Operational Cost Savings Opportunities for MRI Scanners

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ABSTRACT

Medical imaging equipment accounts for about 5% of whole-building energy use in U.S. healthcare. Magnetic resonance imaging (MRI) scanners are the most energy- and cost-intensive equipment, reaching up to $60,000 in utility bills annually per scanner. MRIs often operate up to 90% of the time in nonproductive modes (i.e., not scanning patients). Many modern MRI systems have low-power mode (LPM) hardware and software configurations to reduce energy use during nonproductive time, but technologists, radiologists, and healthcare facility staff are rarely aware of these options, which limits their use. This study quantifies the potential energy and cost savings in the U.S. from the use of MRI LPM. We applied a load duration curve method to metered power data from 20 MRI scanners in four U.S. healthcare facilities to establish operating mode power thresholds. Using these thresholds, we categorized the time spent in each mode and quantified the associated energy use and costs. Our analysis shows that depending on the scanner, MRI devices may have one or more power levels within the nonproductive modes. Shifting from higher-power modes to lower-power alternatives during nonoperating hours therefore highlights opportunities for savings. Finally, we extrapolated the results of the individual scanners to estimate the potential national impact. The results highlight a number of opportunities for energy and cost reductions through the adoption of LPM. In addition to total annual energy use, this work also provides a mode-specific breakdown of MRI electricity costs, offering new insights for efficiency and resilience planning in healthcare facilities.

Introduction

Healthcare facilities are increasingly focused on reducing operational costs and improving energy performance, yet medical imaging equipment remains an often overlooked energy end use. Facilities estimate that medical imaging equipment accounts for approximately 5% of total site energy consumption, with magnetic resonance imaging (MRI) systems representing the largest share of that load (Sheppy et al. 2014). Individual MRI scanners can incur annual electricity costs of up to $60,000 while operating in nonproductive modes (i.e., periods when patients are not being scanned) for as much as 90% of the time (Ghatpande et al. 2026). This operating profile presents a substantial opportunity for energy and cost savings.

Higher-strength MRI systems (≥1.5 Tesla [T]) cannot be fully powered down due to their superconducting magnets, which rely on liquid helium cooling to maintain extremely low temperatures. Shutting off the cooling system would result in helium boil-off and potential magnet quenching, making complete shutdown impractical for routine energy management. To address this constraint, manufacturers have introduced low-power modes (LPM) during nonproductive periods, which allow scanners to reduce electricity consumption while maintaining the operation of critical subsystems, such as the liquid helium cooling system.

Although the hardware and software capabilities for lower-power operation are increasingly standard in modern MRI systems, awareness and implementation remain limited.

Conversations with healthcare facilities reveal that technologists, radiologists, and other facility staff may be unfamiliar with available LPMs, uncertain about operational impacts, or lack clear guidance on how and when to use them. As a result, built-in energy reduction features often go underutilized.

This paper quantifies the potential national electricity cost savings if all existing MRI scanners consistently utilized their built-in low-power functionality during nonproductive periods. By examining operational patterns and scaling savings estimates across the national scanner stock, this analysis highlights a largely untapped, low-cost opportunity to reduce energy use and operating expenses in healthcare facilities.

Background

Several MRI scanner operating mode definitions exist in literature, with researchers and industry using a variety of naming conventions. Most frameworks distinguish between productive and nonproductive modes. The productive mode, commonly referred to as *Scan* mode, is where the scanner is actively imaging a patient. In this mode, most scanner components and subsystems are operational, resulting in average power between 9 and 46 kilowatts (kW) depending on the scanner, with substantially higher instantaneous power (Ghatpande et al. 2026; Chaban et al. 2024). Nonproductive modes encompass all other operational states, ranging from *Prepared-to-scan* mode (ready state occurring just before or after scanning) to various LPMs in which subsystem activity is progressively reduced. Average power for nonproductive modes ranges from 3 to 26 kW (Ghatpande et al. 2026; Chaban et al. 2024), which is lower than that for *Scan* mode.

Hernandez et al. provides a representative framework for these mode definitions, identifying the following modes (Hernandez et al. 2024):

- **Scan:** Mode where individual pulse sequences are actively being acquired to image a patient.
- **Prepared-to-scan:** Ready state occurring just before or after scanning.
- **Idle:** Standby mode between exams that maintains readiness for immediate scanning.
- **Low-power:** Energy-saving mode with reduced system operation, requiring warmup before scanning.
- **Off:** System shutdown, in which scanning is not possible without a lengthy (~5-30 minutes depending on scanner) power-up process. [1]
- **Power-save:** Manufacturer-specific mode that shuts down continuous power to most of the system, however intermittently powers components like the cold-head compressor, to reduce energy use.

Figure 1 illustrates these modes in practice, showing load profiles for a single patient exam followed by a deliberate system shutdown routine for two scanners with operating modes labeled. Identification of the modes defined above require access to the scanner operation and/or log files to determine subsystem operation. For example, information on cold-head compressor

[1] Note that "off" mode is manufacturer nomenclature and does not indicate the scanner is fully powered down. Certain critical subsystems, such as the liquid helium cooling system, require power regardless of operating mode.

activity is required to determine if the scanner is operating in the *Power-save* mode. In this paper, *Idle*, *Low-power*, *Off*, and *Power-save* modes are referred to collectively as LPM to avoid miscategorization due to lack of access to the scanner log files. While "Low-power mode" may refer to a specific manufacturer-defined operating state, the term *low power mode* (LPM) is used throughout this paper to collectively denote all sub-*Prepared-to-scan* operating states, regardless of manufacturer-specific nomenclature.

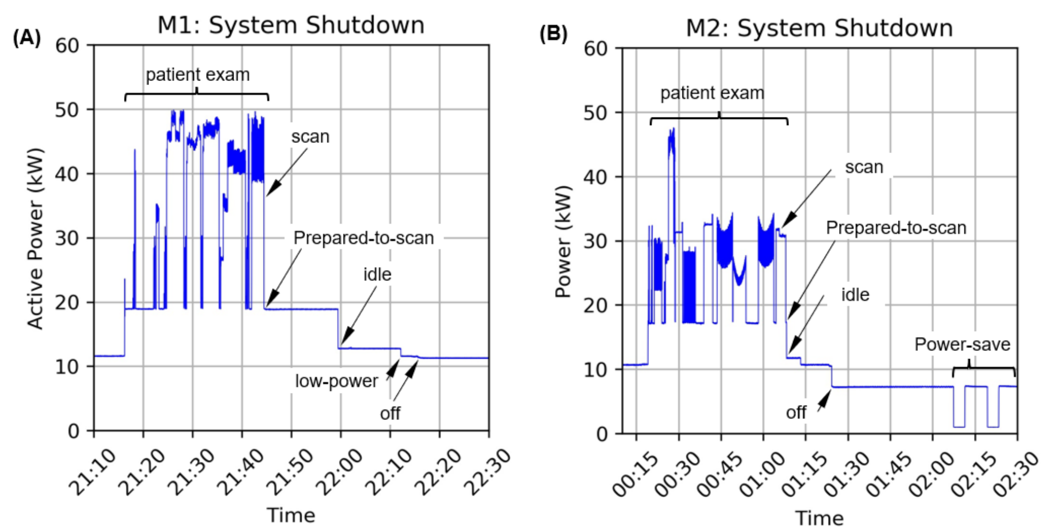


Figure 1. Load profiles illustrating a single patient scan followed by a planned shutdown sequence for two MRI scanners (M1 and M2) (Hernandez et al. 2024)

LPM behavior varies by scanner. Some systems automatically enter LPM after a set period (e.g., 20 minutes) following the conclusion of a patient exam, while others require the MRI operator to manually activate the mode via the console. For scanners with automatic LPM, the scanner progresses through a series of step-down power levels to reach its lowest power state (example progressions shown in Figure 1). Any interruption to this process may prevent the system from entering LPM. In some clinical contexts, such interruptions are appropriate. For example, in an emergency setting where a scanner finishes imaging a patient and enters *Prepared-to-scan* mode, but a new patient arrives before the system steps down further, returning the scanner to *Scan* mode. In other contexts, however, these interruptions represent missed opportunities for energy savings. For example, in a webinar presentation for Mazzetti, University of California, Davis Health presented that they metered several of their MRI scanners and found that one did not consistently enter its LPM step-down sequence at the conclusion of the day. The root cause was traced to the facility's end-of-day restart protocol, a routine practice in which technologists restarted the scanner at the close of each day. The LPM step-down process was triggered by the operator formally ending the patient exam within the system, and the metered data revealed that if the scanner was restarted within 15 minutes of closing the final exam, the system did not automatically enter LPM upon startup. As a result, the scanner remained in *Prepared-to-scan* mode overnight rather than stepping down to LPM. Once this was identified, the facility adjusted their restart procedure to instead restart the scanner at the beginning of each day, allowing the scanner to complete its LPM step-down sequence at the end of the day and remain in LPM overnight, resulting in 10% energy savings (Mazzetti 2024).

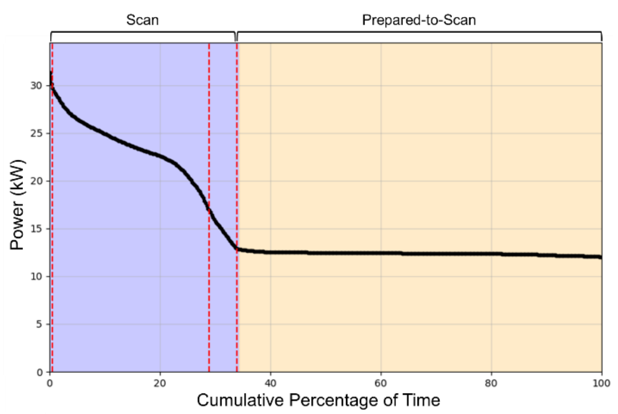
For scanners where switching to LPM is not automatic and must be manually activated by the technologist via the console, understanding scanner operating mode behavior becomes even more critical. In these cases, healthcare facilities should familiarize themselves with the LPM capabilities of their specific scanner models and ensure that technologists are informed and equipped to activate these modes where clinically appropriate. Outpatient facilities (i.e., those that provide scheduled imaging services during defined operating hours without overnight patient stays) typically have predictable schedules with extended periods of scanner inactivity outside of clinic hours, creating opportunity for LPM use overnight and on weekends. Inpatient facilities, such as hospitals and emergency centers, provide imaging services around the clock to support the needs of admitted patients and emergency cases, leaving less predictable and potentially shorter windows of inactivity during which LPM can be used. As a result, outpatient settings generally represent a greater opportunity for LPM-related energy savings, while inpatient settings may require more tailored strategies that account for the required continuous clinical availability.

Two primary strategies exist for understanding the operating mode behavior of a specific scanner: (1) engaging directly with the manufacturer, and (2) metering the scanner's electricity consumption. As the UC Davis Health example demonstrates, metering MRI scanner electricity provides valuable insight into scanner behavior and can reveal energy savings opportunities. When long-term metering data is available, identifying and characterizing operating modes is a critical first step in that analysis. Operational mode characterization for MRI scanners is complex because it requires electrical measurements overlayed with the manufacturer-specific information embedded within the internal scanner log files or pulse sequences. Depending on scanner specifications and configuration, these log files may contain both patient-sensitive data and highly granular operational change logs. The combination of sensitive data and technical complexity makes scanner log files difficult to parse effectively. To tackle these challenges, Hernandez et al. developed a semi-automatic methodology based on plotting and statistically interpreting the load duration curve (LDC) of the metered power data, highlighting the operating mode power cutoff values and successfully categorizing operational modes (Hernandez et al. 2024).

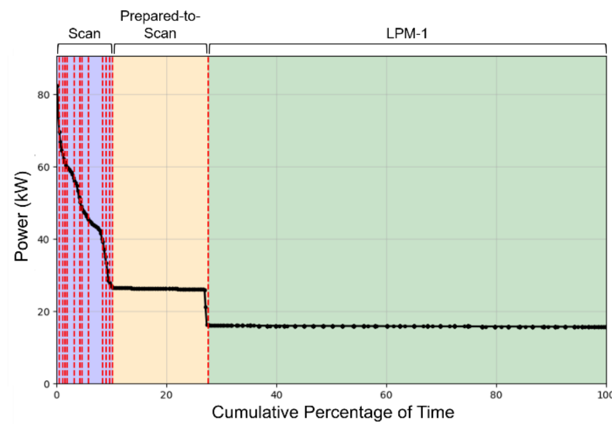
Methods

This paper builds on our previous data analysis results applying the LDC method to long-term scanner metered data (Ghatpande et al. 2026). We sourced and analyzed metered power and energy data from 20 MRI scanners from four healthcare facility sites across the U.S. Table 1 shows the MRI scanners' distinct characteristics like magnet strength (0.55 T, 1.5 T, and 3 T) and year installed (range of 2003–2023), and their clinical settings, including outpatient facilities, inpatient facilities, or a combination of both, categorized as "mixed" for this study. Chosen scanners were selected based on the ease of data collection and thus may not statistically represent the full range of scanner characteristics at each location. Scanner operational details, such as environmental conditions, patient assignment, or imaging procedures, were unaltered, and scanners continued routine clinical operation during the metering period.

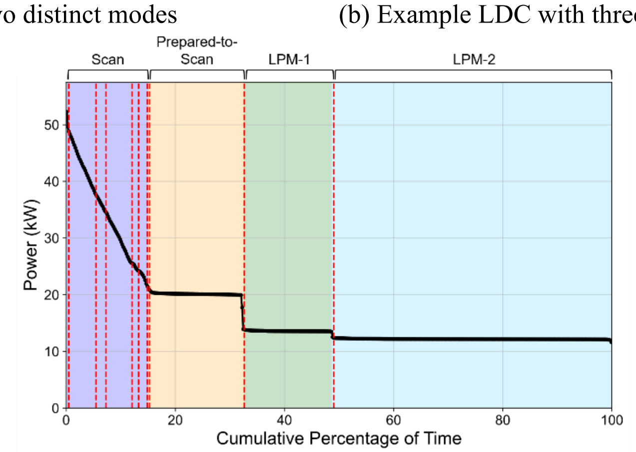
The previously mentioned process of generating an LDC with defined cutoffs between modes was applied to all available scanner power data. Each scanner had a unique LDC and cutoff values. LDC plots showed each scanner in the study had either two, three, or four distinct operating modes (examples shown in Figure 2). All scanners exhibited at least the *Scan* and *Prepared-to-scan* modes that were directly linked to image generation. There was substantial variation for the categorization of nonproductive modes in the remaining scanners. Some scanners did not show any additional nonproductive modes beyond *Prepared-to-scan*, while others had one or two step power changes (denoted as *LPM-1* and *LPM-2*).



(a) Example LDC with two distinct modes



(b) Example LDC with three distinct modes



(c) Example LDC with four distinct modes

Figure 2. Example LDC plots with modes identified

Once the mode cutoff values were determined from the LDC, each metered time step data point was assigned a mode for further analysis. Table 1 includes the number of operating modes identified from each scanner's metered data. The variations in scanner modes and time spent in them during the metered period provide an opportunity to reduce energy use. For example, scanners could spend additional time in LPM or could reduce power while in LPM.

Table 1. Summary of MRI scanner characteristics and mode results

Location	Year of Installation	Magnet Strength (T)	Clinical Setting	Metering Duration (days)	No. Operating Modes Identified[1]
Ann Arbor, MI	2020	1.5	Mixed	58	4
	2019	3	Inpatient	28	4
	2022	0.55	Outpatient	76	2
Rochester, MN	2016	3	Mixed	12	4
	2017	1.5	Mixed	12	4
	2017	3	Mixed	12	3
Sacramento, CA	2019	1.5	Outpatient	12	3
	2019	3	Outpatient	12	3
San Francisco, CA	2003	1.5	Outpatient	13	2
	2012	3	Outpatient	13	4
	2014	3	Inpatient	15	4
	2014	3	Inpatient	13	3
	2018	3	Outpatient	12	3
	2015	3	Outpatient	12	4
	2019	3	Outpatient	13	3
	2015	3	Inpatient	13	3
	2023	1.5	Outpatient	23	2
	2022	3	Outpatient	23	3
	N/A[2]	3	Outpatient	13	3
	2012	3	Outpatient	18	2

[1] Reflects operating modes observed during the data collection period only. Scanners may have additional modes available that were not engaged during metering.
[2] Not available

Based on the published literature (Chodorowski et al. 2024; Chaban et al. 2024; Heye et al. 2020; Hernandez et al. 2024) we considered two potential energy reduction scenarios:

- **Scenario 1.** Add additional time for scanners to spend in an LPM.
- **Scenario 2.** Add LPMs to scanners with either two or three operating modes.

Scenario 1 represents cases where LPM is already present and functioning, but the scanner is not spending as much time in that mode compared to other scanners in the study. Realizing these savings would primarily require operational or procedural adjustments, such as modifying restart protocols or scheduling practices, that allow the scanner to remain in LPM for longer periods. Scenario 2 represents cases where LPM capabilities exist but are not currently being utilized. Savings in this scenario would require either enabling automatic LPM where it is available but inactive, or having technologists manually engage these modes via the console.

Based on the above scenarios, we analyzed the scanners in Table 1 for potential savings. Six scanners had four distinct modes and hence no change was estimated for their savings. Out of those six scanners, one scanner had very low productive time usage and was mostly in the nonproductive modes, and was therefore excluded from this analysis. The LDC data for those five scanners were used to calculate the baseline average time and cutoff power to estimate the savings for the remaining scanners. We identified eight scanners for which more time could be added in LPM. Five scanners demonstrated use of only two distinct modes, and we therefore added additional LPMs for their savings calculation. Figure 3 shows a representative scanner LDC plot with three distinct modes and the proposed LPM plot represented by a dashed blue line. The area between the existing plot and the new proposed lower power level determines the potential energy savings calculation.

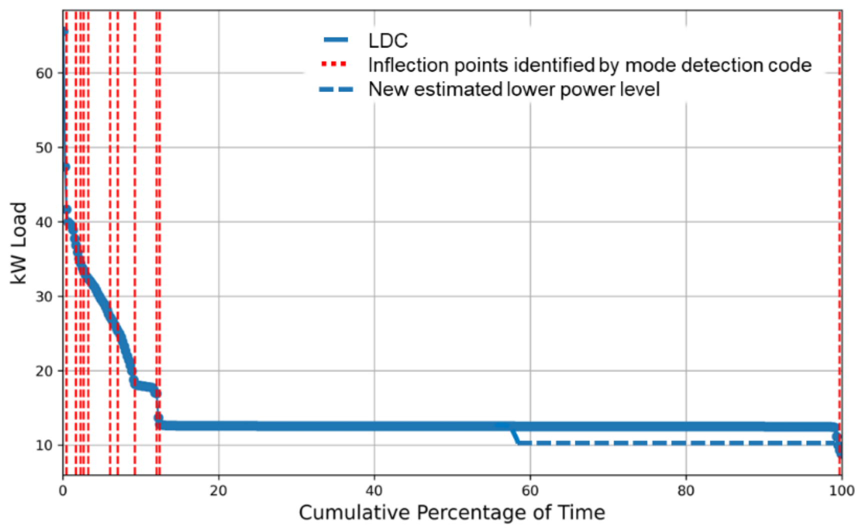


Figure 3. Sample scanner LDC plot with three modes and the proposed lower power mode.

LPM Duration and Cutoff Power Estimation

We selected five scanners (out of six) from the dataset that exhibited four distinct modes, similar to the sample scanner in Figure 2c. The research team also performed literature reviews to find any published references for MRI scanners (with four distinct modes) that include the power cutoff values and the time spent in each of the *LPM-1* and *LPM-2* modes. We found one reference that contained the data required for savings calculations (Hernandez et al. 2024). Figure 4 plots the percentage of time the six scanners from this study and the reference publication spent in each mode. The average percentage of time spent in nonproductive modes is as follows: 18% for *Prepared-to-scan* mode (ranges from 13% to 24%), 17% for *LPM-1* mode (ranges from 5% to 41%), and 41% for *LPM-2* (ranges from 13% to 54%).

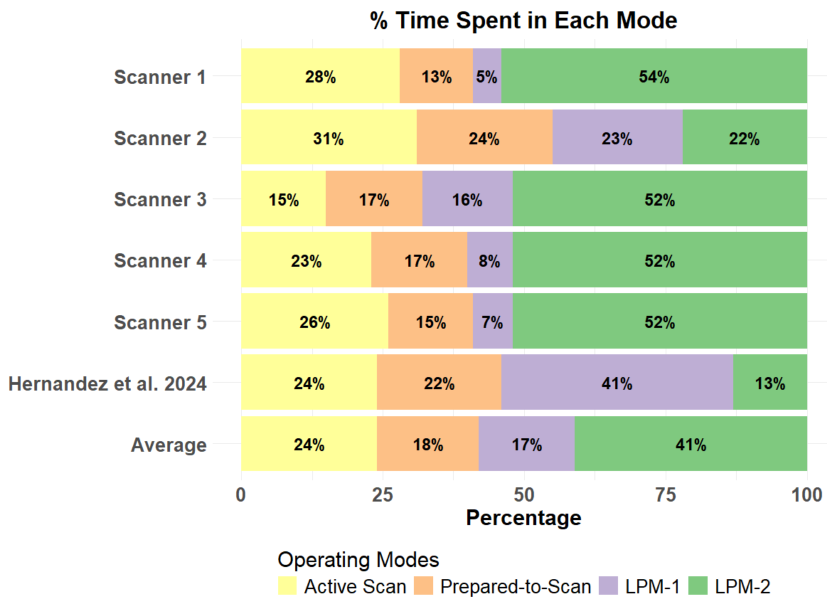


Figure 4. Percentage of time spent in each mode for scanners exhibiting four distinct modes

Figure 5 plots the mode cutoff power values and ratios for those cutoffs for the six selected scanners. The average ratio of *Scan* power cutoff to *Prepared-to-scan* power cutoff is 1.50 (ranges from 1.19 to 1.71), and the average ratio of *Prepared-to-scan* to *LPM-1* power cutoff is 1.14 (ranges from 1.07 to 1.39). These ratios in between modes were used to estimate the power drop in other scanners in the dataset.

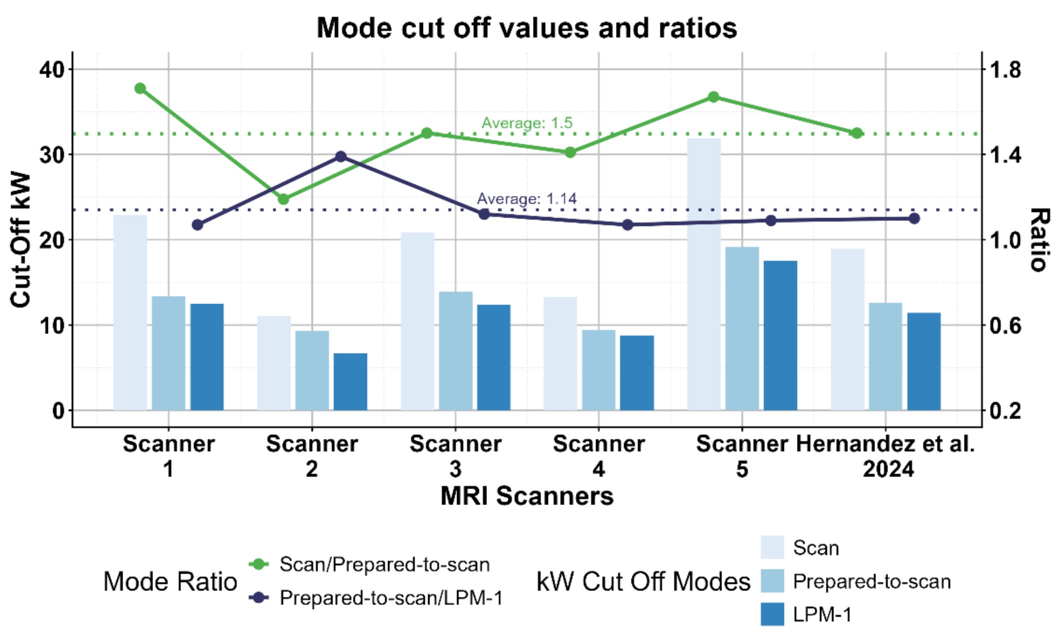


Figure 5. Mode cutoff values and ratios for scanners exhibiting four distinct modes

Individual Scanner Potential Energy Savings

We used the average values calculated for mode cutoff ratio and percentage of time spent in the modes for the representative six scanners for potential energy reduction scenarios. We used the following equation to calculate potential savings per day per scanner:

$$\text{Potential Daily Energy Savings per Scanner} = \text{\% Time Added in LPM} \times \text{\% Power Reduction} \times \text{Average Daily Energy Use per Scanner}$$

Percent time added in LPM represents Scenario 1 (scanners spending more time in LPM), and percent power reduction represents Scenario 2 (scanners utilizing existing LPM available on the scanner that are not being used).

Table 2 tabulates the results of the potential savings calculations per scanner per day using the equation above. There are eight scanners in Scenario 1 with mean savings of 15 kWh per day with a range of 5–20 kWh, and five scanners in Scenario 2 with mean savings of 66 kWh per day with a range of 34–118 kWh. Considering all scanners in the dataset, the mean potential energy saved per day per scanner is estimated to be 23.5 kWh with a median of 17.3 kWh.

Table 2. Potential savings calculation per scanner (kWh/day)

	All Scanners	Scenario 1	Scenario 2
Count	19	8	5
Min	0	5.4	34.3
Lower Quartile	0	9.8	37.5
Mean	23.5	14.9	65.6
Median	17.3	17.4	40.6
Upper Quartile	26.9	18.1	96.7
Max	40.6	19.5	118.3

Scaling Individual Scanner Results to the National Level

We considered three methods for scaling energy savings potential for individual scanners to the national level:

- **Simple national scaling**. Scales the average potential energy savings per scanner by number of scanners in the U.S. and multiplies by a national average electricity rate.
- **Geography-based scaling.** Scales the average potential energy savings per scanner by number of scanners per U.S. region and multiplies by average electricity rate per region.
- **Clinical setting-based scaling.** Scales the average potential energy savings per inpatient and outpatient scanner, derived from assumed inactivate hours by clinical setting, by the number of scanners in each setting and multiplies by hourly electricity rates.

Of the methods, we selected two (simple national scaling and geography-based scaling) for this analysis. We did not use clinical setting-based scaling due to lack of sufficient data to estimate the relative number of MRI scanners in inpatient versus outpatient settings at the time of this analysis. As discussed previously, clinical setting is expected to influence LPM savings potential, given the differences in scanner utilization patterns between outpatient and inpatient facilities. We used the two selected methods independently and compared the results.

Figure 6 shows the workflow for the simple national scaling method. Average single-scanner potential savings were multiplied by the number of scanners in the U.S., as reported by the Organization for Economic Co-operation and Development, to scale the potential energy savings to the national level (OECD 2025). Costs were calculated by multiplying the energy results by a national average electricity rate, as reported by the U.S. Energy Information Administration (EIA) in their 2024 State Electricity Profiles (EIA 2025). As the name implies, this is a simplistic approach of estimating the national-scale potential energy savings and does not account for variation in MRI scanner characteristics, usage, and regional differences.

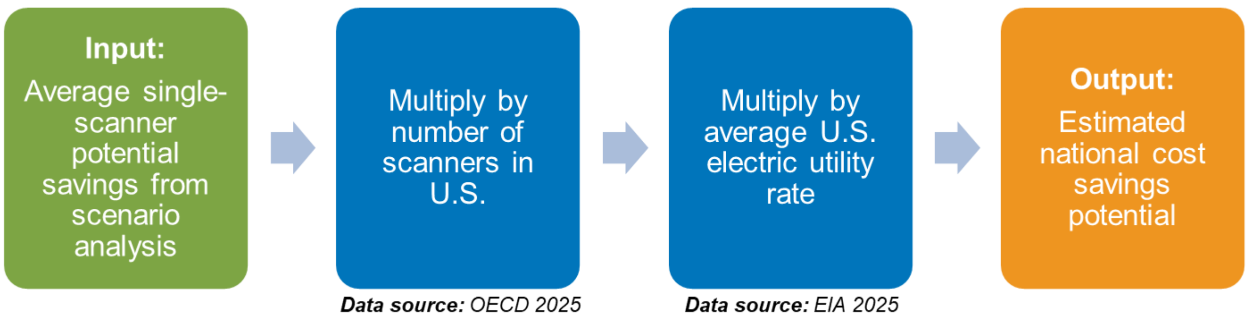


Figure 6. Simple national scaling workflow

Figure 7 shows the workflow for the geography-based scaling method. This method accounts for regional differences in terms of the relative count of MRI scanners across the U.S. and electricity cost, using the regions shown in Figure 8. This method begins with the average single-scanner potential savings and multiplies by the number of scanners in each region. The cost savings by region are then multiplied by the average electric utility rates by region. The number of scanners by region are calculated using the relative number of imaging centers (Definitive Healthcare 2025), assuming each center operates a comparable number of scanners, multiplied by the total number of MRI scanners in the U.S. (OECD 2025). Electric utility rates by region are calculated from EIA's 2024 State Electricity Profiles using the states in each region (EIA 2025).

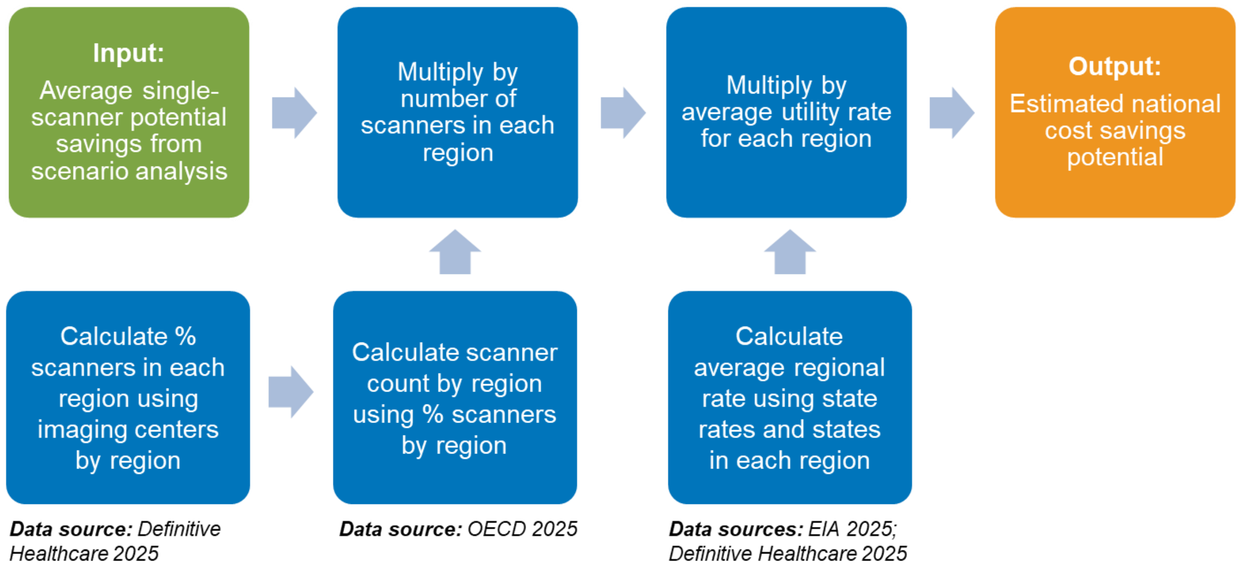


Figure 7. Geography-based scaling workflow

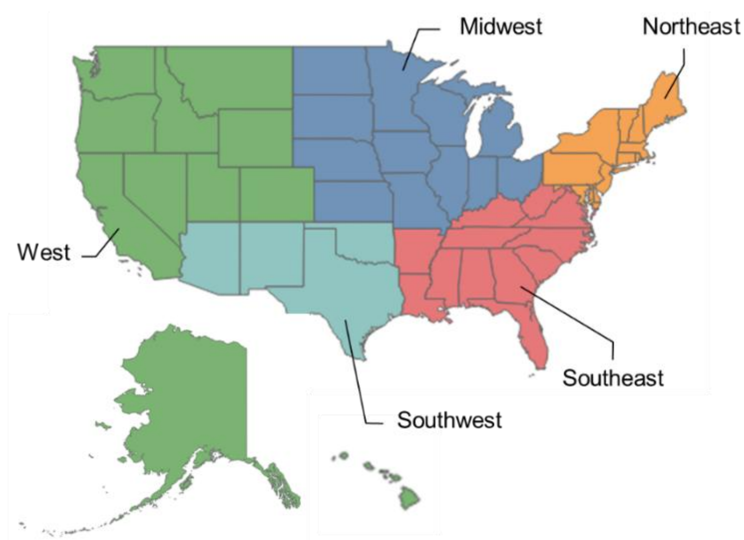


Figure 8. Regions for the geography-based scaling method, as defined by Definitive Healthcare (Definitive Healthcare 2025)

Key Assumptions

This methodology relies on several key assumptions that should be considered when interpreting the results. Because MRI scanner log files were not available, we defined general LPM operating modes that aggregate manufacturer-defined *Idle, Low-power*, *Off*, and *Power-*

save modes.[2] This approach was necessary to characterize scanner behavior using only metered power data.

Additionally, we derived estimates of potential national energy savings by linearly scaling results from the individual scanner level across the U.S. MRI scanner stock. This method assumes that the characteristics of the national MRI population are similar to those of the 20 scanners included in the study. In addition, the analysis assumes that the regional distribution of imaging centers reflects the regional distribution of MRI scanners, which does not account for potential variation like Certificate of Need requirements that limit the number of MRI scanners in certain states.[3] Finally, this methodology assumes that all installed U.S. MRI scanners are equipped with LPM capabilities and that none are currently making use of them, which likely overstates the savings potential.

Results and Discussion

Table 3 and Table 4 show the potential national savings results for the simple national scaling and geography-based scaling methods, respectively. For simple national savings results, we provide calculations using three potential daily energy savings values: median, mean, and upper quartile. All calculations use the same national average electric utility rate of $0.13/kWh (EIA 2025). The results ranged from $10.4 million for the median case to $16.1 million for the upper quartile, with savings of $14.1 million for the mean case.

The geography-based scaling method calculated potential annual national savings of $14.4 million, with regional potential savings ranging from $1.6 million (Southwest) to $4.0 million (Northeast). We used the mean daily potential energy savings per scanner for the geography-based scaling.

At the facility level, these savings translate to approximately $860 to $1,630 in cost savings per scanner annually, depending on the local electricity rate ($0.10 to $0.19/kWh). At the national average rate of $0.13/kWh, this amounts to approximately $1,100 per scanner per year. For a large hospital operating 15 MRI scanners, potential annual cost savings range from approximately $12,900 to $24,400, with a mid-range estimate of $16,700 at the national average electricity rate.

Table 3. Potential national cost savings using simple national scaling method

	Potential Energy Saved (kWh/day/ scanner)	Average Utility Rate ($/kWh)	Potential Cost Saved ($/year)
Median	17.3	$0.13	$10,351,360
Mean	23.5	$0.13	$14,061,096
Upper quartile (75th percentile)	26.9	$0.13	$16,095,467

[2] Note that while "Low-power mode" may refer to a specific manufacturer-defined state, the term LPM is used in this paper to broadly denote all sub-*Prepared-to-scan* operating modes.
[3] A Certificate of Need program is a state regulatory tool that controls the number of health care resources in an area by requiring hospitals and health systems to demonstrate community need before establishing or expanding a health care facility or service.

Table 4. Potential national and regional cost savings using geography-based scaling method

U.S. Region	Estimated Number of Scanners	Mean Potential Energy Saved (kWh/day/scanner)	Potential Energy Saved (kWh/year)	Average Utility Rate ($/kWh)	Potential Cost Saved ($/year)
Southeast	3,443	23.5	29,532,333	0.11	$3,248,557
Midwest	2,728	23.5	23,399,420	0.11	$2,573,936
Northeast	2,443	23.5	20,954,833	0.19	$3,981,418
West	2,190	23.5	18,784,725	0.16	$3,005,556
Southwest	1,806	23.5	15,490,965	0.10	$ 1,549,097
Total	**12,610**		**108,162,275**		**$14,358,563**

The magnitude of potential savings underscores the significance of LPM as a low-cost or no-cost energy and cost savings strategy. Unlike capital-intensive retrofits or equipment replacements, optimizing LPM use primarily requires adjustments to operational practices rather than new infrastructure investments. As a result, LPM adoption represents a comparatively accessible pathway for reducing operating costs and energy consumption across the existing U.S. MRI stock.

Realizing this opportunity will depend on improved education and awareness across key stakeholder groups, while acknowledging the imaging department clinical priorities. Patient care and throughput are the principal priorities for radiologists and technologists, and any operational change perceived as a risk to either is unlikely to be adopted. Energy management rarely falls within their day-to-day purview, so effective engagement requires clearly distinguishing between LPM applications that pose little-to-no clinical risk and those that require more careful workflow consideration. For example, enabling LPM during overnight and weekend hours in outpatient settings, where scanners are inactive for extended periods and there is little-to-no risk of affecting patient care or scheduling, represents low-hanging fruit. However, LPM use between patients requires more careful consideration, as these power modes can require 20–30 minutes to warm up and negatively impact throughput. Framing LPM adoption as a no-cost, low-risk strategy, starting with applications where clinical impact is minimal and implementation demands on staff are limited, is likely to be the most effective approach for building momentum. Energy managers play a key role as well, bringing the technical expertise needed to establish energy baselines and evaluate the effectiveness of operational changes. By aligning clinical practice with energy management goals, healthcare facilities can capture measurable cost savings while maintaining high standards of patient care.

Additionally, many healthcare facilities may be unaware of their scanners' LPM capabilities, as manufacturer procurement and operational materials understandably focus primarily on clinical efficacy and performance. Incorporating energy information alongside these materials would help facilities make more informed decisions. This is a meaningful gap, as interest in energy efficiency among hospitals and radiologists is growing, and procurement teams currently have limited visibility into the relative energy performance of scanner models at the time of purchase. Healthcare facilities could also proactively engage manufacturers to better understand what LPM options are available for their scanners and how to use them effectively.

For example, LPM may automatically activate after a scanner has been inactive for a specified duration. Understanding this threshold can inform operational procedures, such as scheduling practices or decisions about when to restart the scanner, a common practice in many facilities, to maximize time spent in LPM while maintaining clinical readiness. Continued manufacturer investment in LPM development is equally important, as incorporating robust LPM capabilities into new scanner designs can help minimize energy consumption during nonproductive modes across the industry.

Limitations

The study is subject to several data limitations. Metered power data were collected from only 20 MRI scanners at four healthcare facilities, which does not constitute a nationally representative sample. Furthermore, there was limited availability of information to support national scaling, like relative number of scanners in inpatient and outpatient settings. As a result, we did not incorporate several factors such as scanner vintage, magnet strength, manufacturer, and clinical setting into the analysis. Additionally, data collection periods varied from 12 to 76 days, preventing the assessment of seasonal effects on energy use and cost savings. Finally, publicly available national datasets were used to estimate the total number of MRI scanners in the U.S., which may introduce additional uncertainty.

Conclusions

This study analyzed metered power data from 20 MRI scanners at four U.S. healthcare facilities and applied an LDC method to identify scanner operating modes from the metered data. We then evaluated scenarios that increased time spent in LPM and extended LPM use to scanners that had not previously used it, estimating the resulting average daily energy savings per scanner nationwide. Based on these scenarios, we identified approximately $14 million in annual savings potential from broader LPM adoption across existing U.S. MRI scanners (range: $10–$16 million). At the individual scanner level, this translates to approximately $860 to $1,630 in annual cost savings depending on local electricity rates, or roughly $1,100 at the national average rate. For a facility operating 15 scanners, potential annual savings range from approximately $12,900 to $24,400.

Future work could refine the analysis to better capture key sources of variation and quantify more granular cost savings, including differences between outpatient and inpatient schedules and usage patterns, manufacturer-specific performance, magnet strength, and equipment vintage and associated characteristics. Expanding the sample size and geographic diversity of metered scanners would also help validate whether the savings potential observed in this relatively small sample is representative of the broader U.S. MRI stock. Additionally, extending monitoring to a full year would better capture seasonal variability in energy use and associated impacts, and formal uncertainty quantification would further strengthen confidence in national-scale savings estimates.

Enabling and optimizing LPM is typically a low-cost or no-cost operational change, representing a practical opportunity to achieve millions of dollars in annual savings across the U.S. MRI stock. The savings estimated in this study reflect opportunities achievable through changes to human operational practices alone without any major modifications to scanner hardware or software, such as adjusting restart protocols, enabling existing LPM features, or modifying scheduling practices. Additional savings potential may exist beyond what is quantified here, as manufacturers continue to develop and refine LPM capabilities and lower the power levels of nonproductive modes where clinically feasible. Realizing the potential quantified in this study will require educating and engaging radiologists, technologists, and energy managers to ensure that healthcare facilities understand, implement, and sustain these cost-saving practices.

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