Multiple Benefits of Energy Efficiency

Multiple Benefits of Energy Efficiency for Business

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The business value of energy efficiency

Energy efficiency is often described as the “first fuel” because the cheapest and most secure energy is the energy that is not used. For businesses, this begins with a straightforward benefit: **lower energy bills**. In many cases, efficiency investments can pay back quickly through reduced energy costs alone, improving margins and reducing exposure to price volatility.

However, the value of energy efficiency extends beyond energy savings. By improving how equipment, buildings and processes operate, efficiency measures deliver wide-ranging benefits that strengthen business competitiveness across several dimensions:

Operational benefits

Efficient and electrified equipment operates more reliably and with less stress, improving process stability and reducing downtime. As processes become more precise and optimised, they also require fewer material and resource inputs, generating less waste. These gains result in higher productivity: for every dollar saved on energy, up to an additional 30 cents of value can be realised. Maintenance costs can also fall sharply – by more than 50% in some cases – due to reduced wear and longer equipment lifetimes, while reduced material losses and waste further strengthen operational efficiency.

Quality and reputation

Energy efficiency often provides improved process control, enhancing output consistency and quality. Around 75% of companies report that energy efficiency measures reduce production defects. At the same time, more efficient production practices can strengthen brand image and market positioning, with more than half of consumers willing to pay a premium for products associated with efficient and sustainable production.

Health and well-being

By reducing pollution and improving indoor conditions, energy efficiency can significantly enhance worker health and well-being. Lower exposure to harmful pollutants leads to healthier staff and better working conditions, with tangible productivity gains of up to eight additional productive days per employee each year.

These benefits add up. Every dollar saved on energy can deliver more than one additional dollar through those multiple benefits, highlighting how energy costs alone understate the full business case for efficiency. Building on the IEA’s work on the multiple benefits of energy efficiency, this report focuses on how these gains materialise within firms, and how businesses can capture these benefits in practice.

Operational benefits

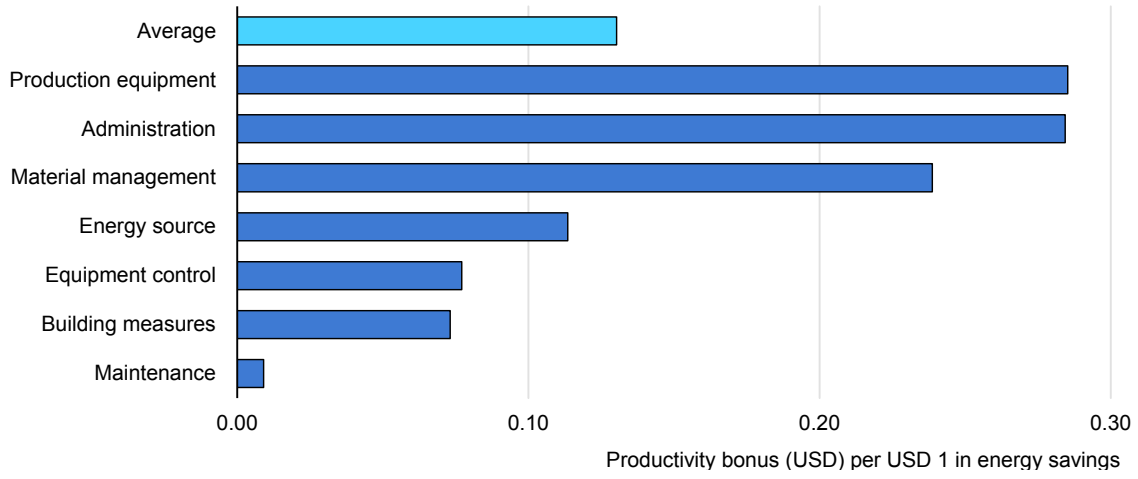
For every dollar in energy cost savings, productivity gains can deliver up to an extra 30 cents of value

Energy efficiency measures can improve how firms use labour, equipment and materials, leading to gains that go beyond reduced energy use. These improvements are often driven by more efficient, precise and optimised processes. By reducing losses – such as excess heat, inefficient combustion or friction – equipment operates more smoothly and reliably. Electrified processes can further enhance efficiency by reducing the number of moving parts and points of failure.

This improved performance leads directly to higher productivity. More efficient production lines enable better capacity utilisation, greater process control and less labour-intensive operations. For example, a more efficient knitting machine, as introduced by a textile manufacturer in Scotland, can replace about 14 conventional looms, cutting energy costs by about 90% and enabling higher output with lower space requirements. Similarly, at a food and consumer goods manufacturing facility in Brazil, energy efficiency improvements – such as reducing waste and better aligning production processes – have increased capacity by 20% while lowering energy use.

Evidence from a study of more than 1 000 energy efficiency measures in SMEs in the United States confirms these findings. On average, each dollar in energy savings is associated with an additional 13 cents in productivity gains, with some categories reaching up to 30 cents per dollar saved.

Productivity bonus, additional to energy cost savings, in small and medium enterprises by energy efficiency measure in the United States, 2002-2024



Notes: Sample size n = 1023. Examples for energy efficiency measures: Production equipment (efficient motors, waste heat recovery); Administration (space optimisation, employee training, workforce scheduling); Material management (closed-cycle water use, waste reduction); Energy source (fuel switching, storage); Equipment control (pressure optimisation, system monitoring); Building measures (lighting, Space heating and cooling); Maintenance (preventive maintenance, leak reduction).

Source: IEA analysis based on Industrial Training and Assessment Centers (ITAC) (2002-2024), ITAC Database (accessed 18 March 2026).

Efficient and electrified technologies can reduce maintenance costs by at least 25%

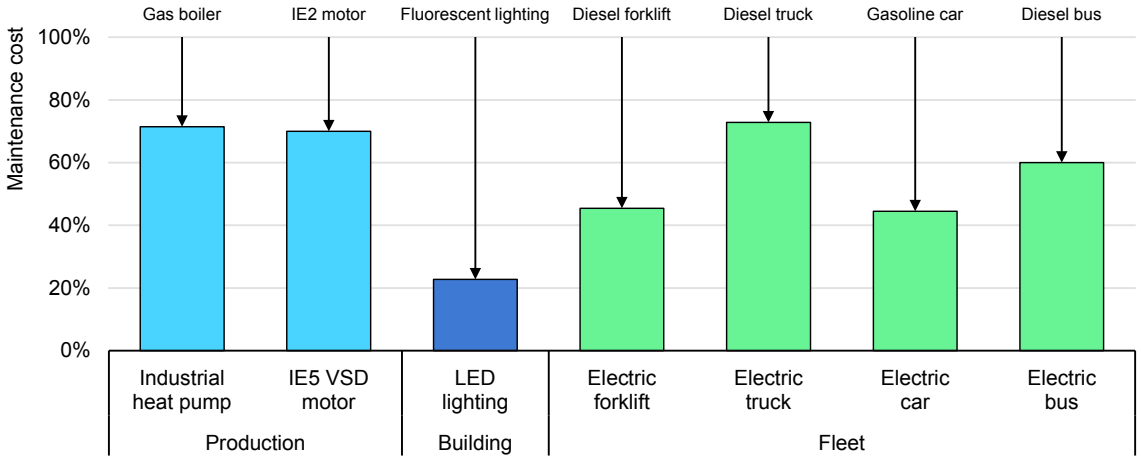
More precise and efficient processes designed to reduce energy loss often also limit wear and tear on equipment. As a result, energy efficiency measures can extend equipment lifetimes and reduce maintenance needs.

In practice, the effect can be significant. More efficient and electrified technologies typically have fewer moving parts and operate under more stable conditions, leading to lower failure rates and reduced servicing requirements. As a result, maintenance costs can fall by 25% to 80%, depending on the technology. For example, LEDs have longer lifetimes and require less frequent replacement, which can be particularly valuable in industrial settings where access is more complex and costly.

Further gains can be seen in industrial processes. In food processing, for example, a high-efficiency centrifugal compressor has been shown to reduce energy consumption by more than 40% while cutting maintenance costs by 85%. Similarly, the use of variable speed drive (VSD) motors in heating, ventilation and air conditioning (HVAC) systems under high-temperature conditions in a plant in Saudi Arabia reduced energy consumption by 30% and maintenance costs by 20%.

Cross-sector analysis shows these patterns are consistent across a wide range of technologies, from heat pumps and industrial motors to electric vehicles.

Maintenance cost of efficient technologies compared to conventional counterparts



Notes: VSD = Variable Speed Drive, IE2 motor = International Efficiency rating 2.
Sources: IEA (2026), Renewables for Industry; IEA (2025), Global EV Outlook 2025; IEA (2024), Global EV Outlook 2024; Argonne National Laboratory (2021), Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains; CEE.fr (2026), IE4 and IE5 industrial motor: understanding their key benefits (Moteur IE4 et IE5 industriel : comprendre leurs avantages clés), E3 Entegral Solutions (2026), Comparing Energy Savings: LED vs Fluorescent Lighting; Shouwo Machinery (2026), Electric Forklift Maintenance Cost: How Low Can It Really Go?

Resource efficiency can amplify energy savings, almost doubling savings in some sectors

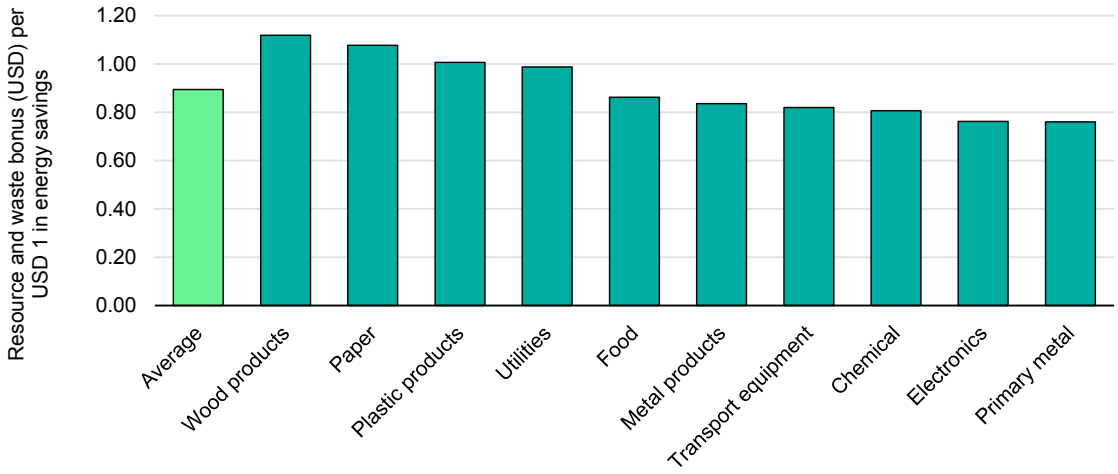
Energy efficiency improvements in industrial processes often include improved precision and optimisation that enable a more efficient use of resources. Energy savings are therefore often accompanied by reductions in material and water use, and a decreased production of waste, which significantly increases their overall economic value, particularly where measures reshape production processes.

In manufacturing, for example, greater precision in cutting or shaping can reduce margins and minimise offcuts, lowering energy use and material inputs. A wood panel producer in Türkiye illustrates this: by introducing an advanced measuring and material distribution system, the company reduced energy use in cutting and grinding while decreasing material inputs, saving around USD 6 million in a single year.

The link between energy and water efficiency is similarly strong. Processes operating at lower temperatures, or reusing waste heat, reduce both energy demand and process as well as cooling water needs. In the United Kingdom, a beverage producer implemented a closed-loop heat recovery system across brewing and distilling, enabling around 90% of surplus steam heat to be reused, reducing energy costs while saving approximately 2 million litres of water annually.

Evidence from an assessment of more than a thousand energy efficiency measures in SMEs confirms these benefits at scale. Reductions in water and material use as well as waste added, on average, 90 cents for every dollar of energy savings, with some sectors, such as wood products and paper, seeing total savings double.

Resource use and waste reduction bonus additional to energy cost savings in small and medium enterprises by sector in the United States, 2002-2024



Notes: Sample size n = 1023.

Source: IEA analysis based on Industrial Training and Assessment Centers (ITAC) (2002-2024), ITAC Database (accessed 18 March 2026).

Quality and reputation

Greater efficiency can reduce defects and improve production quality

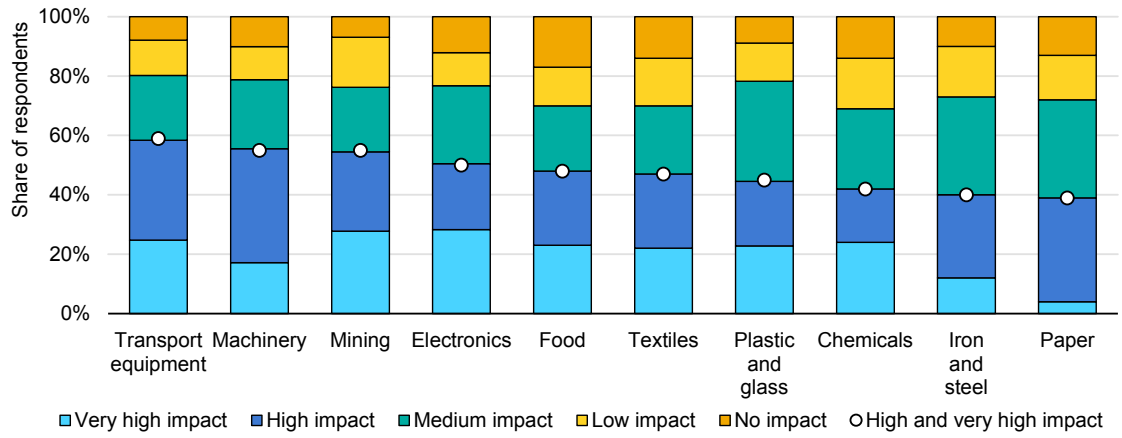
Energy efficiency improvements often involve tighter control and optimisation of production processes. By improving precision and stability in how equipment operates, firms can reduce variability in output and limit the occurrence of defects. These effects are particularly important in manufacturing sectors where small deviations can affect product quality and increase waste.

For example, an industrial bakery in Switzerland implemented a highly efficient centralised cooling system with CO_2-refrigerant and advanced controls. The system allowed for a more constant controlled temperature and reduced downtime, improving product quality and consistency, all while reducing energy costs and embodied refrigerant emissions.

Similar effects are observed in other manufacturing processes. For instance, at an Irish insulation company, replacing an inefficient moulding machine with a more efficient one, combined with waste heat recovery, led to more stable operations. As a result, defects and waste were reduced, cutting the use of waste compactors on site by 80%.

Recent survey evidence confirms the scale of these effects. Among 1000 manufacturing companies across a wide range of sectors, around two-thirds report at least a medium decrease in defective production following the implementation of energy efficiency measures, and almost half report a high or very high impact.

Global observed decrease in defective production due to energy efficiency measures by sector



Notes: Survey of 1 000 manufacturing companies in 14 countries.

Source: IEA survey on competitiveness (2025).

Improved energy performance is associated with better brand image and market positioning

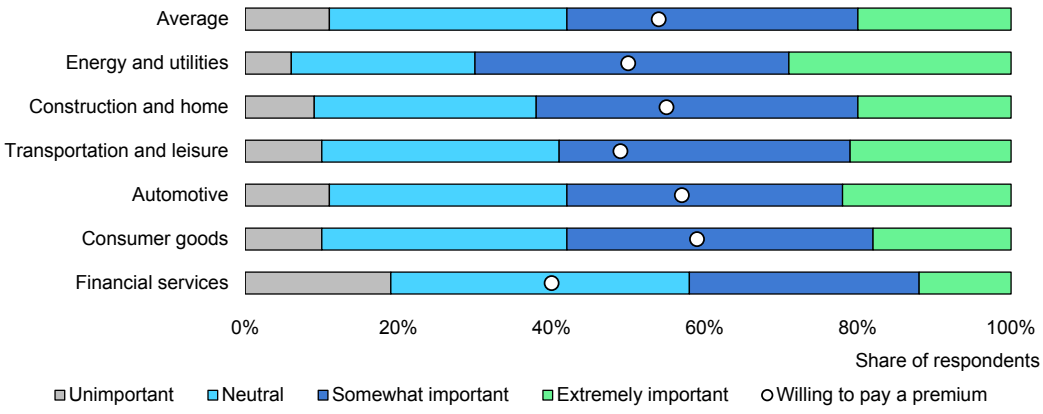
Energy efficiency can shape how firms are perceived in the market. By reducing energy use in visible and measurable ways, more efficient production can signal operational excellence and environmental responsibility, strengthening brand positioning and differentiation. This can generate commercial advantages through customer acquisition, supplier relationships and, in some cases, price premiums.

At the firm level, these effects are often linked to visible improvements in production. For example, Ahascragh Distillery in Ireland installed a heat pump for its distillation processes. While reducing energy costs by around 40%, the project also created a clear point of differentiation as being the first carbon-neutral distillery in the country.

Energy performance can also influence access to supply chains, as companies increasingly set expectations for suppliers to improve efficiency and reduce emissions. Apple requires suppliers to work towards net zero emissions by 2030 and includes energy efficiency performance in their supplier selection. Its Supplier Energy Efficiency Program helps suppliers to achieve that goal and estimates it has reduced the carbon footprint by 2 million tonnes of CO_2-eq in 2025. Similar approaches are emerging across sectors, with companies like Unilever requiring suppliers to meet energy performance standards, effectively making efficiency a condition for doing business.

Consumer evidence reinforces these trends. A recent survey shows that sustainability and energy performance are increasingly factored into purchasing decisions. The share of consumers willing to pay a premium for more sustainable products averages at more than 50%, despite broader affordability pressures in recent years. The effect is strongest in sectors with more direct links to energy use, such as utilities or transport.

Importance of corporate efficiency and sustainability performance for consumers, and willingness to pay a price premium, by sector, 2024



Notes: Survey of 6 120 representative consumers from Australia, Germany, India, the Netherlands, United Kingdom, United States.
Source: Simon Kucher & Partners (2026), Sustainability 2024: Navigating consumer behavior, as modified by the IEA.

Health and well-being

Energy efficiency can improve working conditions, increase employee productivity and reduce sick leave

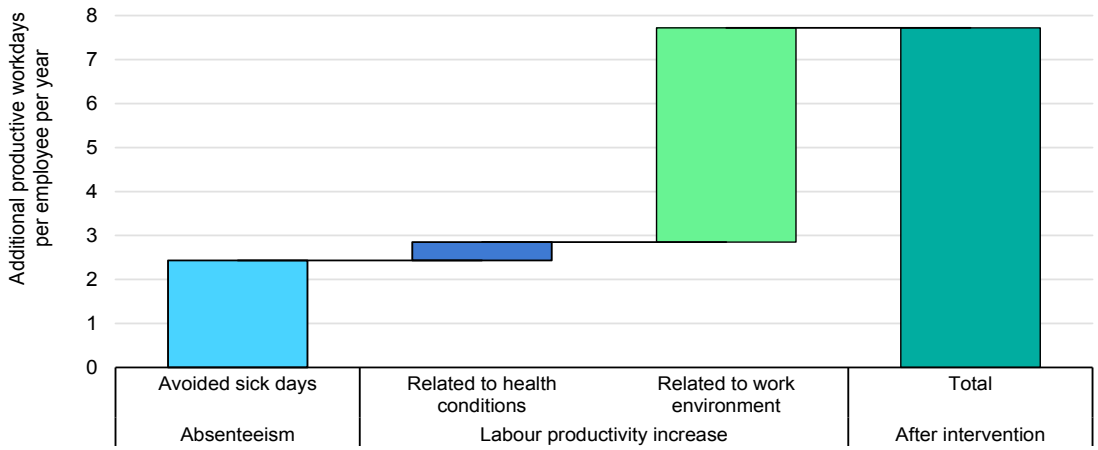
Energy efficiency improvements can enhance working environments and worker health. By reducing waste heat, air pollutants and other process inefficiencies, they lower health and safety risks while improving comfort and working conditions.

In manufacturing, these effects can be direct. For example, in electronics manufacturing, conventional soldering requires thermal pre-heating cycles that exposes workers to high ambient heat as well as safety risks. Replacing this with induction heating enables localised heating of the material, reducing energy demand by around 70% while eliminating heat stress and safety hazards for workers.

Similar benefits are observed in other industrial settings. For example, in apparel manufacturing in India, replacing fluorescent lighting with LEDs reduced energy use by around 85% and lowered indoor temperatures by up to 2.4 °C, reducing heat stress and improving worker productivity, particularly during hotter periods.

These effects are also evident in office buildings, where much of the workforce is concentrated. Improved energy efficiency is often associated with better thermal comfort and indoor air quality. On average, employees require between two and three fewer sick days per year following such interventions. At the same time, healthier and more comfortable working environments have been shown to improve productivity. Together, these effects amount to the equivalent of nearly eight additional productive working days per employee, delivering additional output from labour costs that are already incurred.

Increase in productive workdays due to improved indoor environmental quality in office buildings



Notes: Health conditions include asthma, allergies, depression and stress. Work environment includes improved air quality and thermal comfort, lighting quality and workplace satisfaction.

Source: IEA based on Singh A. et al. (2010), Effects of Green Buildings on Employee Health and Productivity; Chatterjee S. and D. Ürge-Vorsatz (2018), Measuring the Productivity Impacts on Energy Efficiency Measures.

Efficiency can significantly reduce worker exposure to local air pollution and associated health risks

Air pollution is a major risk to health, with an estimated 6.7 million premature deaths every year. In industrial settings, emissions from fossil fuel combustion for process heat are a key source of local air pollution. As a result, the way energy is produced and used in production has direct implications for the health of workers and surrounding communities. These effects are predominantly linked to outdoor air pollution, although some industrial processes can also affect indoor air quality through poor maintenance or fuel handling.

Energy efficiency plays a central role in reducing these health risks. By lowering overall energy demand and enabling the adoption of cleaner technologies, efficiency measures can significantly reduce emissions of local air pollutants. This is particularly important for the 70% of manufacturing processes that rely on low- and medium-temperature heat, for which more efficient and cleaner alternatives are available.

Electrified heat technologies, including industrial heat pumps, can lead to a sharp decline in local emissions while delivering higher levels of efficiency. Although emissions may still occur upstream in electricity generation, these technologies reduce health risks in the workplace by lowering local pollutant exposure. This helps reduce sick leave, healthcare costs and productivity losses, strengthening business performance and reputation in local communities.

Local air pollutants, efficiency levels and health risks of industrial heat technologies

	NOx	SO_2	CO	PM2.5	*Efficiency level*
Coal boiler	**173 g/GJ**	**900 g/GJ**	**931 g/GJ**	**108 g/G**	**80%** Low
Oil boiler	**513 g/GJ**	**47 g/GJ**	**66 g/GJ**	**20 g/GJ**	**85%** Low
Biomass boiler	**91 g/GJ**	**11 g/GJ**	**570 g/GJ**	**140 g/GJ**	**80%** Low
Natural gas boiler	**74 g/GJ**	**0.7 g/GJ**	**29 g/GJ**	**0.8 g/GJ**	**90%** Medium
Electric boiler	**0 g/GJ**	**0 g/GJ**	**0 g/GJ**	**0 g/GJ**	**99%** High
Heat pump	**0 g/GJ**	**0 g/GJ**	**0 g/GJ**	**0 g/GJ**	**350%** Very high
Health risk	*Respiratory disease, asthma*	*Respiratory disease, airway irritation*	*Cardiovascular stress, impaired cognition*	*Lung cancer, stroke, heart disease*	

Emission intensity Very high High Medium Low Very low None

Notes: NOx = Nitrous Oxide, SO_2 = Sulphur Dioxide, CO = Carbon Monoxide, PM2.5 = Particulate Matter <2.5 µm.
Electric technologies are emission-free locally, though upstream emissions in electricity generation may occur. Efficiency levels are defined as useable heat output per unit of energy input.

Source: IEA based on European Environment Agency (2023), EMEP/EEA air pollutant emission inventory guidebook 2023; WHO (2026), Air Quality, Energy and Health.

Turning the opportunity into reality

Across sectors, the evidence consistently shows that the value of energy efficiency extends far beyond energy savings, often matching or even exceeding them.

A key challenge is that much of this value is not systematically captured in investment decisions. Business cases are often built on energy savings alone, overlooking gains in productivity, resource efficiency, product quality, brand reputation and workforce health. Reflecting these wider benefits can significantly strengthen investment cases and improve how efficiency projects compete for capital.

This report draws on available evidence to highlight these broader benefits and why they matter in practice. The steps below show how to reflect them in investment decisions:

1. **Start with information**
   Energy audits and energy management systems provide the foundation for well-informed decisions. They help identify measures with the strongest operational relevance for a given site or process. IEA analysis shows that establishing a culture of energy management alone can yield savings of 10 to 18% in lighter industries in the early years, rising to as much as 60% over a longer period.

2. **Establish the core business case**
   A simple payback analysis, based on investment costs and energy savings, offers a clear starting point. Many measures already perform well on this basis, with payback periods of around three years for motor upgrades and within months for LED lighting.

3. **Expand the analysis to capture multiple benefits**
   Incorporating the additional benefits highlighted in this report can further enhance the business case. These benefits include productivity gains, reduced material and water use, lower maintenance costs, improved product quality and stronger brand positioning, as well as health and well-being impacts. Analysis tools, such as the interactive JUSTIFI tool developed by the National Laboratory of the Rockies and the Oak Ridge National Laboratory, can help identify, quantify and link these benefits to key performance indicators, often showing how they shorten payback periods.

4. **Position energy efficiency as a strategic investment**
   Energy efficiency often competes for capital with other core business investments. Strategic objectives within companies often take precedence over simple payback calculations to determine investment decisions, as argued by the 'salience approach' in multiple benefits research. They can be grouped in three dimensions: the value proposition (e.g. product quality and reliability), cost reduction (e.g. maintenance or defective products) and reduced risk (e.g. workplace safety).

To position efficiency projects effectively, practitioners can map expected results against these dimensions and frame proposals in terms of core business priorities. This means converting technical outcomes into metrics such as improved productivity, reduced downtime, lower defect rates or enhanced safety performance, and clearly showing alignment with corporate objectives.

For example, decision makers at a 3M plant in the United States initially rejected an energy efficiency project proposal despite a payback time of less than one year for energy savings alone due to concerns over the two-day downtime needed for implementation. The decision was ultimately reversed when the broader benefits were recognised: notably a reduction in the risk of accidents, unplanned downtime and raw material losses.

5. **Leverage targeted financing opportunities**

   Access to capital remains a key constraint for many companies, especially SMEs. Energy efficiency can help address this by improving credit conditions and opening access to dedicated instruments. For example, private banks in France have offered loans at more favourable interest rates for efficiency-related renovation projects compared to other types of renovation.

   Efficiency investments can also unlock access to green financing mechanisms not always available to other projects, such as special credit lines or sustainability-linked loans tied to specific measures or performance outcomes, often supported by public subsidies. In parallel, alternative models such as green leasing and Energy Service Company (ESCO) models can reduce upfront costs by spreading payments over time or linking them to realised energy savings. Recognising and leveraging these options can ease access to capital and strengthen the overall investment case.

6. **Measure, verify and communicate results**

   Business operations evolve over time, and so do opportunities for energy efficiency. Measuring and demonstrating realised benefits across all relevant dimensions, drawing on established measurement and verification frameworks, helps build a stronger evidence base for future investments.

   Documenting outcomes such as reduced downtime, improved product quality or lower maintenance costs can strengthen internal confidence, support replication across sites and make subsequent investment cases more compelling. Communicating these results reinforces the strategic value of efficiency.

There is significant – and often untapped – value for companies in enhancing energy efficiency. These steps offer a practical foundation for integrating the multiple benefits of energy efficiency into business investment decisions. This helps strengthen competitiveness and contribute to wider policy targets such as the doubling of energy efficiency improvements by 2030.

Acknowledgements

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