Recommendations for saving energy in MRI

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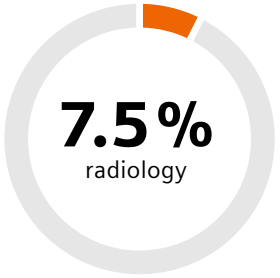
SIEMENS Healthineers

Recommendations for saving energy in MRI

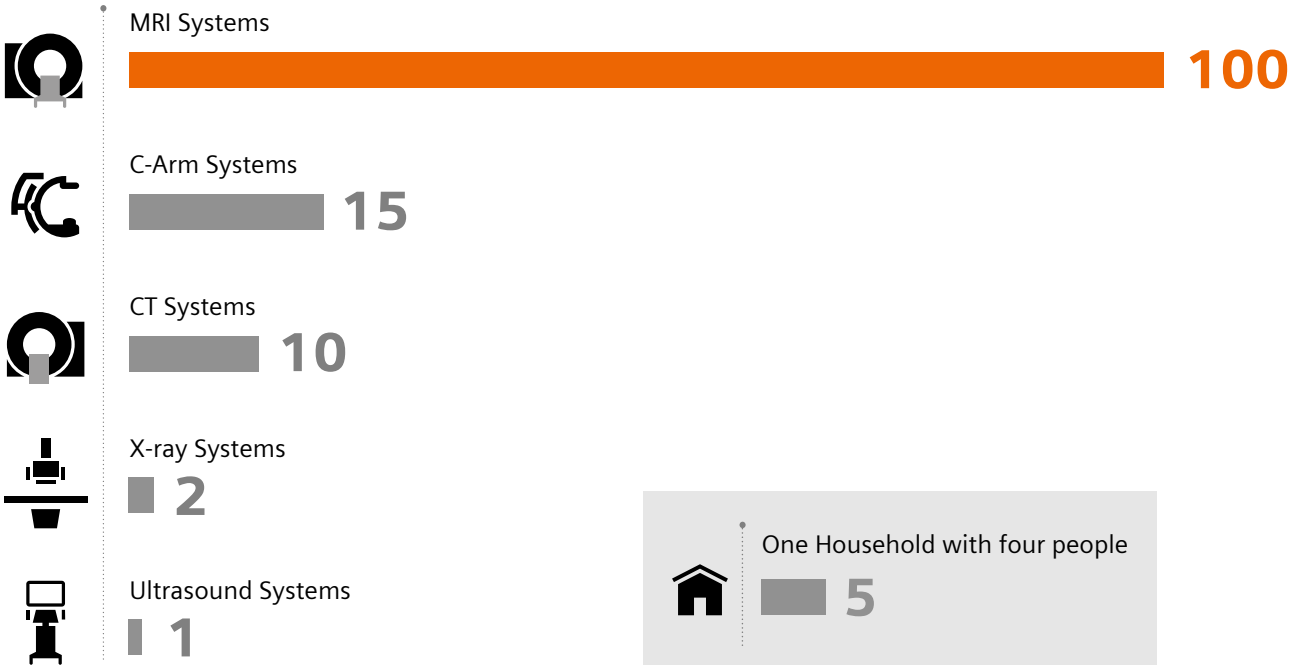
Contributing to a regenerative and healthy environment is one of the most crucial aspects of sustainability. How we handle natural resources, our production, and our waste will determine the future of our human habitat, our living standard as well as our advancements as a civilization. In this context, optimizing the energy consumption of our MRI scanners is a way to limit our environmental impact. In addition, the medical sector is strongly affected by the recent increase in energy costs.
The European power benchmark has increased 181% in 2022[1] alone. MRI is the biggest user of electricity within radiology departments: An average MR system of the installed base uses in the range of 100 MWh[3] per year, the equivalent of 20 households with four people[4]. In this context, we as Siemens Healthineers wish to provide guidance on how to reduce the energy consumption of our MRI scanners and recommend the following measures to our system users.

Global greenhouse emissions[1]



Electric energy consumption of hospital[2]

Approximate energy consumption per year[3] [MWh]



Recommendation 1

Turn off the MR scanner during non-working hours

What is it?

Turning the scanner off during non-working hours (for example, overnight and during weekends) is a simple, yet very effective measure to save energy. It's important to be aware that the user manually needs to initiate the standby modus or turn the system off within our user interface.

How much you can save?

Up to 4.5 kW when the system is put into standby mode and up to 5.5 kW when the system is shut down.

Available for which systems?

Any MAGNETOM system can be turned off at regular intervals.

What can you do today?

Turn off your scanner during non-working hours (for example, overnight and during weekends).

Important to know

- We frequently encounter customer perceptions that starting up an MR scanner would take a very long time and thus impacts the daily workflow. This perception is not correct. As an example, the average start-up time for MAGNETOM Vida (3T) and MAGNETOM Sola (1.5T) is 5:30 min.
- Please rest reassured that turning on and off the system at regular intervals does not affect its performances nor stability during operations. Additionally, turning off the system does **not** affect the magnetic field of the scanner, which remains at its nominal strength. **Therefore, please continue to operate local MRI safety within the department!**
- Please make yourself familiar with how to turn your system off safely. Detailed information is provided in our user manual.

Scanner always on[5]		Scanner **off** during non-working times[6]
100 MWh	-20%	**80 MWh**
Energy savings per year		Financial savings per year[7] (assumed price range of 0.2 €/kWh – 0.4 €/kWh)
~ 20 MWh		~ 4,000 € – 8,000 €
~ 100 MWh		~ 20,000 € – 40,000 €

Recommendation 2

Utilize the System Start-Up Timer for optimized operations

What is it?

System Start-Up Timer can be programmed to enable the automatic start-up of your scanner in the morning. This streamlines operations as the MR scanner will already be ready-to-scan when the workday starts. This can save precious minutes in the morning.

Available for which systems?

System Start-Up Timer is available for MAGNETOM Avanto Fit BioMatrix, Sempra, Amira, Altea, Sola, Sola Fit, Skyra Fit BioMatrix, Lumina, Vida, Vida Fit, Cima.X[8] and Cima.X Fit[8], on *syngo* XA software line. Please be aware, the System Start-Up Timer is not retrofittable.

What can you do today?

Make sure to enable the System Start-Up Timer, if installed on your MRI system, to benefit from the automatic start-up of the machine and be ready to scan as soon as you walk into the door.

Recommendation 3

Make use of Eco Power Mode

What is it?

The Eco Power Mode further reduces the energy consumption of the MRI system when the system is in standby mode or shut off. The Eco Power Mode automatically and periodically switches off the cold-head compressor, whilst monitoring the system to ensure an unimpaired magnet cooling.

How much you can save?

The energy savings of the Eco Power Mode itself are further 12 % per year on top of the 20 % that were already achieved by just turning the scanner off during non-working times. In total, those two measures will sum up to energy savings of up to 30 %. This might translate to a saving of over 12,000 € for a single system and of over 60,000 € for a fleet of five systems – depending on the usage profile and energy pricing of the specific country.

Available for which systems?

MAGNETOM Avanto[fit], Avanto Fit BioMatrix, Aera, Amira, Sempra, Altea, Sola, Sola Fit, Viato.Mobile[12], Skyra, Skyra[fit], Skrya Fit BioMatrix, Lumina, Vida, Vida Fit, Cima.X[12], Cima.X Fit[12], Prisma and Prisma[fit], on the XA software line.[13]

What can you do today?

The Eco Power Mode needs to be manually enabled within the service menu by our Customer Service team. Once the Eco Power Mode is enabled, the Eco Power Mode will automatically be activated as soon as the system is in standby mode or shut off.
If the Eco Power Mode is not yet enabled on your MR scanner or you are uncertain, please reach out to your local Siemens Healthineers representative: our Customer Service team can activate the Eco Power Mode also remotely. Similarly, should you wish to upgrade your system to the *syngo* XA software line and make use of Eco Power Mode, your local Siemens Healthineers representative will be able to support you.

Turn-off your system during non-working times

Scanner always on
100 MWh
Scanner off during non-working times[9]
80 MWh
-20 %
~20 MWh

Make use of Eco Power mode

Without Eco Power mode[9]
80 MWh
With Eco Power mode[9]
70 MWh
-12 %[10]
~10 MWh

-30 %
~30 MWh

Achieve up to 30 % savings by turning off your scanner when not in use and by leveraging Eco Power Mode

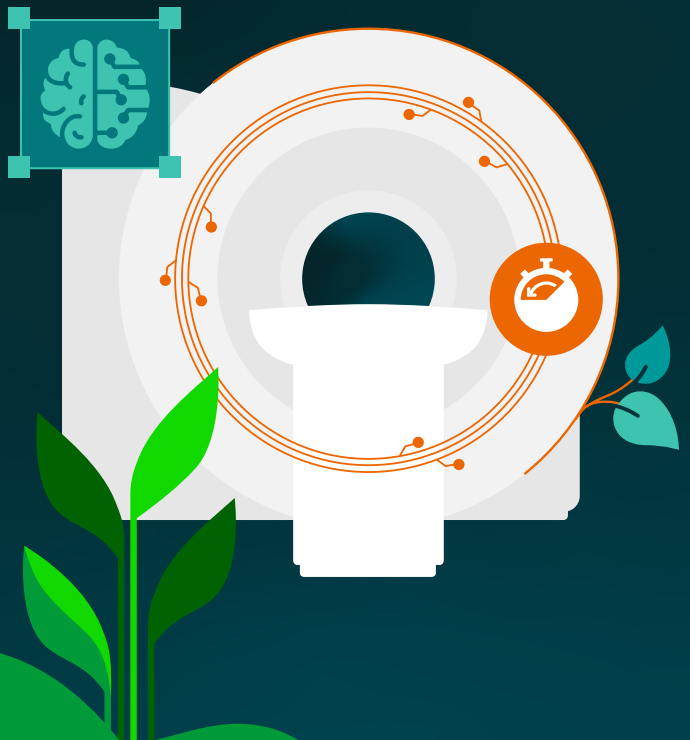
Financial savings per year[11]

1 **~ 6,000 € – 12,000 €**

5 **~ 30,000 € – 60,000 €**

Recommendation 4

Reduce energy consumption with AI-powered Deep Resolve



What is it?

Deep Resolve is our AI-powered image reconstruction technology that can radically shorten scan time whilst maintaining image quality. Saving scan time means saving average energy consumption per patient and accumulates to significant overall energy savings per year.

How much you can save?

With Deep Resolve you can reduce scan times by up to 60 % which directly translates into 60 % less energy consumption for the individual examination. If you now simulate an average clinical workday and accumulate the savings for an entire year, this can translate into up to 13 % energy savings overall[14] (or approx. 14 MWh). Alternatively, the time saved could equally be used to add additional patients to your schedule.

Available for which systems?

MRI scanners that are eligible for Deep Resolve are MAGNETOM Free.Star, Free.Max, Sempra, Amira, Altea, Sola, Sola Fit, Lumina, Vida, Vida Fit, Avanto[fit16], Avanto Fit BioMatrix[16], Aera[16], Skyra[fit16], Skyra Fit BioMatrix[16], Skyra[16], Prisma[16], Prisma[fit], Cima.X[17], Cima.X Fit[17], Viato.Mobile[17], Terra.X[17].

What can you do today?

If you are not taking advantage of Deep Resolve yet, and you wish to accelerate your MR scans and save energy, please speak to your Siemens Healthineers representative.

Without Deep Resolve

With Deep Resolve

- 25 patients
- 6 spine, 6 brian, 5 knee, 2 angiography, 6 abdominal examination
- 15 minutes idle time between consecutive patients

Financial savings per year[15]

1 ~ 2,000 € – 4,000 €

5 ~ 10,000 € – 20,000 €

Outcomes of Recommendations 1 – 4

Turn-off your system during non-working times

&

Make use of Eco Power Mode

Scanner always on
~ 100 MWh

Scanner off during non-working times
~ 70 MWh

-30 %
~ 30 MWh

-40 %
~ 40 MWh

Make use of Deep Resolve

Without Deep Resolve
~ 70 MWh

With Deep Resolve
~ 60 MWh

-13 %
~ 10 MWh

Financial savings per year[18] **~ 8,000 € – 16,000 €** **~ 40,000 € – 80,000 €**

Simple measures can help you to save the energy consumption of your MAGNETOM system by up to 40%. The combination of Eco Power mode with the good practice of turning your system off during non-working times contributes to an energy saving of up to 30%.
On top of this, the utilization Deep Resolve, our AI-powered image reconstruction technology, leads to an additional 13% of energy savings when operating COCIR-like protocols. Together, all of those measures lead to an energy saving of up to 40% (equivalent to approx. 40 MWh per year).

Recommendation 5

Check the operating conditions of third-party solutions

What is it?

A large proportion of our systems operates in combination with pieces of equipment provided by third parties, such as injectors and fMRI stimulus, that can contribute to the overall energy consumption of your MRI operations.

What can you do today?

Make sure to take a look at the manufacturers' guidelines and, if possible, turn equipment off or place it in stand-by mode when not in use.

Recommendation 6

Control and adjust environmental conditions

What is it?

MRI scanners operates within tightly controlled environmental conditions. However, even within these strict boundaries, there is room to implement adjustments that could have a positive impact on energy consumption – if applicable. For example, MAGNETOM Sola must have an ambient room temperature between 18°C and 22°C[19].

What can you do today?

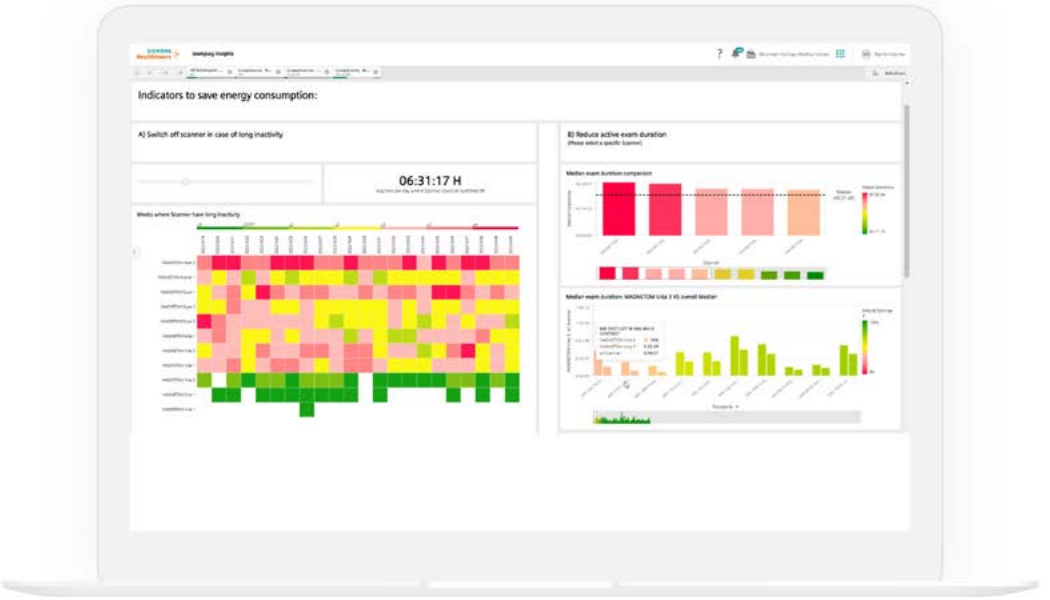
Consider either lowering the room temperature in the winter or raising the temperature in the summer to avoid excess heating or cooling of the scanner, console, or technical rooms.

Important to know

Room temperatures and humidity levels should always remain within stipulated levels. Please contact your local Siemens Healthineers organization to get more advice on your specific system and adjustments you can implement.

Recommendation 7

Optimize your workday with teamplay Insights



Teamplay Insights is equipped with a new Energy Efficiency Dashboard to help you optimize energy consumption across departments.
It allows you to easily track inactive systems that could be switched off or to assess if exam duration optimization could help you save energy. This new standard base sheet is available for all teamplay Insights users in the Institution Library and can be used to improve the energy consumption of MR scanners. The tool can help you, for example, in assessing which systems are turned on but have a long inactivity time (without scanning). This can help you with the identification of an optimized "idle time threshold", to determine when systems can be potentially turned off.
For more information on how this might help your department save energy then please contact your local Siemens Healthineers representative.

Please scan the qr-code or klick here to find out more about teamplay insights

Jointly toward a sustainable future

MRI scanners	Energy saving	Equivalent households	Financial savings per year[20]	Financial savings over 10 years
1	~ 40MWh	8	~ 8,000 – 16,000€	~ 80,000 – 160,000€
5	~ 200MWh	40	~ 40,000 – 80,000€	~ 400,000 – 800,000€
50k	~ 2 TWh	400,000	~ 390 – 780 million €	~ 3.9 – 7.8 billion €

We hope the provided recommendations in this document will help you to save the energy consumption of your MRI systems and therewith make a positive impact on our environment and equally your finances. MRI systems are the biggest energy consuming equipment within radiology departments; thus, saving energy in MRI can have significantly impact. Taking actions today, such as turning off your MRI system when not in use and leverage Eco Power mode, can lead to significant energy reductions. To put it into perspective, a fleet of five systems with the measure we have described in this document can save a yearly amount of energy (approx. 200 MWh) that can power 40 households[21] and reduces carbon emission by up to approx. 140,000 Kg of CO_2[22].

Financially, this might translate to up nearly 80,000 € of savings per year for a fleet of five scanners. Now, assuming a global presence of 50,000 MRI scanners, this can equal to the amount of energy (approx. 2 TWh) that is required to empower 400,000 households, a reduction in carbon emission of over 1,500,000 Tons of CO_2 and a financial saving for the healthcare sector of up to 780 million Euros per year. By saving energy in MRI you can make an impact: for your finances, for the healthcare sector, and for the planet.

Footnotes

Page 2

1 Quarterly report on European electricity markets Q2 2022

2 Aunión-Villa, J., Gómez-Chaparro, M. & García-Sanz-Calcedo, J. Study of the energy intensity by built areas in a medium-sized Spanish hospital. Energy Efficiency 14, 26 (2021)

3 Data Siemens Healthineers own measurements & assumptions. Actual consumption may vary depending on use pattern, system type, and configuration.

4 Data from www.destatis.de and referring to a typical household with 4 people in Germany.

Page 3 (Recommendation 1)

5 Assuming the system is turned off during the weekends and overnight.

6 Results are quantified assuming scanning operations as per COCIR standards.

7 Energy costs from the "Quarterly Report on European electricity markets", Volume 15, third quarter 2022, from the European Commission. Estimates generated for a price range of 0.2 €/kWh – 0.4 €/kWh.

Page 4 (Recommendation 2)

8 MAGNETOM Cima.X and Cima.X Fit are a work in progress and their future availability cannot be guaranteed.

Page 5 (Recommendation 3)

9 Results are quantified assuming scanning operations as per COCIR standards.

10 Eco Power Mode results in 12% yearly energy reduction based on COCIR methodology. Results are quantified assuming scanning operations as per COCIR standards.

11 Energy costs from the "Quarterly Report on European electricity markets", Volume 15, third quarter 2022, from the European Commission. Estimates generated for a price range of 0.2 €/kWh – 0.4 €/kWh

12 MAGNETOM Cima.X, Cima.X Fit, and Viato.Mobile are still under development and not commercially available. Their future availability cannot be ensured.

13 XA line for MAGNETOM Avanto^{fit} and Skyra^{fit} is still under development and not commercially available. Its future availability cannot be ensured.

Page 6 (Recommendation 4)

14 Values are computed for a MAGNETOM Sola XQ system for illustration purposes.

15 Energy costs from the "Quarterly Report on European electricity markets", Volume 15, third quarter 2022, from the European Commission. Estimates generated for a price range of 0.2 €/kWh – 0.4 €/kWh

16 Deep Resolve is still under development for MAGNETOM Avanto^{fit}, Skyra^{fit}, Aera, Skyra, Prisma, Prisma^{fit}, Cima.X, Terra.X, Cima.X Fit and Viato.Mobile. Its future availability cannot be ensured.

17 MAGNETOM Cima.X, Cima.X Fit, Viato.Mobile and Terra.X are still under development and not commercially available. Their future availability cannot be ensured.

Page 7

18 Energy costs from the "Quarterly Report on European electricity markets", Volume 15, third quarter 2022, from the European Commission. Estimates generated for a price range of 200€/MWh - 400€/MWh.

Page 9 (Recommendation 6)

19 Data on File

Page 11

20 Energy costs from the "Quarterly Report on European electricity markets", Volume 15, third quarter 2022, from the European Commission. Estimates generated for a price range of 200€/MWh - 400€/MWh.

21 Data from www.destatis.de and referring to a typical household with 4 people in Germany.

22 EPA. 2022. Greenhouse Gases Equivalencies Calculator- Calculations and References. Environmental Protection Agency, Washington, DC. U.S. Accessed on December 26, 2022. Available at: https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references and EPA. 2020. AVERT, U.S. national weighted average CO2 marginal emission rate, year 2019 data. Environmental Protection Agency, Washington, DC. U.S. Accessed on December 26, 2022. Available at: https://www.epa.gov/avert/download-avert.

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The statements and recommendations by Siemens Healthineers for energy and cost savings described herein are based on results that were achieved in settings pissoble due to certain standard and optional features available on Siemens Healthineers MAGNETOM systems. Because there is no "typical" hospital or MRI suite and many variables exist (e.g., MRI location, site installation, case mix, level of IT and/or automation adoption) there can be no guarantee that customers will achieve the sa-me results.

The information in this document contains general technical descriptions of specifications and optional features which do not always have to be present in individual cases. Siemens Healthineers reserves the right to modify the design, packaging, specifications, and options described herein without prior notice. Please contact your local Siemens Healthineers sales representative for the most current information.

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