Multiple Benefits of Energy Efficiency

Emission Reductions

Why is energy efficiency important for emission reductions?

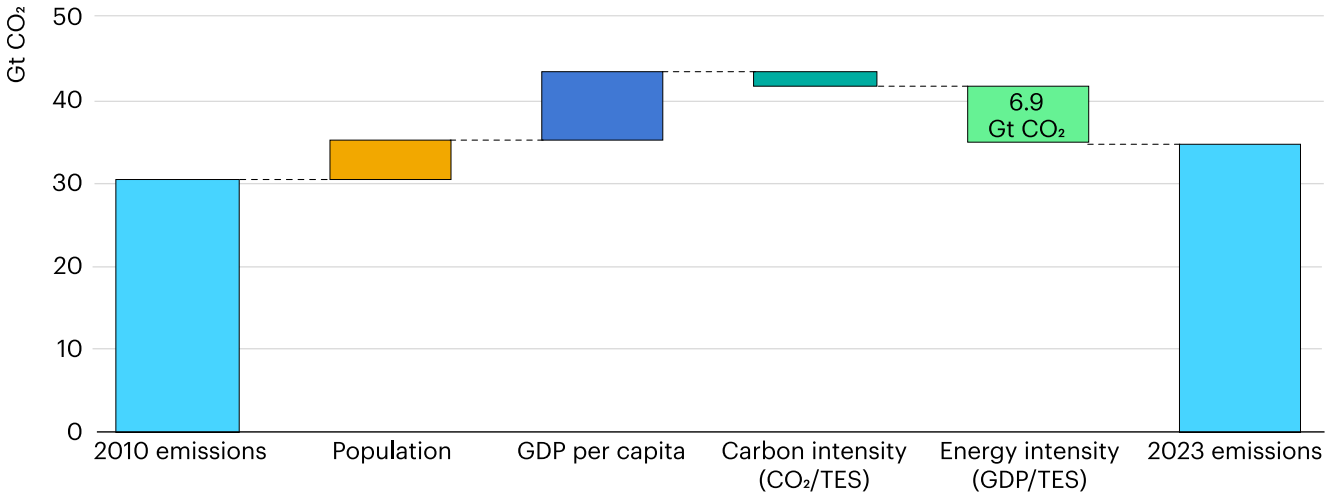
Energy efficiency can **reduce emissions of greenhouse gases** and **air pollutants** and make the energy system more sustainable.

- Since 2010, efficiency measures avoided energy-related carbon dioxide (CO_2) emissions equivalent to **nearly 20% of the global total** in 2023. This is more than the entire energy-related emissions of India and the European Union combined.
- Accelerating efficiency improvements could deliver a **third of all energy-related CO_2 emission reductions between now and 2030** in a pathway aligned with reaching net zero emissions by 2050 – the largest share of any sector or technology.
- Energy efficiency also improves **air quality** and people's health by lowering local air pollutants such as fine particulate matter (PM2.5) and nitrous oxide.

Key analysis

Global energy-related CO_2 emissions increased by around 15% between 2010 and 2023, driven by an increase in population and strong economic growth. Energy efficiency measures have helped counteract some of this rise in emissions, with a reduction of nearly 7 Gt of global energy-related CO_2 emissions over the same period – equal to around 20% of the total in 2023.

Change in global energy-related CO_2 emissions, 2010-2023



Notes
GDP = gross domestic product; TES = total energy supply. Decomposition analysis expresses the change in CO_2 emissions in four major indicators (carbon intensity, energy intensity, GDP per capita and population) using the logarithmic mean divisia index (LMDI) method.

Source
IEA (2024), Global Energy and Carbon Tracker, (accessed on 04 April 2025).

A closer look at sectoral air quality

Improving energy efficiency has additional benefits for **indoor and outdoor air quality**, by lowering the amount of particulate matter, nitrogen oxides and other harmful gases in the air:

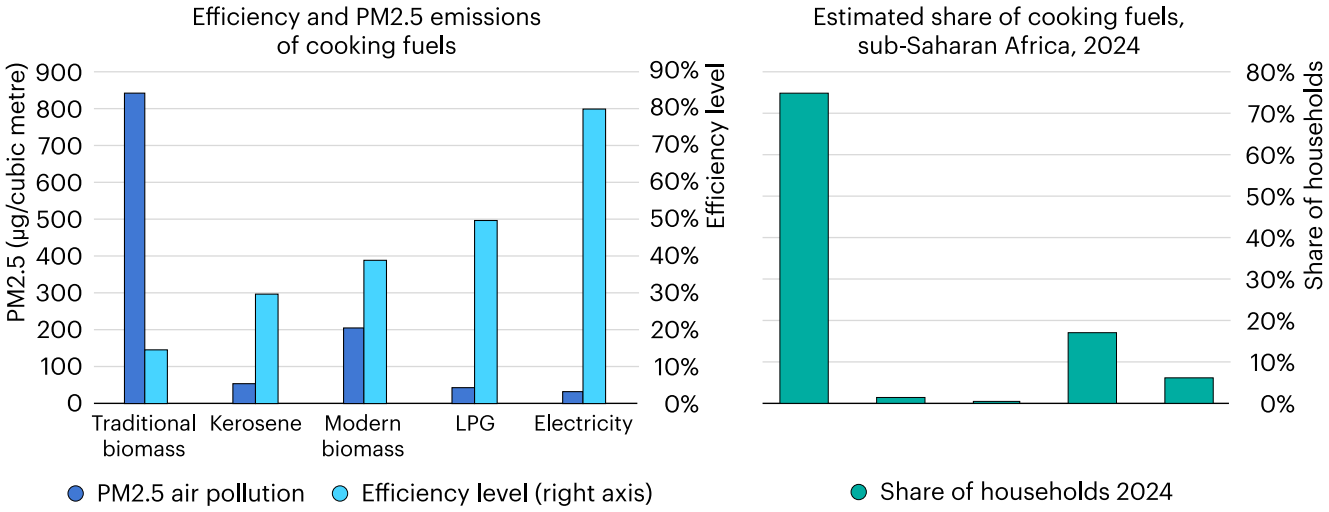
- Retrofitting poorly insulated houses can reduce indoor air pollutants in homes and commercial buildings, as long as these have adequate ventilation.
- Promoting efficient transportation in cities, such as through low-emission zones or a modal shift to public transport, can improve ambient air quality.

Given that many air pollutants have a localised effect, disadvantaged communities are often **disproportionally affected** by the environmental risks of low air quality and thus benefit the most from improvements. Urban air quality policies can therefore not only reduce air pollution but also reduce inequality.

In households that lack access to **clean cooking**, air pollution is linked to around 3.7 million premature deaths a year. Replacing open fires and inefficient stoves with cleaner, more modern stoves and fuels reduces household air pollution and improves efficiency.

Indoor air pollution from liquid petroleum gas (LPG) cookstoves is only around 5% of pollution from traditional biomass, while being over three times more efficient. Switching from LPG to electric cooking would further reduce indoor air pollution by 25% and is over 1.5 times more efficient.

PM2.5 air pollution and efficiency, by cooking fuel, cooking fuel share in sub-Saharan Africa, 2024



Notes
µg = microgramme; LPG = liquefied petroleum gas. Modern biomass defined as solid biomass, burned in Tier 4 ICS (improved biomass cookstove) or higher and bioethanol; Efficiency and PM2.5 refer to a pellet cookstove.

Source
IEA (2025), Global Energy and Climate Model. Khavari, B., Ramirez, C., Jeuland, M. et al. (2023), A geospatial approach to understanding clean cooking challenges in sub-Saharan Africa.

Need more information?

IEA (2024), Energy Security 2024.
IEA (2023), A Vision for Clean Cooking Access for All.