeal system because it's so easy to use – particularly when you transition from traditional MRIs as we have."

"What I'm seeing," adds Zelenyanszki. "is that the patient is well supported with various functionalities to help us complete the scan. As an example, AutoVoice technology comforts our anxious patients and supports exam compliance."

AutoVoice ensures that patients are receiving consistent instructions by telling them what to expect and what is expected of them. It announces scan duration and table movements, and provides breath hold guidance. Another feature, VitalEye, is highly appreciated by Barking CDC staff. This AI-based touchless patient sensing provides fast detection of patient's breathing without any operator interaction.

AutoVoice ensures that patients are receiving consistent instructions by telling them what to expect and what is expected of them

Meeting BHRUT's Required Criteria Brings Satisfaction and Intent to Expand

Zivio Mascarenhas sums up BHRUT'sperspective on their new Philips BlueSeal MR system. "We were looking for an efficient system to save us money in the long run. When we take sustainability, clinical quality, ease-of-use, and lack of downtime interruptions into consideration and add an excellent total cost of-ownership – not just up front, but over the next 10 years – we know we made the right decision."

Both the clinical and non-clinical teams on the decision panel were so satisfied that they have purchased a second Philips BlueSeal MR system to be placed in their latest Community Diagnostic Centre slated to open in 2025 at BHRUT's St. George location.

References:

1 Due to closed magnet system
2 Ingenia 1.5T ZBO magnet
3 https://digital.nhs.uk/data-and-information/data-collections-and-data-sets/data-collections/diagnostics-waiting-times-and-activity-dm01
4 Compared to SENSE imaging
5 On average, measured across a sample of sites from Philips MR installed base

Disclaimer:
Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Towards a More Sustainable Healthcare System with Adopting Helium Free Operations In MRI

Jonathan D. Agnew, *PhD, MBA, Adjunct Professor, Faculty of Medicine, University of British Columbia*

Helium-free MRI technology is emerging as an attractive alternative to traditional systems, offering potential economic and environmental benefits. With global helium shortages driving costs higher and disrupting supply chains, healthcare facilities are exploring sustainable imaging solutions that maintain diagnostic quality while reducing reliance on scarce resources. Advances in superconducting magnet designs highlight new opportunities for cost-effective, mobile, and energy-efficient MRI systems. However, further research is needed to quantify the full environmental impact and long-term feasibility of these innovations.

The imaging performance of these whole-body, high-field sealed MRI systems remains comparable to traditional systems, with support for recent scanning methods, including high-speed AI technologies

Introduction

The healthcare industry faces growing pressure to adopt sustainable practices while maintaining quality patient care. A significant challenge is the dependence on helium in magnetic resonance imaging (MRI) systems. As facilities worldwide contend with rising costs and environmental concerns, innovative MRI technologies that drastically reduce helium use have emerged as practical solutions while supporting sustainability goals.

Current commercial MRI systems predominantly operate at 1.5T and 3.0T field strengths, which remain standard for most clinical applications. While research into experimental technologies continues, the industry requires realistic, commercially available solutions implementable within existing workflows. Recent advances from major manufacturers have made significant progress in addressing helium dependency while maintaining necessary diagnostic capabilities.

The global helium shortage has intensified challenges for healthcare providers, with supply chain disruptions directly impacting patient care. This reality has accelerated adoption of reduced-helium technologies offering immediate benefits while supporting long-term sustainability objectives. This article examines the current landscape of commercially available reduced-helium MRI systems and their implications for healthcare facilities.

The Role of Helium in Healthcare

Traditional MRI systems rely heavily on the availability of helium for superconducting magnets, presenting significant operational and cost challenges. The global helium shortage and the growing insight that healthcare needs to become more sustainable have intensified these challenges, pushing healthcare providers to seek more sustainable solutions. This has led to the development of various helium-free and reduced-helium technologies to help address these helium challenges and manage total cost of ownership.

Current Market Solutions for Reduced-Helium MRI Systems

One of the most remarkable advances in MRI technology is the enormous reduction of helium use with the revolutionary BlueSeal technology (Figure 1). Since 2018, 1.5 Tesla BlueSeal MRI systems have been on the market, using efficient micro-cooling technology that requires only a negligible amount of liquid helium. These systems operate with just 7 liters of helium, less than 0.5% of today's standard helium volume. This small amount of helium is sealed within the system, preventing any escape from the magnet. This sealed design eliminates the need for hospitals to refill helium, saving associated costs and reducing downtime.

The significant reduction of helium in the magnet results in lower overall weight of the MRI system, potentially expanding siting options. Additionally, because the helium is sealed in the magnet, no vent pipe is needed, which can save considerable construction costs.

The imaging performance of these whole-body, high-field sealed MRI systems remains comparable to traditional systems, with support for recent scanning methods, including high-speed AI technologies.

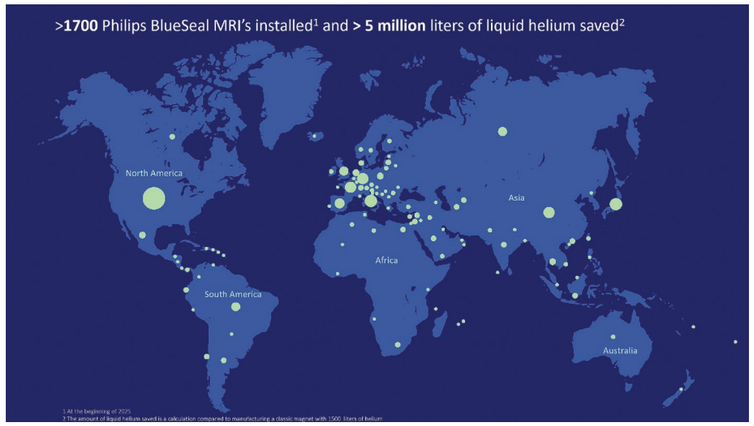


Figure 1: BlueSeal Global Distribution

Other manufacturers have recently introduced their own approaches to reduced-helium systems, as evidenced at recent industry conferences. While research continues into experimental approaches such as high-temperature superconducting technologies[1], the current market primarily offers solutions that maintain conventional field strengths while reducing helium dependency.

Mobile and Relocatable Applications

One of the most promising aspects of helium-free MRI technologies is their potential to expand healthcare access through improved mobility and flexibility. Research emphasises the potential for these systems to be deployed in resource-poor environments, emergency response situations, and remote regions.[2,3] This capability represents a significant advancement in healthcare delivery accessibility.

The studies demonstrate that ultra-low-field and low-field systems can be particularly effective in mobile applications. Qin et al. specifically highlighted the potential for these technologies in rural and remote communities, as well as low-to-middle-income countries.[2] The simplified hardware requirements and reduced operational complexity make these systems more suitable for deployment in areas with limited infrastructure or technical support capabilities. Finally, apart from these research studies, the introduction of Philips' commercially available BlueSeal mobile MRI in 2023 represents the first industrialized concept of helium-free MR operations in a mobile or relocatable system.

Environmental Impact of Reduced-Helium Technologies

When measuring the sustainability impact of MRI systems, multiple factors beyond helium usage must be considered. A comprehensive assessment should include energy consumption, CO_2 emissions, waste generation (including contrast agents and consumables), lifecycle considerations for both magnets and peripheral components, installation requirements, material reuse, system production processes, and replacement frequency.

Traditional MRI systems are significant contributors to healthcare facilities' energy consumption and carbon footprint. Chaban et al. highlight that MRI operations demand substantial electricity, emphasizing the urgent need for sustainable practices in medical imaging to mitigate environmental impacts.[6] Meanwhile, the decreasing production and supply of helium have led to imaging service disruptions, underscoring the vulnerability of helium-dependent healthcare services.[3]

Commercially available reduced-helium systems like sealed or closed loop technology offer quantifiable environmental benefits. These systems eliminate the need for regular refills and vent pipes, substantially reducing resource consumption and infrastructure requirements. Also the risk of helium loss in quench events is eliminated, which prevents both a safety hazard and significant helium waste.

Energy efficiency improvements in modern reduced-helium systems further contribute to sustainability. Lower magnet weight can reduce transportation impacts, while simplified installation requirements may decrease construction-related environmental footprints. However, quantitative data comparing these systems' comprehensive environmental impacts remains limited.

Future research should establish standardized environmental impact measurements across all sustainability factors. This would enable more meaningful comparisons between different MRI technologies and provide healthcare facilities

These systems eliminate the need for regular refills and vent pipes, substantially reducing resource consumption and infrastructure requirements

As radiological departments face increasing pressure to balance clinical outcomes with environmental responsibility, reduced-helium systems operating at conventional field strengths offer a practical solution that maintains diagnostic quality while addressing sustainability goals

with the data needed to make environmentally informed purchasing decisions.

Clinical Considerations and Patient Outcomes

When evaluating reduced-helium MRI technologies for clinical implementation, healthcare facilities must prioritize maintaining diagnostic quality and workflow efficiency. Modern commercial whole-body, high-field systems operating at 1.5T and 3.0T remain the standard for most clinical applications due to their established image quality, versatility, and validated diagnostic protocols.

Philips' BlueSeal technology demonstrates that reduced-helium systems can maintain the clinical performance standards expected from conventional high-field MRI. These 1.5T systems support the full range of clinical applications – from neurological and musculoskeletal imaging to cardiac and abdominal diagnostics – without compromising image quality or diagnostic confidence. The systems utilize the same coils, protocols, and advanced techniques available on traditional systems, ensuring seamless integration into clinical workflows.

Patient experience benefits include reduced acoustic noise levels compared to some conventional systems and faster scanning times through AI-driven acceleration techniques. For healthcare providers, the operational reliability of reduced-helium systems offers significant advantages, including minimized downtime for helium refills and reduced risk of quench-related service interruptions.

While research into ultra-low-field systems continues, as demonstrated by Qin et al.[2] and others, current clinical practice relies predominantly on standard field strengths. The primary value of commercially available reduced-helium technologies lies in their ability to combine sustainability advantages with the clinical performance healthcare providers require for diagnostic confidence.

As radiological departments face increasing pressure to balance clinical outcomes with environmental responsibility, reduced-helium systems operating at conventional field strengths offer a practical solution that maintains diagnostic quality while addressing sustainability goals.

Conclusion and Future Outlook

The transition toward reduced-helium MRI systems represents a significant advancement in sustainable medical imaging. Commercially available technologies like sealed magnets offer healthcare facilities immediate solutions that address helium dependency while maintaining clinical performance at standard field strengths. These systems demonstrate that sustainability improvements need not compromise diagnostic quality or operational efficiency. Looking ahead, the industry must focus on developing standardized methods for quantifying environmental impacts beyond helium reduction, including energy consumption, material usage, and lifecycle considerations. While experimental technologies like ultra-low-field systems and completely helium-free designs continue to evolve, healthcare facilities can take meaningful steps toward sustainability today by adopting reduced-helium systems that operate within established clinical parameters. As global helium supplies remain uncertain, these innovations provide critical resilience for healthcare providers while supporting broader environmental responsibility goals. The future of MRI technology will likely see further refinements in reduced-helium designs alongside continued research into alternative approaches, ultimately driving toward imaging solutions that balance clinical excellence with environmental stewardship.

References:

1 Urayama S ichi, Fukuyama H, Ozaki O, et al. Cryogen-free 3T-MRI system for human brain research using B-2223 high-temperature superconducting tapes. In: 2012 ICME International Conference on Complex Medical Engineering (CME). IEEE; 2012:376-381. doi:10.1109/ICCME.2012.6275593

2 Qin C, Murali S, Lee E, et al. Sustainable low-field cardiovascular magnetic resonance in changing healthcare systems. Eur Heart J - Cardiovasc Imaging. 2022;23(6):e246-e260. doi:10.1093/ehjci/jeab286

3 Nazir A, Ali Chaudhry M, Nadeem B, Qadeer A, Junaid Dar A. Global helium shortage leading to the shutting of imaging modalities is the world's next medical crisis-driving factors, future of helium-free magnetic resonance imaging systems, and alternatives to magnetic resonance imaging. IJS Glob Health. 2023;6(4):e0155. doi:10.1097/GH9.0000000000000155

4 Sarracanie M, LaPierre CD, Salameh N, Waddington DE, Witzel T, Rosen MS. Low-cost high-performance MRI. Sci Rep. 2015;5(1):15177.

5 Leong ATL, Liu Y, Zhao Y, et al. A Feasibility Study of 0.055T MRI for Neuroimaging and Comparison with Clinical 3T MRI. In: ; :4370. doi:10.58530/2022/4370

6 Chaban YV, Vosshenrich J, McKee H, et al. Environmental Sustainability and MRI: Challenges, Opportunities, and a Call for Action. J Magn Reson Imaging. 2024;59(4):1149-1167. doi:10.1002/jmri.28994

Saint-Augustin Clinic Increases Imaging Capacity, Reproducibility and Patient Satisfaction

Dr. Stéphane Gellée

Radiologist at Saint Augustin Hospital in Bordeaux, France, specializing in liver and other digestive imaging as well as female pelvis imaging

BlueSeal MR 5300 System Delivers Versatility and Efficiency

When Saint-Augustin Clinic, an illustrious private hospital in Bordeaux, France, decided to add a second MRI system to accommodate its high patient load, they were looking for an all-around, easy-to-use 1.5T system that provides high image quality throughout the body. They found what they wanted in the Philips MR 5300 system, and began operation with the system in January 2022. Saint-Augustin's radiologists and technologists prize the MRI system for its ability to deliver high quality imaging in a short time, as well as for the remarkably lightweight coils that are easy to position. Radiologist Stéphane Gellée, MD, shares her experiences.

Serving More Patients and Helium-Free Operation

Saint-Augustin Clinic chose the BlueSeal MR 5300 system to help it serve more patients. According to Dr. Gellée this system meets its clinical needs for versatility, high quality and diagnostic reliability, while also addressing the need for better workflow and ergonomics that enhance both patient and operator experience.

The decision-makers were also impressed by the system's magnet that enables helium-free operation. The fully-sealed BlueSeal magnet uses just 0.5%* of the helium of a conventional system – and no refills are required.

"This system is a sign of strong ecological progress for imaging," Dr. Gellée says. "We are able to have excellent image quality while also respecting natural resources, and that contributes to the health of people in two ways."

Because no helium can escape, there is no need for a vent pipe, which makes siting easier and less costly. Dr. Gellée says the sealed magnet is also perceived as 'insurance' against quench.

Saint-Augustin Clinique (Bordeaux, France), a member of the ELSAN group of private hospitals, was recently named the 14th best private hospital in France by Le Point magazine. The hospital was also named first nationally in four specialties: prostate cancer, kidney cancer, bladder cancer and adult heart surgery. In addition, Newsweek recognized Saint-Augustin on its list of the top 20 hospitals of France.

"We are able to have excellent image quality while also respecting natural resources, and that contributes to the health of people in two ways"

Saint-Augustin Clinique (Bordeaux, France), a member of the ELSAN group of private hospitals, was recently named the 14th best private hospital in France by Le Point magazine. The hospital was also named first nationally in four specialties: prostate cancer, kidney cancer, bladder cancer and adult heart surgery. In addition, Newsweek recognized Saint-Augustin on its list of the top 20 hospitals of France.

"I can image the intestines in a single acquisition by using a large field of view, which is enabled by combining coils to get more coverage. The images are of good quality and look very crisp"

Consistent Image Quality and Speed Impress

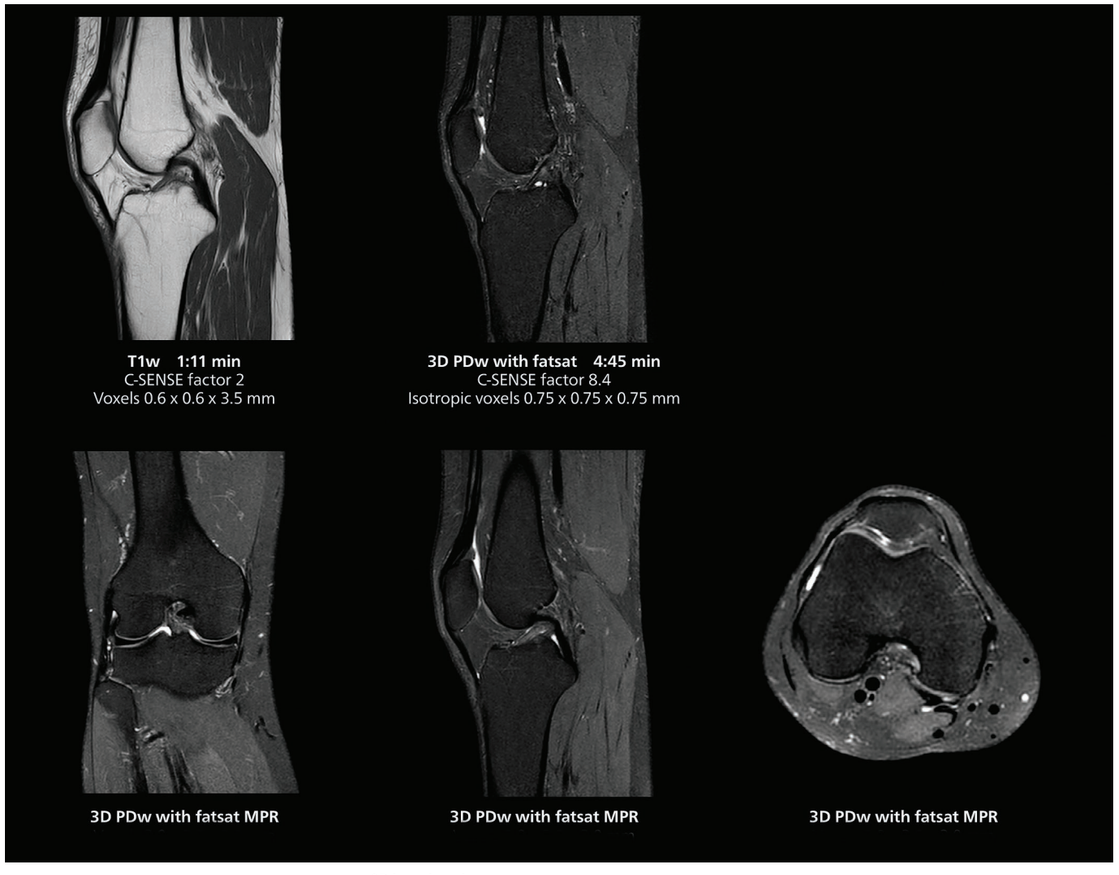
According to Dr. Gellée, the hospital conducts an average of four studies each hour, totaling about 40-45 patients per day on their MR 5300. Studies are read by approximately 50 radiologists in the Bordeaux area. Dr. Gellée is especially satisfied with the image quality of the MR system. "I obtain higher image contrast and more anatomical precision than I was used to," she says. "When I am able to choose, I request that studies be done on this system, because I get better anatomical image quality. For example, in the knees, I can get great images of the meniscus. To me, it looks as pretty as 3T."

She values the consistent, reproducible results for all anatomies. "I have seen no bad exam on this system. I always can answer the question asked," she says.

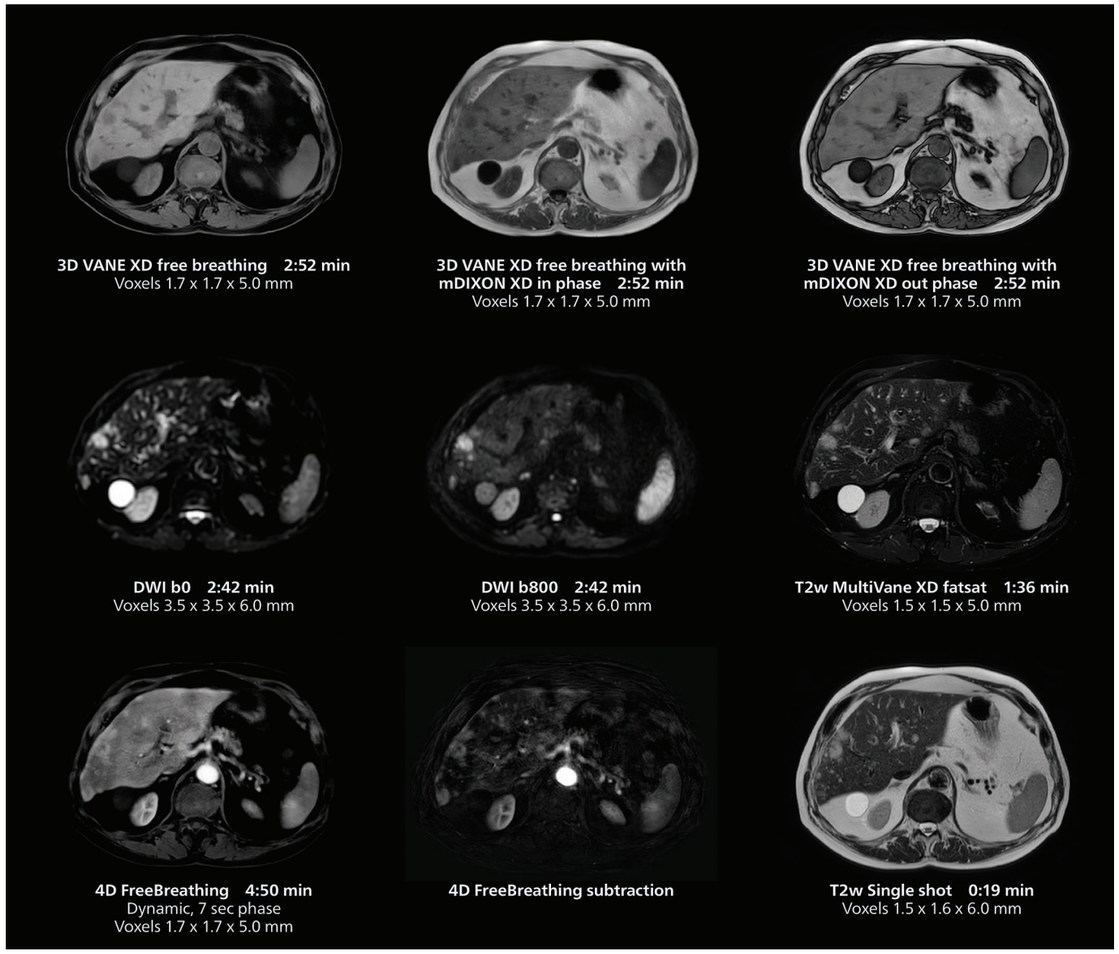
Dr. Gellée also appreciates the large FOV imaging that the system makes possible. "I can image the intestines in a single acquisition by using a large field of view, which is enabled by combining coils to get more coverage. The images are of good quality and look very crisp."

Supports Management of Emergency Patients Without Disrupting Schedule

Also remarkable is the high-quality black blood imaging for vascular and brain imaging as well as the fast stroke imaging. "In stroke imaging we achieve high quality diffusion, T2* with excellent homogeneity and high resolution TOF (time-of-flight) images. Even with this high resolution, the protocol is very fast, which allows us to include emergency imaging in our daily schedule," she says. "We often can accommodate an emergency patient without disrupting the schedule of other patient's appointments. Having the MR 5300 helps us in good emergency management in daily practice."



3D knee imaging
The isotropic high resolution 3D sequence in this MRI case allows for reformatting to obtain other orientations with high quality. Acquired on the BlueSeal MR 5300 system.



Liver imaging using MR 5300
This case includes 3D free breathing and 4D dynamic free breathing MRI of a metastasized liver. A high quality fatsat sequence with good resolution is obtained in 1:36 minutes with T2-weighted MultiVane XD.

Free-Breathing Scans Provide Reproducibility and Patient Comfort

Dr. Gellée highlights the robust free-breathing scans as "the feature that makes the biggest difference in my daily work. The 3D free breathing sequences are very reproducible, and the axial acquisition is very good. For example, in endometriosis, which is one of my focus areas, it provides high contrast and good resolution so that I can see small details. We also use free breathing for liver and pancreas imaging. In multi-phase liver studies, 4D Free Breathing delivers 3-second temporal resolution, making a dynamic scan with more than one arterial phase possible."

For elderly patients in particular, free-breathing protocols make exams more comfortable while providing the image quality needed for confident diagnosis. "We have a large elderly population in the city, and because long breath holds are difficult for many older patients, free-breathing is a significant advantage," Dr. Gellée says. "In cardiac MR for example, with 4D flow and late enhancement, we get excellent diagnostic quality without asking our patients to hold their breath."

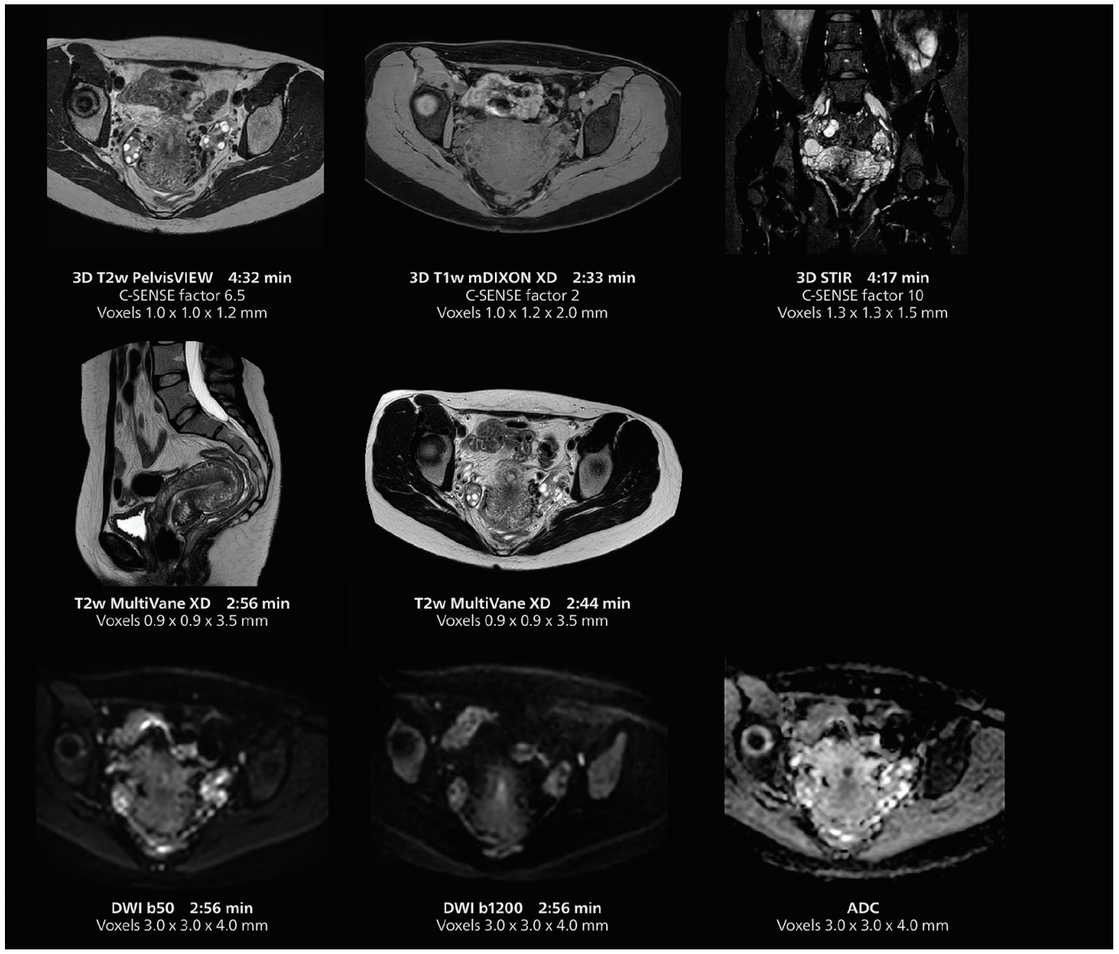
She also uses free breathing with 3D mDIXON to obtain in-phase, water and fat images in a single scan. "It is very reproducible before and after gadolinium, which makes it useful for liver imaging," she adds.

The free breathing sequences use VitalEye touchless patient sensing, which provides a respiratory signal without requiring a respiratory belt.

Imaging Speed Benefits Diagnostic Confidence

The BlueSeal MR 5300 with Compressed

In cardiac MR we get excellent diagnostic quality with 4D flow and late enhancement, without asking our patients to hold their breath



Female pelvis imaging
This MRI case illustrates good resolution and imaging quality obtained within reasonable scan times using the MR 5300 1.5T system with the anterior torso cardiac coil that allows use of a large field of view (FOV).

Touchless patient sensing is always ready – no respiratory belt positioning needed – and the system offers automatic centering and in-room exam starting. Automated exam planning

SENSE is up to 50%** faster for many exams. It can provide routine exams in less than 5 minutes and whole-body exams in less than 20 minutes. Saint-Augustin has taken advantage of that speed to create highly efficient protocols. The hospital's standard stroke protocol is just about 8 minutes, and standard ear-nose-throat, prostate PIRADS staging, and endometriosis studies all clock in at just about 10 minutes.

"We have more speed in 3D sequences," Dr. Gellée states. "With Compressed SENSE, we can replace two or three 2D scans with one high-quality 3D scan. High quality additional orientations are then obtained by post-processing of the 3D data set, thus saving scanning time."

Dr. Gellée often takes advantage of the system's speed to add more sequences to an exam. "When Compressed SENSE reduces typical exam duration, I can add sequences to increase my confidence in diagnosing. For example, post-gadolinium liver scans used to be axial, but now we can use a faster coronal scan. And because I know that the quality will be good the first time, I know I won't have to repeat the sequence. That frees up time to comfortably add one more sequence," she says.

"Having this speed is better for patients as well. For example, if a patient has a fibroma, I like to include a post-gadolinium scan, because the enhancement pattern helps in diagnosis. Without that sequence, we sometimes need another appointment to perform additional scanning, but I really prefer to do it all in just one scan session. So, adding that post-gadolinium sequence is more valuable to me than reducing exam length."

Efficient Workflow and Light Coils Improve Exams for Staff and Patients

The Saint-Augustin technologists appreciate the fresh approach to exam efficiency that includes guided patient set-up in under a minute. The extensive set of workflow features contributes to a more pleasant working environment, and changes the experience for both staff and patient, says Dr. Gellée. "Patient set-up is faster. Technologists can begin the exam when they are near the patient, and they don't have to stop the acquisition if the patient has a question. If we can image one or two more patients in a day, that adds up to many more patients that we can help."

"Our technologists are also very happy with the Breeze coils," says Dr. Gellée. "They like that these are lightweight and easy to connect. A light signal confirms that the coil is properly connected, and we can check that any time on the console as well. Coils can also be combined to increase coverage."

Touchless patient sensing is always ready – no respiratory belt positioning needed – and the system offers automatic centering and in-room exam starting. Automated exam planning, scanning, post-processing and automated patient coaching support the technologist in the operator room. These Smart Workflow features reduce the number of steps involved in an MR exam, so that patients – not technology – retain the focus of operators.

Hospital Values Creating a Positive Patient Experience

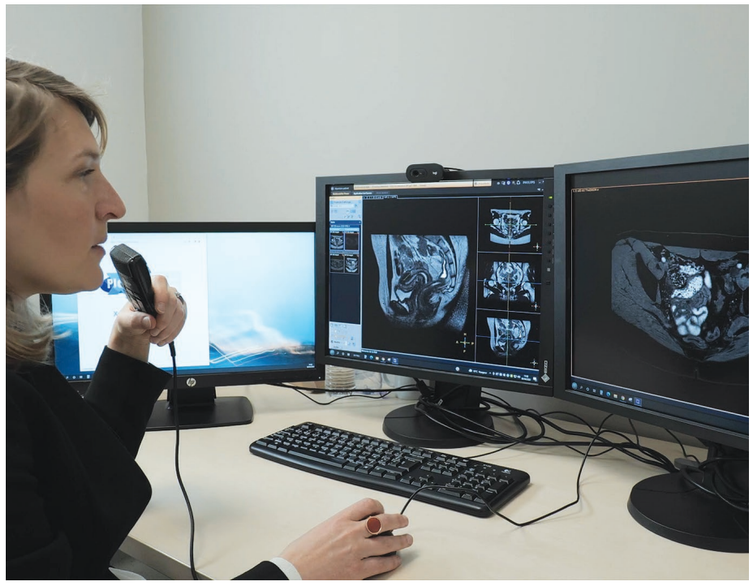
Saint-Augustin puts high value on creating a good experience for patients. The team receives positive feedback from patients, who appreciate the comfortable memory foam mattress of the MRI system as well as the Ambient features. "We talk to the patient after each exam," Dr. Gellée says. "They appreciate the 'Zen atmosphere' and they like that they can choose a film to watch. It makes the experience less 'cold' for them. The lighting is beautiful, and it calms their fears. Sometimes, with our other MRI, it is more intimidating."

System is a Game-Changer

Dr. Gellée notes that the combination of productivity features, high diagnostic quality and potential to conduct research and partner with Philips make the BlueSeal MR 5300 a perfect fit for Saint-Augustin Clinic. "The MR 5300 is a game-changer in medical imaging for a large range of applications," she says. "We are pleased with the high level of diagnostic confidence it brings us, regardless of the anatomy or the sequences used."

The MR 5300 is a game-changer in medical imaging for a large range of applications

*Compared to the Ingenia 1.5T ZBO magnet
**Compared to Philips scans without Compressed SENSE
Results from case studies are not predictive of results in other cases.
Results in other cases may vary.



NOTES

IMPROVING HEALTHCARE SUSTAINABILITY - THE DRIVE TOWARDS HELIUM-FREE MRI OPERATIONS

NOTES