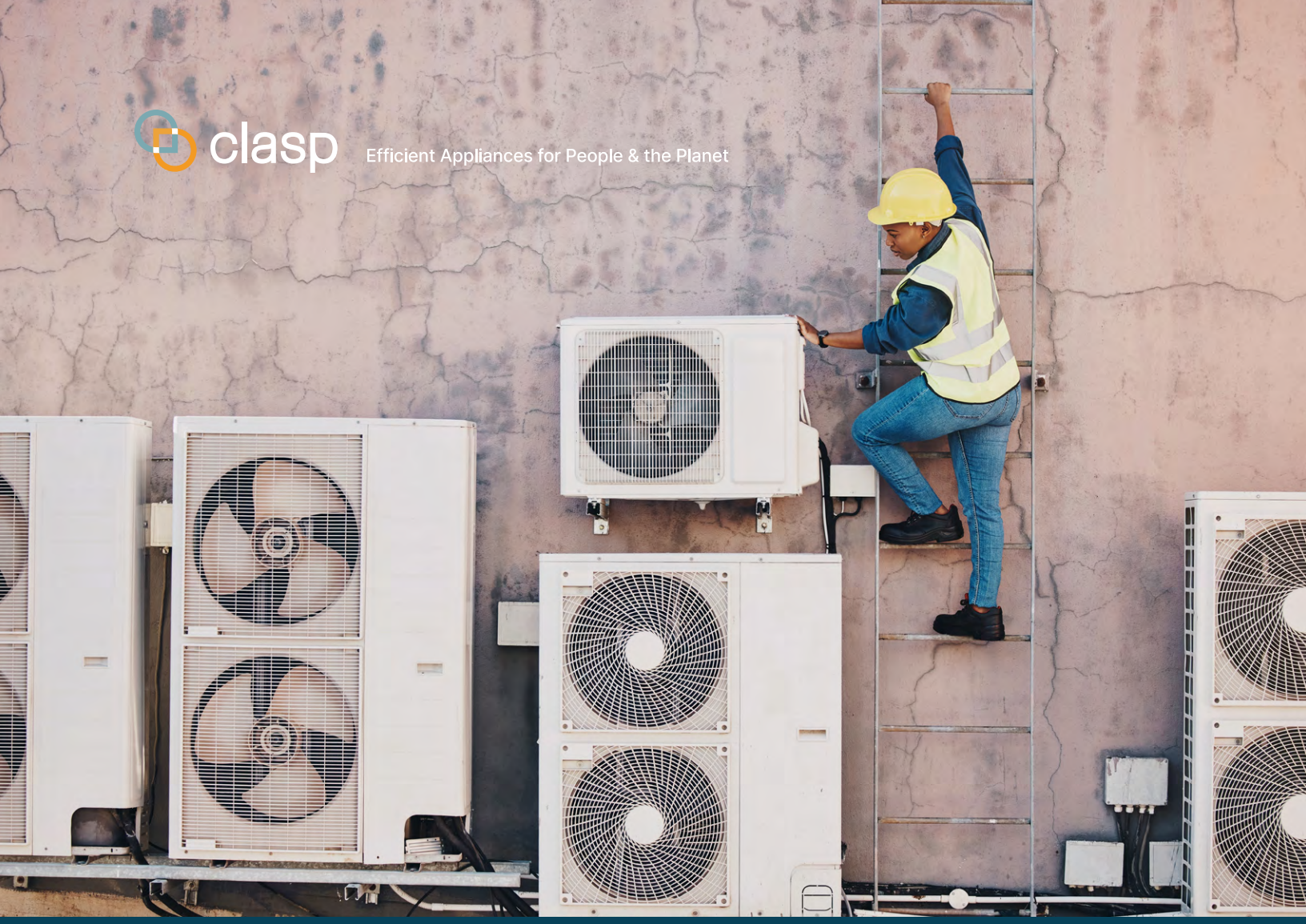
clasp Efficient Appliances for People & the Planet



Doubling Energy Efficiency with Appliances

How governments can leverage appliances to reach climate targets

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DESIGN

Kerry Nash

CLASP's research aims to bridge the gap between analysis and action to hit net zero emissions in the appliances sector by 2050. Read ***Net Zero Heroes: Scaling Efficient Appliances for Climate Change Mitigation, Adaptation & Resilience*** to learn more about our net zero strategy.

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Appliance efficiency could provide roughly one fifth of the reduction in energy demand needed to meet a pivotal climate commitment, according to new CLASP analysis. With nearly 110 countries pledging at COP28 to double annual energy efficiency improvements by 2030, more ambitious appliance policies are critical to reaching this goal before the narrow window for net zero by mid-century closes.

KEY FINDINGS

- To get on track for net zero emissions by mid-century, the average global annual rate of improvement in energy intensity must double to at least 4% by 2030. Appliance efficiency can deliver approximately 20% of the total reduction in energy demand required to meet this goal.
- Brazil, China, India, and Indonesia have recently taken significant steps to integrate appliance efficiency into their national strategies, recognizing its critical role in achieving energy and climate goals.

RECOMMENDATIONS

- Policymakers must rapidly implement stringent minimum efficiency standards for appliances, ensuring that they meet or exceed the best standards currently in place. Countries with world-leading standards should increase them further to reflect the levels of today's best available technologies.
- Governments need to embed clear, measurable appliance efficiency targets into their national climate goals. They must also track progress with standardized metrics to stay on course to meet the doubling efficiency goal.
- All stakeholders across government, industry, and civil society must strengthen international and cross-sectoral collaboration to accelerate global energy efficiency gains. This cost-effective approach includes sharing technical expertise, conducting joint market surveillance, and harmonizing standards to overcome common barriers.

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EXECUTIVE SUMMARY

Appliance efficiency is essential to reaching the goals of the Paris Agreement and preventing the worst outcomes of climate change. New CLASP analysis shows that appliance efficiency could deliver approximately 20% of the total reduction in energy demand required in 2030 to meet the doubling energy efficiency (2xEE goal—thereby making net zero emissions possible.

This work builds on the International Energy Agency (IEA's finding that the annual rate of energy efficiency improvement needs to double by 2030 to achieve net zero emissions by 2050. It also relies on the organization's subsequent analysis showing that the world was not on track to meet this target as of 2024.

To quantify the degree to which appliance policy change can help countries meet the doubling efficiency goal, CLASP analyzed two IEA scenarios using our climate impacts modeling tool, Mepsy, to estimate the impacts of rapidly improving the efficiency of new appliances.

Findings show that raising the minimum efficiency of new products in 162 countries to the levels of today's best available technologies[i] would cut global energy demand in 2030 by almost one fifth of what would be required to reach net zero by mid-century.[ii]

To achieve this, CLASP recommends that all governments align their minimum energy performance standards (MEPS) for appliances with the most ambitious MEPS currently in place. For governments already at this level, we recommend aligning MEPS with the most efficient appliances currently available on the market.

Case studies from Brazil, China, India, and Indonesia demonstrate that many governments increasingly recognize the multiple benefits of appliance efficiency and are taking steps to realize these benefits, offering models that others can learn from.

i In this report, "best available technologies" refers to the most efficient technologies currently sold on the market.

ii The assessment includes eight appliances: air conditioner, refrigerator, fan, TV, motor, lighting, space heating, and water heating.


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Global momentum on energy efficiency improvement

At the 28th United Nations Climate Change Conference (COP28) in 2023, the International Energy Agency (IEA) stated that doubling the global average annual rate of energy efficiency improvement by 2030—referred to as the 2xEE goal—is one of the key actions needed to limit global warming and achieve net zero emissions (NZE) by mid-century (see Box 1).[1] To reach this goal, IEA also identified three key measures:[2]

- Switch to more efficient fuels
  This includes taking steps such as electrifying vehicles, using heat pumps for heating, and expanding access to clean cooking solutions.
- Improve technical efficiency
  This involves actions like constructing better-insulated buildings, using more efficient appliances (e.g., air conditioners and motors), and upgrading industrial processes.
- Use energy and materials more efficiently
  This can be accomplished through behavior change and circular economy practices such as adjusting space heating temperatures, choosing public transport, and recycling metals and plastics.

Together, these actions could cut emissions by more than 7 gigatons (Gt) in 2030, accounting for half of the climate mitigation needed to stay on track for NZE.[3]

In response, more than 110 countries pledged to collectively double the global pace of energy efficiency progress by raising the average annual rate of energy intensity improvement from 2% to 4% by 2030.[4]

While this is a global target, the level of effort required varies by country. Those countries already nearing the 4% improvement rate may need only incremental shifts, while others, particularly those with slower historical progress, will require more transformative actions.

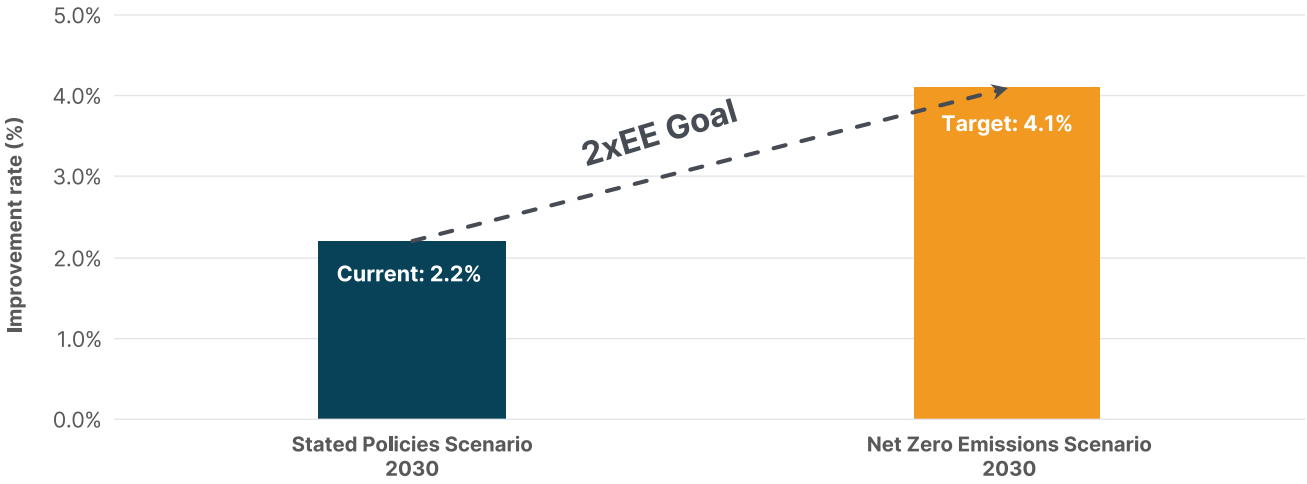
No major country has maintained or exceeded the 4% rate over a full decade, demonstrating the scale of the challenge.[5] Still, the goal remains achievable if all countries perform to their full abilities.

However, since the signing of the 2xEE pledge, global progress on energy efficiency has not been on track to meet this target. A recent IEA report shows that under existing policies, the annual rate of energy efficiency improvement will stay at about 2% in 2030, significantly less than the 4% annual improvement rate required to reach net zero emissions and limit global warming (Figure 1).[6]

To achieve the 2xEE goal, countries must take immediate and decisive action to avoid locking the world into even greater climate risk.[iii]

iii Even when taking into account announced climate pledges (as the IEA did in its APS scenario), the energy efficiency improvement rate still falls short of the target (4%) by one percentage point.

FIGURE 1 Global annual improvement rate of energy efficiency in 2030 by IEA scenario



***Note**: Detailed explanations of the Stated Policies Scenario and Net Zero Emissions Scenario used in this chart can be found in Box 1.*
***Source**: Adapted from: IEA, Energy Efficiency 2024 (2024), https://www.iea.org/reports/energy-efficiency-2024.*

BOX 1: DEFINITIONS AND KEY CONCEPTS

Appliances: In this report, *appliances* encompass electrical and gas-powered devices commonly found in residential and commercial buildings, such as air conditioning, refrigerators, lighting, space heating, and water heating, as well as industrial equipment like electric motors, pumps, fans, and compressors.

Appliance efficiency: For appliances, *efficiency* means getting the same or better performance while using less energy. Energy-efficient appliances are designed to use less energy while performing the same functions. These appliances may use advanced technologies like sensors, programmable settings, and improved insulation to reduce energy consumption and save people money on utility bills.

Tracking energy efficiency improvement: There are several ways to track energy efficiency progress. In this report, we follow the IEA's approach, which measures the quantity of energy required to produce one unit of gross domestic product (GDP).[7] A higher energy intensity means more energy was used to produce a product or service. Energy intensity is commonly used as an indicator of energy efficiency at the national or economy-wide level.[8]

$$\textit{Energy Intensity} = \frac{\textit{Total Energy Supply (TES)}}{\textit{Gross Domestic Product (GDP)}}$$

IEA scenarios: IEA uses the Global Energy and Climate Model to assess climate risks, identify opportunities for climate action, and explore future technology and emissions trends. The model includes three scenarios, each based on different assumptions about how the energy system might evolve. A definition of each scenario is listed below.[9]

- **Stated Policies Scenario:** This scenario refers to policies that were in place or under active development as of August 2024, based on detailed analyses by country and sector. No new policies are adopted in this scenario.
- **Announced Pledges Scenario (APS):** This scenario assumes all announced ambitions and targets by governments and industries around the world as of the end of August 2024 are met. It includes nationally determined contributions (NDCs), net zero goals, and targets for access to electricity and clean cooking
- **Net Zero Emissions Scenario:** This scenario outlines a roadmap for the global energy sector to achieve net zero CO_2 emissions by 2050, with advanced economies reaching this target earlier. It prioritizes rapid deployment of clean energy technologies, major improvements in energy efficiency, and universal energy access by 2030, while ensuring energy security and minimizing disruptions.

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The potential of appliance efficiency

Why does appliance efficiency matter?

Appliances account for a substantial share of global energy use and emissions. CLASP analysis has found that appliances (including those used in residential and commercial buildings, along with industrial electric motor-driven systems) were responsible for 35% of global final energy consumption and nearly 40% of energy-related CO_2 emissions in 2021.[iv,10]

As the global population grows and incomes rise, the demand for appliances continues to increase. This surge in demand tends to drive up both energy use and greenhouse gas emissions, while also placing increased stress on power grids.[11] Improving appliance efficiency is one of the most effective ways to address all three challenges simultaneously.[12]

Governments employ three main policy mechanisms to drive energy efficiency improvements:[13]

- **Regulation** helps remove the worst-performing equipment from the market and shift markets toward higher efficiency levels.
- **Information** enables consumers to prioritize efficiency during the purchase and use phases.
- **Incentives** can accelerate market transformation by encouraging the adoption of new technologies and practices.

Minimum energy performance standards (MEPS) are one of the policy tools most frequently used to improve appliance efficiency.[14] MEPS establish minimum efficiency thresholds that products must meet to be sold on the market. By regularly updating MEPS, governments can phase out less efficient products over time and prevent the dumping of inefficient technologies onto the local market. Compared to other regulatory measures, MEPS are defined by simple numerical thresholds, making them easy to benchmark across countries—a quality that supports regional harmonization.

Over 120 countries have already adopted MEPS, with the pace of adoption increasing in recent years.[15] However, the effectiveness of these policies depends heavily on the level of stringency applied.[16]

CLASP modeled the impact of raising MEPS for new products starting in 2026 to align with the world's most stringent MEPS and today's best available technologies for eight key energy-consuming appliances across 162 countries.[v] The results show that this alignment could avoid 9 exajoules (EJ) of energy consumption globally in 2030. Further aligning MEPS with today's best available technologies would yield an additional reduction in energy consumption of up to 10 EJ.

Altogether, the improvements in MEPS could avoid about 19 EJ of energy consumption globally, achieving about 20% of the total reduction in energy consumption[vi] needed in 2030 to put the world on track to meet the 2xEE goal and keep the 1.5 °C climate goal within reach.

CLASP's assessment was conducted using Mepsy, an online climate impact calculator that estimates the potential impacts of appliance energy efficiency policies on energy use, emissions, and costs across 162 countries.

This MEPS energy saving potential analysis includes eight appliance categories: fans, lighting, motors, refrigerators, air conditioners, space heaters, televisions, and water heaters.

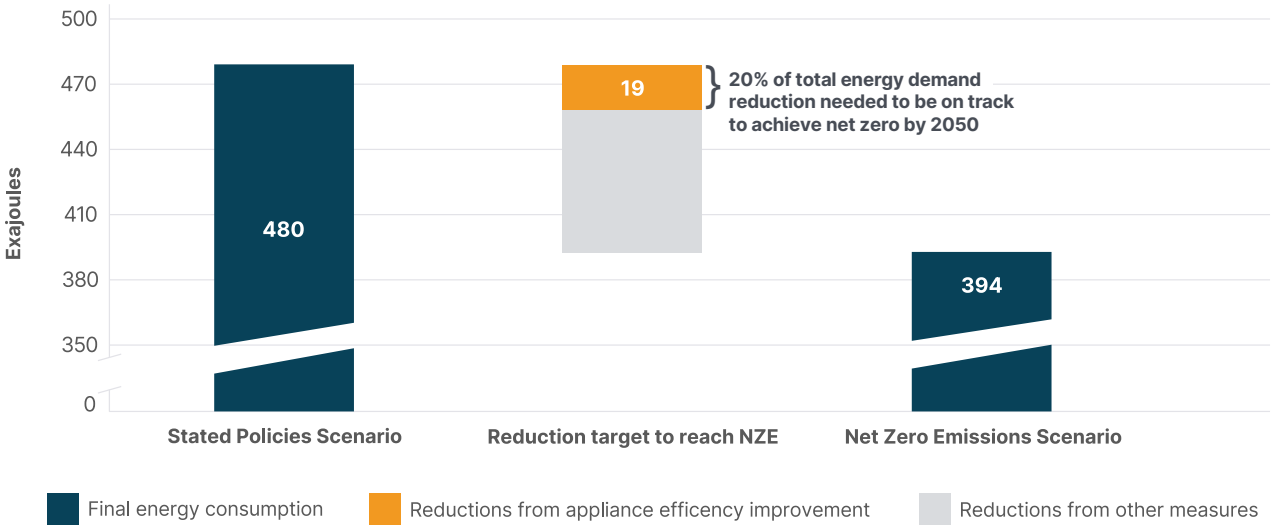
A complete list of the 162 countries analyzed, along with detailed information on Mepsy's data sources and methodology, is available on CLASP's website.

iv The 35% of global final energy consumption from residential, commercial, and industrial does not include boilers consumption.

v This analysis draws from our World's Best MEPS tool, which identifies the world's most stringent standards by comparing current MEPS for six appliance types across ten economies; hereafter, we will use *World's Best MEPS* and *world's most stringent MEPS* interchangeably. The savings potential assessment includes eight appliances: air conditioners, refrigerators, fans, televisions, motors, lighting, space heaters, and water heaters. The analysis was conducted using Mepsy, one of CLASP's online tools. See the callout box on the next page for a description of the tool.

vi The term *reduction in energy consumption/demand* in this article refers to the reduced amount of energy consumed.

FIGURE 2 Global final energy consumption in two IEA scenarios, 2030

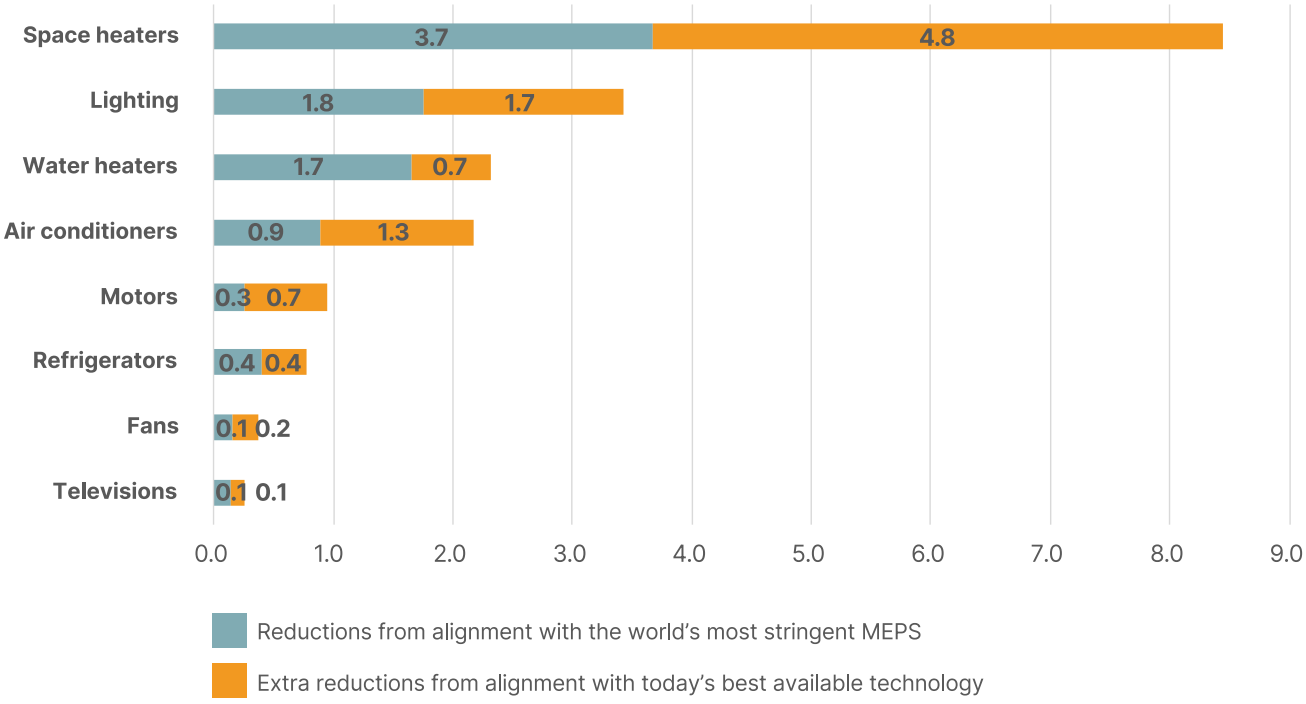


Source: *The reduction in energy demand from appliance efficiency improvement calculated using CLASP's climate impact calculator, Mepsy. Total energy consumption under the Stated Policy and Net Zero Emissions scenarios sourced from IEA, Energy Efficiency: The Decade for Action (IEA, 2023), https://www.iea.org/news/doubling-global-pace-of-energy-efficiency-progress-by-2030-is-key-step-in-efforts-to-reach-net-zero-emissions.*

A breakdown of the reduction in energy demand in 2030 shows that **lighting, space heating, and water heating** account for about 75% of the total. Aligning national MEPS with the World's Best MEPS could lead to a decrease of approximately 7 EJ in energy consumption from these three appliances. Further alignment with the best available technologies could yield an additional decrease of 7 EJ of energy consumption.

These decreases are driven by a combination of efficiency improvements and technology transitions. For instance, significant decreases in space heating and water heating energy use result from both the shift to heat pump technologies and enhancements in heat pump efficiency. For lighting, gains come from the phaseout of fluorescent lamps as well as the increasing efficiency of LEDs.

FIGURE 3 Breakdown of reduced energy consumption in 2030 from improving MEPS for eight appliances



Source: *CLASP analysis, calculated using CLASP's climate impact calculator, Mepsy. Detailed methodology available on the CLASP website.*

Appliance efficiency standards must be improved

In this section, we examine four common residential appliances and benchmark MEPS levels across ten countries, using data from the World's Best MEPS tool.[vii] This benchmarking highlights the gaps between the ten economies analyzed and the highest efficiency standards currently in place. We also assessed the best available technologies on the market today to better understand the range of possible improvements for future MEPS revisions.

The benchmarking highlights clear opportunities for improvement. Most national MEPS fall short of the world's most stringent MEPS, while even best-in-class MEPS remain well below the efficiency levels of the best available technologies.

> CLASP's World's Best MEPS tool compares the stringency of minimum energy performance standards (MEPS) across six key appliance categories—lighting, industrial electric motor systems, air conditioners, refrigerators, water heaters, and space heaters—in ten major economies, including Brazil, the European Union, the United States, China, and India, among others. The tool identifies the most ambitious standards globally and highlights opportunities for policy improvement. It is accessible online through the CLASP website.

Figure 4 shows that among the four sample appliances, MEPS levels vary widely across countries, and the amount of variation differs by product. While a few countries' MEPS come close to the world's most stringent standards, the majority still lag. For example, refrigerator MEPS in some countries are close to the World's Best MEPS level (within about 10%), while others are significantly behind, with

vii For additional appliance benchmarking results, please visit the World's Best MEPS online tool.

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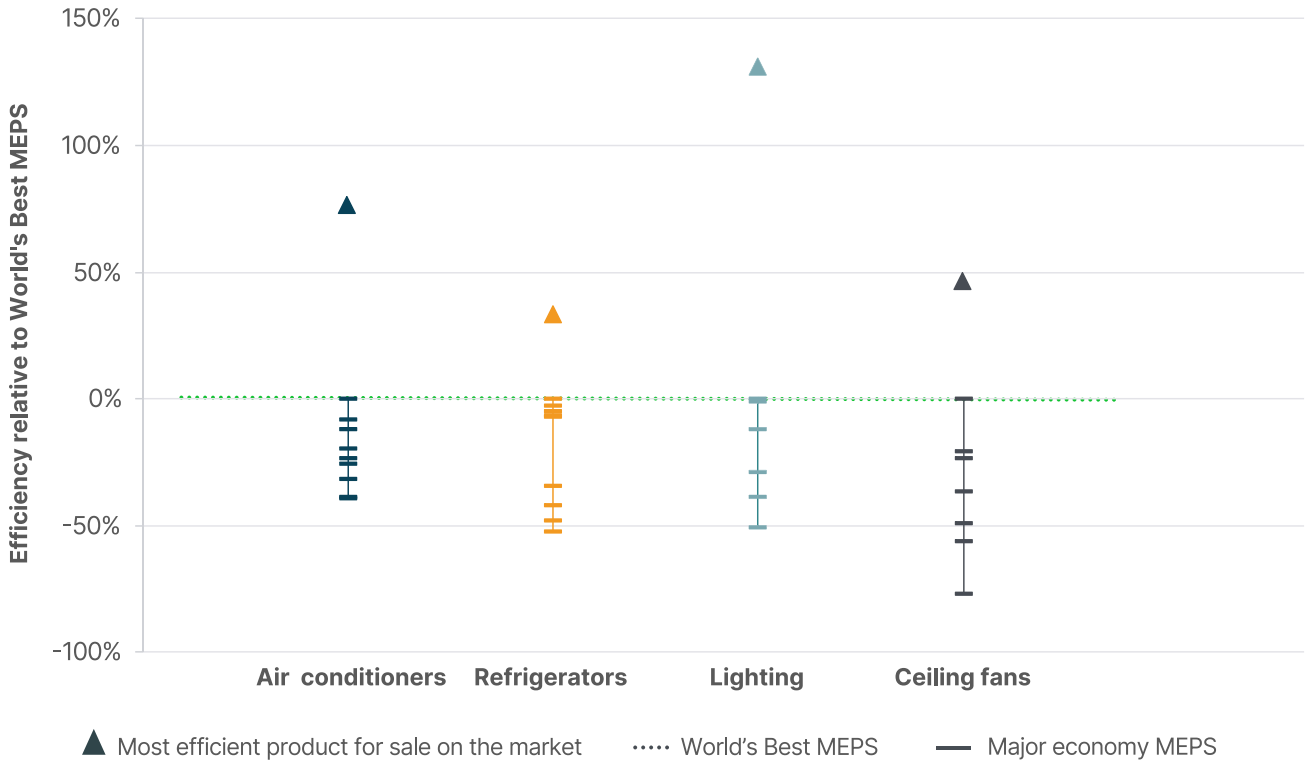
standards up to 50% less efficient. In contrast, for room air conditioners, most standards fall within 30% of the World's Best MEPS level due to recent appliance policy revisions in many countries.

Our research also found that the best available technologies significantly outperform the World's Best MEPS level across all four product categories. For example, today's best-performing lighting technology exceeds the World's Best MEPS level by a significant 131%. Similarly, top-performing air conditioners are about 70% more efficient than the World's Best MEPS level, while the most efficient refrigerators and fans surpass the most stringent MEPS by 31% and 45%, respectively.

FIGURE 4 Benchmarking countries' MEPS against world-leading standards and best available technologies



Note: *Please see Annex 1: MEPS Benchmark Methodology for the full list of assumptions, data sources, and country coverage. While the overall reduction in energy demand assessment includes space heating and water heating, these two appliances are excluded from this chart due to the complexity of benchmarking their MEPS across countries. Motors are not included in this comparison because their efficiency is classified in broad categories (e.g., IE1–IE5), not as specific energy use values, as is the case with appliances such as refrigerators. This makes it difficult to calculate direct percentage differences across countries compared to the World's Best MEPS level.*
Source: *CLASP analysis. Detailed efficiency category distributions are available on the CLASP website.*

Case studies: Appliance efficiency powers national climate targets

The findings underscore that there is room for existing MEPS to improve. To unlock the full potential for reduced energy consumption, it is urgent for **countries to align their standards with the World's Best MEPS levels. For countries that have already reached this level, the best available technologies should serve as a forward-looking benchmark when reviewing and updating MEPS.** This will help governments further reduce energy consumption and move closer to achieving the 2xEE target.

This section examines the energy efficiency progress, challenges, and opportunities across four major emerging economies: Brazil, China, India, and Indonesia. These four countries are pivotal to global efficiency progress, as they are projected to account for an increasing share of global energy consumption in the coming decades.[17]

When it comes to energy efficiency progress, each country has a unique context that shapes its challenges and opportunities. Some have demonstrated strong historical performance in energy efficiency improvements, while others represent significant untapped potential. Although their starting points and motivations differ, all four countries have integrated energy efficiency into their national climate strategies, recognizing its critical role in reducing emissions and promoting sustainable development.

These case studies also review each country's current efficiency policies, such as their efficiency standards programs, identifying both successes and gaps. Analysis highlights where stronger, more ambitious measures could accelerate progress toward national goals and contribute meaningfully to meeting the global 2xEE target.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Brazil

Brazil has significant potential to accelerate its energy efficiency progress. Compared to the global average level, the nation's annual efficiency improvement remained relatively flat (at around 0%) from 2010 to 2023, meaning energy demand mostly grew at the same pace as the economy.[18] While nearly half of Brazil's domestic energy supply comes from renewable sources, the national grid is increasingly strained by extreme weather events and rising energy demand, particularly from the use of cooling appliances during frequent heat waves.[19,20] Enhancing energy efficiency is therefore essential to meet growing energy needs without expanding fossil fuel infrastructure or increasing reliance on fossil fuels.[21]

The government's national plans have prioritized energy efficiency improvement. Brazil's Ten Year Energy Expansion Plan, developed by the Ministry of Mines and Energy (MME) and the Energy Research Company (EPE), targets 42 TWh of avoided electricity consumption in 2034 compared to the business-as-usual (BAU) scenario.[22] This avoided consumption will be achieved through energy efficiency improvements across different sectors, including accelerating electrification, rewinding industrial motors, and improving MEPS and labeling programs.[23]

In recent years, Brazil has made notable progress in tightening MEPS and labeling requirements for key energy-consuming products. For example, recent updates to MEPS for air conditioners are projected to reduce the average annual electricity consumption of each new unit by approximately 2% between 2024 and 2034.[24] However, despite this progress, our benchmarking finds that Brazil's MEPS for appliances such as air conditioners and refrigerators are still approximately 10% below the world's best standards.[viii]

According to CLASP analysis, aligning Brazil's MEPS with the best available technologies for six major appliances[ix] could yield a reduction of up to 39 TWh[25] of electricity consumption by 2034, representing over 90% of the reduction in electricity use targeted in the Ten Year Energy Expansion Plan.[x] The results demonstrate that strengthening MEPS could not only help Brazil get closer to its national climate targets and accelerate national energy efficiency progress but also enhance the country's contribution to the global 2xEE goal.

A key barrier to timely improvements in Brazil's efficiency regulations is the delay in revising standards, often, but not exclusively, caused by strong resistance from manufacturers. A notable example is Brazil's ongoing revision of lighting standards (originally scheduled for completion in 2024), which is expected to deliver a significant reduction in annual energy consumption of 3 TWh. Given the government's limited capacity, delays in one appliance standard's progress can hold up others in the pipeline. These cumulative delays risk undermining efficiency targets in the buildings and industrial sectors and, over time, may jeopardize broader national climate commitments.

Collaboration with international organizations, industry, and between government organizations can support timely and effective policy updates by building capacity, harmonizing testing protocols, aligning industrial and energy efficiency policies, addressing industry challenges, and providing targeted technical assistance. With this support, the government will be better equipped to manage industry resistance and sustain progress toward national energy efficiency and climate goals.

viii The percentage is estimated based on the MEPS benchmarking analysis presented in the previous section, "Appliance efficiency policies must be improved.".

ix The six appliances included in the analysis are air conditioners, refrigerators, fans, washing machines, TVs, and commercial refrigerators. These were selected in consultation with government stakeholders. Some other appliances with significant energy-saving potential are not included here due to limited prospects for revising their standards and labeling in the near future.

x The savings potential from aligning MEPS with the best available technologies represents the technical upper limit.

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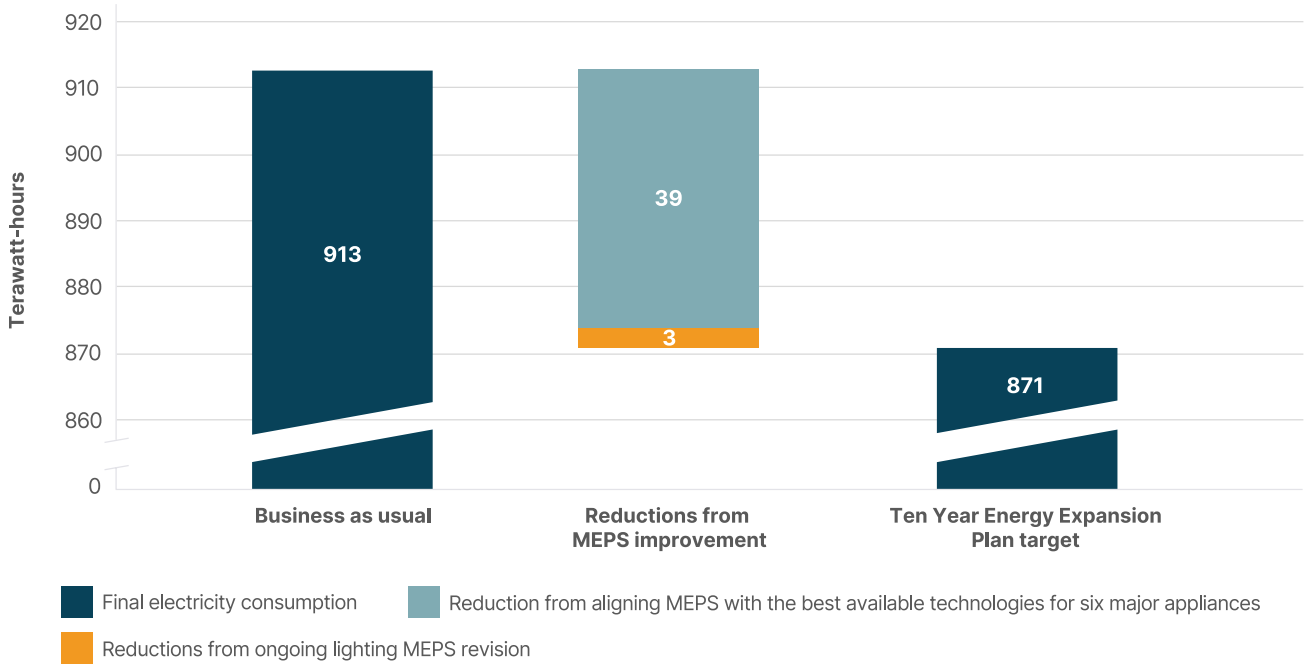
FIGURE 5 Total electricity consumption in Brazil in 2034



Note: *The six major appliances considered are air conditioners, refrigerators, fans, washing machines, TVs, and commercial refrigerators.*
Source: *Potential reductions in electricity consumption calculated with CLASP's climate impact calculator, Mepsy. Total electricity consumption under the business-as-usual scenario and the Ten-Year Energy Expansion Plan target sourced from the Ministry of Mines and Energy and Energy Research Company, Ten-Year Energy Expansion Plan 2034 (EPE, n.d.), accessed August 12, 2025, http://www.epe.gov.br/pt/publicacoes-dados-abertos/publicacoes/plano-decenal-de-expansao-de-energia-2034.*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China

According to IEA data, China made significant progress in energy efficiency between 2010 and 2019, averaging a 3.8% annual improvement (Figure 6). However, this momentum has slowed in recent years, with a more than 1% decrease in energy efficiency recorded in 2023.[26] As China is one of the world's largest energy consumers, accelerating its energy efficiency improvements is critical to placing the global 2xEE goal on track for success. Moreover, with fossil fuels still making up over 50% of China's primary energy consumption, energy efficiency offers an effective pathway to reduce fossil fuel use and CO_2 emissions, supporting the national goal of peaking carbon emissions by 2030.[27]

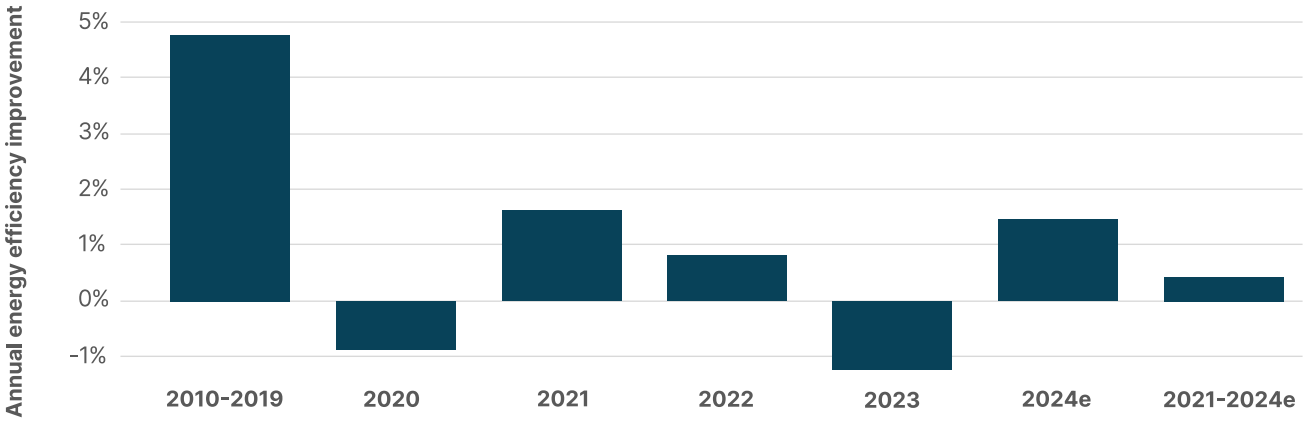
The Chinese government has prioritized energy efficiency as a core strategy in its Action Plan for Reaching Peak Carbon Emissions Before 2030.[28] The plan emphasizes the importance of improving appliance energy efficiency (particularly for major energy-consuming appliances such as cooling appliances, motors, pumps, and compressors) by strengthening MEPS.[29]

In line with this guidance, Chinese authorities published a framework guideline in 2023 for energy efficiency regulation, mandating review cycles and completion deadlines and requiring that MEPS and labeling levels reflect specific market benchmarks.[30] As a result, China has emerged as a global leader in MEPS for product categories such as cooling-only room air conditioners and electric motors.[31]

However, China's MEPS for some other appliances do not align with the World's Best MEPS. Changing this would allow the government to achieve its goal of leading the world in energy efficiency regulation.[32]

As a result of several shifts currently underway in the country (i.e., rising energy demand, rapid technological advancements, and the recent slowdown in energy efficiency gains), China must take further action by continuing to raise the ambition of its MEPS, especially for key energy-consuming appliances such as air conditioners, refrigerators, and motors. CLASP estimates that raising the stringency of MEPS for these three appliances alone could avoid around 351 Mt of CO_2 emissions in 2030.[xi]

FIGURE 6 Energy efficiency improvement rate in China (2010–2024)



***Source**: Energy Evaluation Asia Pacific webinar, March 4, 2025, https://energy-evaluation.org/wp-content/uploads/2025/03/iea-eeap-webinar-energyefficiency-2024-tracker.pdf.*

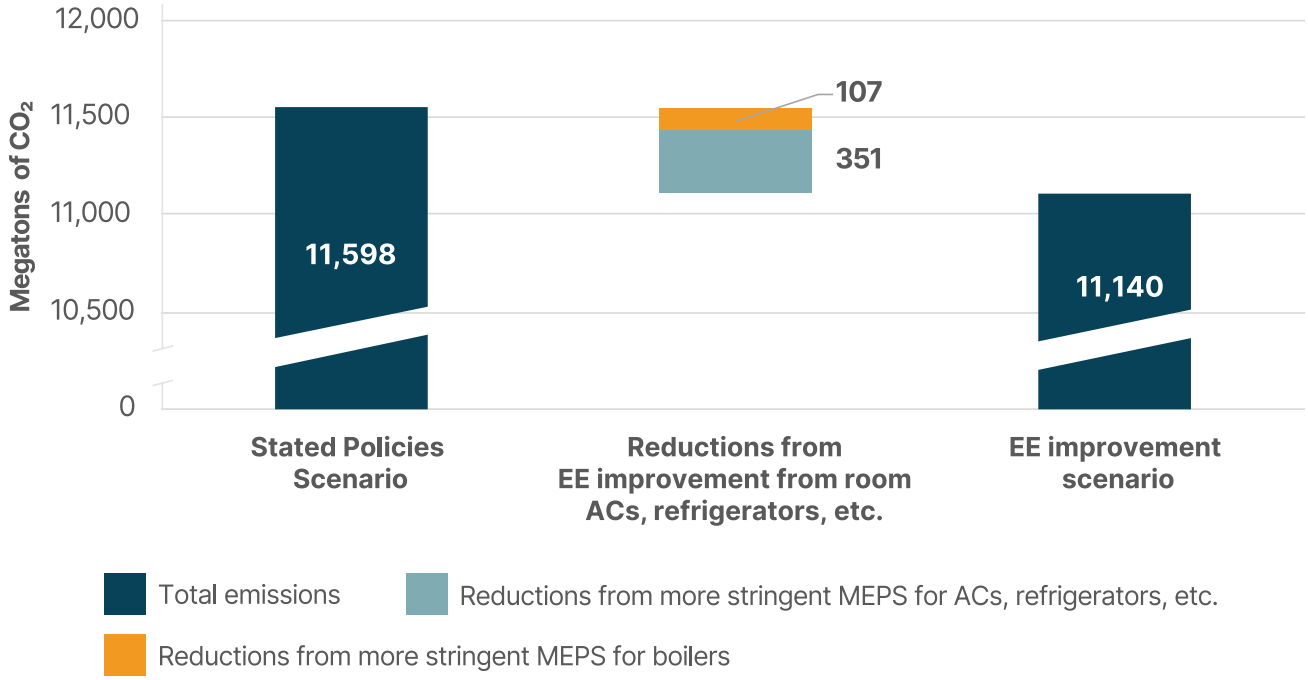
xi The impact assessment assumes that MEPS will reach an annual performance factor of 6.5 for room air conditioners, 140 kWh/year for refrigerators, and a 16% efficiency improvement over the BAU scenario for motor-driven systems in 2025.

In addition, there is substantial potential to improve efficiency in large-scale industrial equipment such as industrial boilers. In China, boilers produce roughly 40% of the country's total carbon emissions.[33] Raising the labeling requirement by shifting the entire labeling scale upward by one level for all new models could reduce emissions by an estimated 107 Mt of CO_2 in 2030.[xii]

Close collaboration with stakeholders and international partners can help ensure that China's regulatory authorities receive the technical assistance, policy insights, and capacity-building support needed to accelerate policy revision progress.

xii The assessment assumes that MEPS for coal and gas boilers will be raised by one efficiency level, with the policy coming into effect in 2025.

FIGURE 7 Total CO_2 emissions[xiii] in China in 2030, based on the IEA scenarios



Note: *Please refer to footnote xii for the assumptions used in estimating the climate impact for the three appliances. In this chart, the total emissions change in the energy efficiency (EE) improvement scenario is calculated by subtracting the emissions avoided through energy efficiency measures for air conditioners, refrigerators, motors, and boilers from the total emissions in the Stated Policies Scenario.*

Source: *Total CO_2 emissions calculated using CLASP's climate impact calculator, Mepsy. Total emissions under the Stated Policies Scenario sourced from IEA, World Energy Outlook 2024 (IEA, 2024), https://www.iea.org/reports/world-energy-outlook-2024.*

xiii Total CO_2 includes carbon dioxide emissions from the combustion of fossil fuels and non renewable wastes, from industrial and fuel transformation processes (process emissions), and from flaring and CO_2 removal. CO_2 removal includes captured and stored emissions from bioenergy and renewable waste combustion, biofuels production, and direct air capture.

Credit: Shutterstock

India

Over the past ten years, the country's annual rate of energy efficiency improvement has remained steady at around 2%.[xiv] In response to the 2xEE goal, the Ministry of Power (MoP) recently announced a target of reducing energy use by 1,035 terawatt hours (TWh) in 2030, supported by a set of measures.[xv,34] The proposed measures focus on improving energy efficiency across industry, transport, and buildings (especially cooling demand) by updating building codes, improving fuel-efficiency norms, and strengthening appliance standards and labeling to significantly reduce energy consumption by 2030.[35]

Among these initiatives, improving appliance efficiency stands out as a major opportunity to significantly reduce energy consumption. India's existing energy efficiency standards and labeling programs already reduce energy use by about 90 TWh annually.[36] Building on this progress, the government has considerable potential to achieve further progress through more ambitious policies.

According to CLASP's analysis:

- Aligning India's MEPS with the World's Best MEPS for eight key appliances[xvi] could result in 163 TWh less energy consumption in 2030.
- If India were to align its MEPS with the best available technologies currently on the global market, the total energy consumption could be cut by 400 TWh in 2030.

India has made steady progress in energy efficiency and has set a 2030 mitigation target across key sectors. To further strengthen its strategy, India could consider incorporating measurable efficiency targets and identify priority appliances beyond cooling.

For example, motors in the industrial sector, responsible for roughly 25% of total energy consumption, could be explicitly prioritized in future strategy updates.[37] While the current approach emphasizes the role of incentives and labeling in influencing the market, introducing clear targets for MEPS and positioning them as a central policy tool could significantly drive market action, reduce energy use and play a critical role in achieving India's energy-sector mitigation goals.[xvii]


Credit: Shutterstock

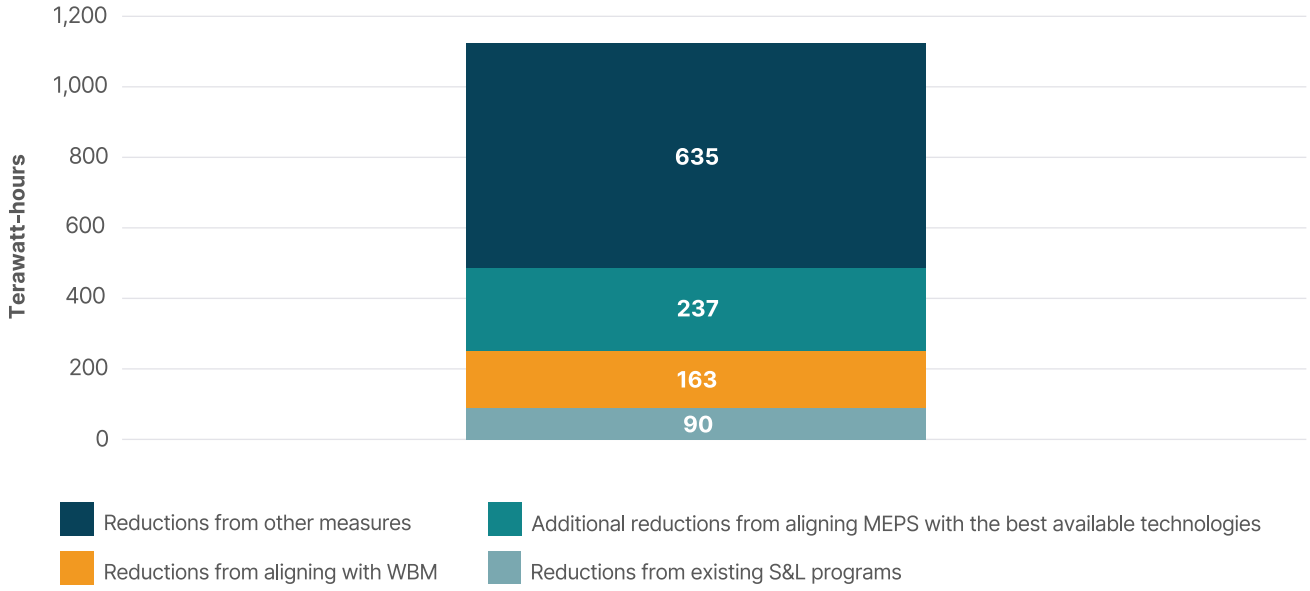
xiv Annual energy intensity is based on information about India's total primary energy supply and GDP obtained through public data from India's Ministry of Statistics and Programme Implementation and Energy Statistics India 2024.

xv The Ministry of Power sets the reduction in energy consumption goal at 89 million tons of oil equivalent, relative to a baseline scenario—no additional energy efficiency interventions are implemented. For comparison, the analysis converts the mitigation goal to terawatt hours by using a standard conversion factor in which 1 Mtoe is equal to 11.63 TWh.

xvi The eight appliances considered here include air conditioners, refrigerators, fans, TVs, beverage coolers, water heaters, transformers, and motors.

xvii As the Indian government is still in the process of developing a detailed strategy, the recommendations provided here are based on the currently available policy documents and may be subject to change as the strategy evolves.

FIGURE 8 India's energy use reduction target for doubling efficiency in 2030



Note: *The reduction target is measured relative to a no-intervention scenario (i.e., a baseline without additional energy efficiency measures).*
Source: *Energy consumption reduction potentials from existing standards and labeling programs, as well as MEPS alignment with World's Best Methods (WBM) and best available technologies, estimated using CLASP's climate impact calculator, Mepsy. Total reduction target sourced from Ministry of Power, India, Target of Doubling Energy Efficiency, April 3, 2025, https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=2118327.*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Indonesia

Indonesia's annual energy efficiency improvement rate averaged 0.9% between 2016 and 2021,[38] which is below the global average of 1.4% for the same period.

Energy demand in Indonesia is projected to rise by 75% by 2040, driven largely by increased appliance ownership and rapid expansion of building floor area.[39] This accelerating demand makes it even more difficult for Indonesia to improve energy efficiency and contribute to the global 2xEE goal by 2030.

Further adding to the challenge, fossil fuels currently account for 35% of Indonesia's electricity supply.[40] Without stronger energy efficiency measures, rising demand could lead to significantly higher emissions.

Recognizing this risk, Indonesian policymakers have integrated energy efficiency into national planning as a key strategy to support the country's net zero emissions target. As part of this effort, Indonesia aims to cut energy-sector emissions from 1.7 Gt under the business-as-usual scenario[xviii] to 1.3 Gt CO_2 (its unconditional target[xix]) by 2030. The Ministry of Environment has set a target for energy efficiency measures to contribute 137 Mt of CO_2 reductions toward this goal.[xx,41]

According to the Net Zero Emission 2060 Roadmap (NZE roadmap) published by the Ministry of Energy and Mineral Resources (MEMR), Indonesia has already made significant progress in advancing appliance energy efficiency.[42] Since 2021, the government has implemented efficiency policies for seven appliances.[xxi] Together, these policies are projected to cut about 14 Mt CO_2 in 2030.[43]

In the NZE roadmap, MEMR also assessed the emissions reduction potential of 18 appliances across the residential, commercial, and industrial sectors.[xxii] The assessment applied a top-down methodology, using the total mitigation goal from energy efficiency measures, 137 Mt CO_2 to understand stringency needs for future efficiency standards. The analysis found that Indonesia should expand current appliance policies to cover at least 11 additional unregulated appliances. In addition, the existing seven MEPS should progressively adopt more stringent requirements by incrementally raising efficiency thresholds, following the MEPS ladder, which shifts each efficiency level one step higher at each update. Under this plan, today's second-lowest efficiency level will become the new minimum standard by 2025–2030 and the current highest level will become the new baseline by 2055–2060. Strengthening existing MEPS requirements and expanding appliance policies to 11 additional appliances could cut 2030 emissions by another 62 Mt CO_2. [44]

In summar y, efficiency improvements for 18 appliances could deliver 45 % of the emissions reductions expected to result from energy efficiency in Indonesia.

CLASP's MEPS benchmarking confirms that Indonesia's current standards have significant potential for improvement. Instead of following the MEPS ladder, as modeled in the government's NZE roadmap, Indonesia should align its existing MEPS for seven appliances[xxiii] with the World's Best MEPS.

To avoid stagnation in efficiency gains, the government should also ensure the timely review and revision of standards across appliance categories. A regular process to review and revise MEPS and labeling requirements will help sustain progress and keep policies aligned with international best practices.

xviii The BAU scenario used here refers to a projection without any additional policy interventions.

xix Indonesia submitted emissions reduction goals under unconditional and conditional targets. The unconditional (also called CM1) target reflects efforts Indonesia can undertake on its own, while the more ambitious conditional (also called CM2) target depends on international financial support or favorable global climate policies.

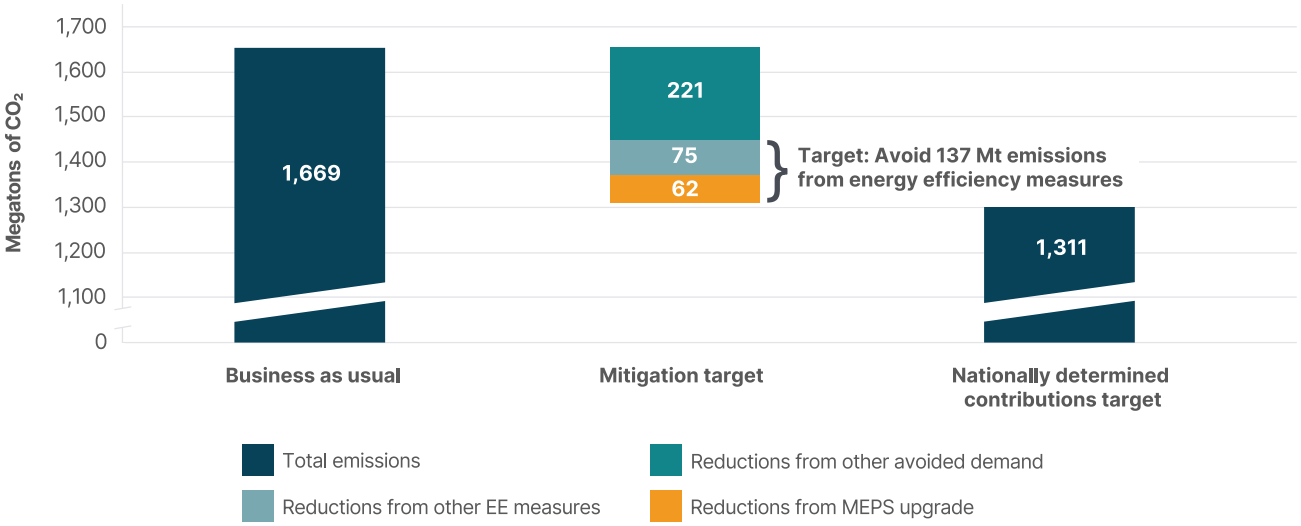
xx Energy efficiency measures are expected to reduce 137 Mt CO_2 by 2030, including 8.2 Mt from the power sector, 25 Mt from industry, 13.55 Mt from transport, and 89.83 Mt from the residential and commercial sectors. More reduction target detail is listed in the report online.

xxi The seven appliances include air conditioners, rice cookers, electric fans, refrigerators, LED lamps, TVs, and refrigerated display cases.

xxii The 18 appliances included in the assessment are: rice cookers, refrigerators, lighting, televisions, electric fans, air conditioners, water dispensers, washing machines, irons, water pumps, blenders, induction cookstoves, commercial AC chillers, RDCs, industrial process chillers, electric motors, distribution transformers, and "other."

xxiii The seven appliances include air conditioners, rice cookers, electric fans, refrigerators, LED lamps, TVs, and refrigerated display cases.

FIGURE 9 Indonesia's CO_2 emissions from the energy sector in 2030: BAU vs. NDC scenario



Note: *EE = energy efficiency; MEPS = minimum energy performance standards.*
Source: *Total emissions under the business-as-usual scenario sourced from the Ministry of Environment of Indonesia, "First Biennial Transparency Report of Indonesia to the United Nations Framework Convention on Climate Change," 2024, https://unfccc.int/documents/645082. Emissions reduction potentials from upgraded MEPS, and other measures sourced from the Ministry of Energy and Mineral Resources et al., Net Zero Emission 2060 Roadmap for the Indonesian Energy Sector (Ministry of Energy and Mineral Resources, 2024), https://simebtke.esdm.go.id/sinergi/page/content/66/peta-jalan-net-zero-emission-2060-sektor-energi-indonesia.*

BOX 3 Standards and labeling (S&L) program status in four emerging economies

Country	Regulatory authority	S&L establish year	Program coverage	Appliance efficiency mentioned in the latest NDC plan?	Energy efficiency mentioned in the national plan/climate strategy?	Average Annual rate of improvement in energy efficiency (2016–2021)
Brazil	MEPS: Ministry of Mines and Energy Label (mandatory): National Institute of Metrology, Quality and Technology	2001	18 appliances	Yes	Yes	0.3%
China	China National Institute of Standardization	2005	45 appliances	No	Yes	1.3%
India	Bureau of Energy Efficiency	2006	10 appliances (mandatory)	No	Yes	1.5%
Indonesia	Directorate General of New, Renewable Energy, and Energy Conservation	2021	7 appliances	No	Yes	0.9%

***Note**: This table includes only information on mandatory standards and labeling programs. The average annual energy efficiency improvement rates shown here may differ from those mentioned in the main text, as they are based on different periods.*
***Source**: "Appliance Efficiency Finally Recognized in National Climate Commitments," CLASP, n.d., accessed August 12, 2025, https://www.clasp.ngo/updates/appliance-efficiency-ndcs-early-trends/. The average annual rate of improvement in energy efficiency (2016–2021) is sourced from SEforALL, "SDG 7.3—Energy Efficiency Tracker," n.d., accessed August 8, 2025, https://www.seforall.org/goal-7-targets/energy-efficiency.*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Recommendations

As global energy demand continues to grow, strong appliance efficiency policies are more important than ever. Emerging economies will account for an increasing share of energy use and play a decisive role in achieving the global 2xEE goal.[45] Many have taken initial first steps, such as adopting MEPS or labeling programs, but the current pace of progress is insufficient. CLASP's analysis shows that many emerging economies' MEPS lag behind global best practice by over 30%.

Country-level analyses further show that aligning with the World's Best MEPS is often not sufficient to meet the global 2xEE goal. In many cases, adopting more stringent efficiency levels—the best available technologies level—is needed to help countries achieve their climate commitments.

To bridge this gap and unlock the full potential of appliance efficiency, countries should prioritize the following actions:

COMMIT TO STRENGTHENING MEPS, WHICH ARE CRITICAL, PROVEN POLICY TOOLS.

- To reach the 2xEE goal, our analysis reveals that countries without MEPS or with lagging MEPS should, at a minimum, align them with the world's most stringent MEPS.
    - CLASP has developed a research tool, the World's Best MEPS (WBM), which benchmarks MEPS levels for six key appliances across ten economies. This tool can guide national standard setting.
- Countries that are already leading in MEPS should make them even more stringent and set a schedule for matching the efficiency of the best-performing appliances currently available on the global market.

SET SPECIFIC MITIGATION TARGETS FOR ENERGY EFFICIENCY AND TRACK PROGRESS USING ROBUST, STANDARDIZED METRICS.

- To support effective implementation, countries should incorporate appliance efficiency into their NDCs, including detailed sector-level targets and measurable indicators.
    - Governments can consult CLASP's Net Zero Appliances NDC Toolkit, which includes data, guidance, for support in integrating appliance efficiency into NDCs.
- Tracking progress with standardized metrics, such as reductions in annual emissions, enables policymakers to monitor policy impact, inform policy, and attract climate finance. Standardized tracking frameworks also improve coordination across ministries and with international partners.

STRENGTHEN INTERNATIONAL AND CROSS-SECTORAL COLLABORATION TO ACCELERATE GLOBAL ENERGY EFFICIENCY GAINS.

- Doubling energy efficiency is a global goal that requires collective effort. International cooperation can help overcome shared barriers, such as misaligned standards and the dumping of inefficient appliances.
    - Country-to-country collaboration: Regional alignment of MEPS and testing protocols reduces compliance costs, facilitates trade, and strengthens market surveillance, especially across shared borders. It also enables countries to share technical expertise, co-develop regulatory frameworks, and increase bargaining power in international negotiations.
    - Collaboration with international organizations: International organizations can play a critical role by facilitating knowledge exchange, aligning testing protocols, and providing capacity-building support to national governments.

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Annex 1: MEPS benchmarking methodology

DATA SOURCES

MEPS data and best available technologies product information were sourced from:

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SCOPE OF MEPS BENCHMARKING

This analysis compares MEPS levels for one representative product type within each appliance category, focusing solely on MEPS policies currently in effect. Policies set to become effective after 2025 are not included.

The representative products used for comparison are:

- Air conditioner: Split-system room air conditioner with 7 kW cooling capacity. (To ensure consistency, air conditioning efficiency metrics were converted to Cooling Seasonal Performance Factors according to International Organization for Standardization standards.)
- Refrigerator: 400-liter frost-free refrigerator-freezer
- Lighting: General service non-directional indoor lamp
- Ceiling fans: 1400 mm blade span ceiling fans

COUNTRY COVERAGE

The following countries were included in the MEPS benchmarking analysis for each appliance category:

- Air conditioners: Brazil, Canada, China, European Union (EU), India, Indonesia, Japan, United Kingdom (UK), United States (US)
- Ceiling fans: Brazil, China, India, Indonesia, Mexico, Pakistan, US
- Lighting: Brazil, Canada, China, EU, India, Indonesia, South Africa, UK, US
- Refrigerators: Brazil, Canada, China, EU, India, Indonesia, Japan, South Africa, UK, US

BENCHMARKING APPROACH

The most stringent MEPS levels—referred to as the World's Best MEPS (WBM)—are set as the policy target (marked as 0% in charts). National MEPS levels from key economies are represented with short dashes to indicate their relative distance from the WBM target.

Additionally, the efficiency of the most efficient models currently available for sale worldwide was identified through product registration databases. These represent the best available technologies and are marked with triangles in the chart for comparison.

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