Multiple Benefits of Energy Efficiency

Grid Investments

Why is energy efficiency important for grid investments?

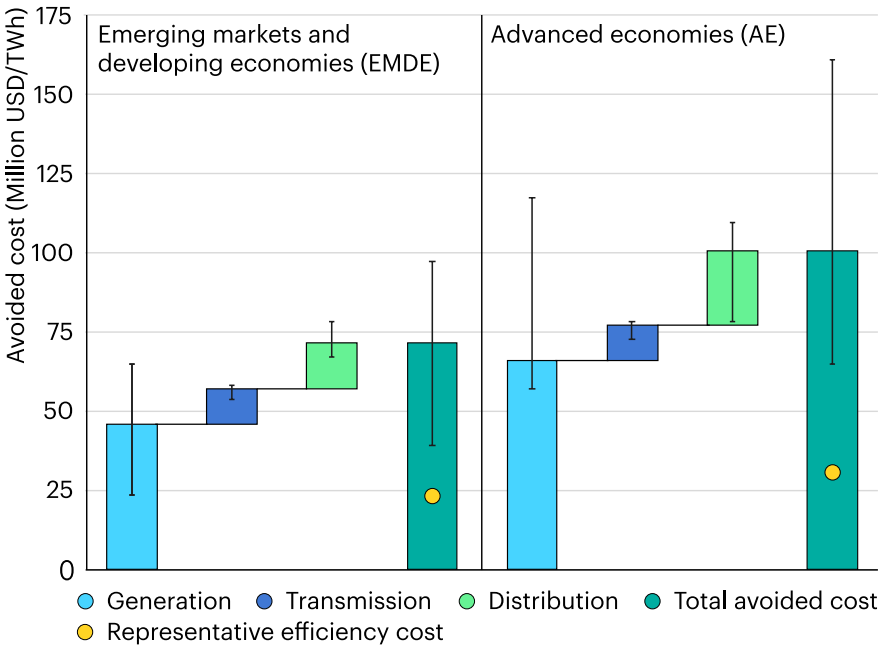
As we enter the Age of Electricity, global electricity demand is rising rapidly – and so is the demand for the expansion of electricity grids. Energy efficiency can help **close the gap between supply and demand**, but often at a **lower cost**, and **more quickly**, than new generation and grid expansion.

- On average, energy efficiency costs **less than half** the amount it would cost to build new generation capacity and grid infrastructure, per unit of energy.
- Energy efficiency measures can typically be deployed in **under a year**, while generation and transmission projects require between one and seven years to build on average, depending on technology, or over a decade for nuclear.

Key analysis

IEA analysis of nine major regions shows that increasing electricity generation and grid capacity by one terawatt-hour (TWh), will require investments of USD 30 to 110 million in emerging economies and USD 75 to 150 million in advanced economies. In order to save the same amount of electricity, energy efficiency measures would cost only between USD 10 million and 50 million.

Range of upfront investment costs for one terawatt-hour of energy, 2023-2030



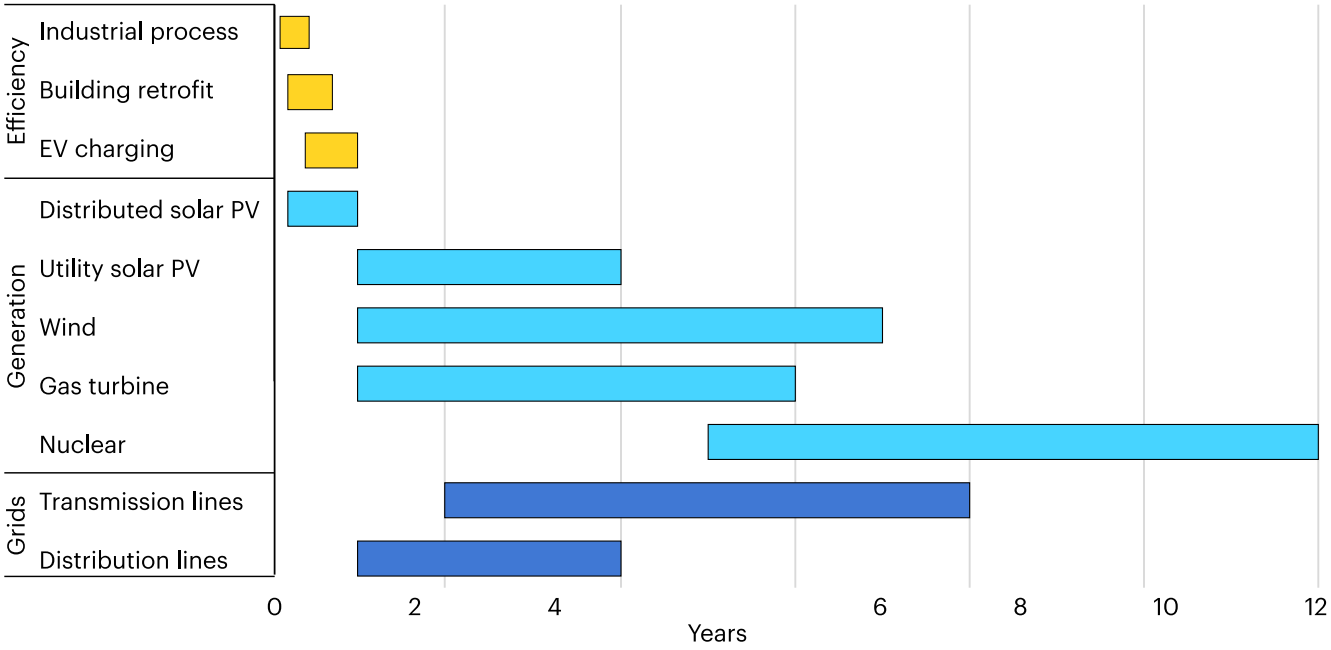
Note
The graph shows the average of all types of generation in the APS scenario for each World Energy Outlook model region (United States, European Union, Japan, other AE, China, India, Southeast Asia, Africa, and other EMDE). Columns denote average of all regions; spread indicators denote the range for all regions. Generation, transmission and distribution cost estimates will be sensitive to the cost of capital.

Source
IEA analysis based on IEA (2023), Electricity Grids and Secure Energy Transitions, IEA (2024), World Energy Outlook.

A closer look at grid management

The deployment of energy efficiency measures typically requires less time than the implementation of most new generation and grid infrastructure. On average, new generation and grid infrastructure can take years to implement, whereas efficiency measures, such as industrial process upgrades and building retrofits, take less than one year to deploy.

Typical development time for selected efficiency measures, electricity generation and grids



Note
EV = electric vehicle, PV = photovoltaic.

Source
IEA Analysis based on IEA (2025) The Path to a New Era for Nuclear Energy; Solar Reviews (2024), Solar Panels and Installation Time.

Demand-side measures can also reduce grid congestion, a key factor in determining costs to manage the system. These congestion management costs tripled in Germany, the United Kingdom and the United States from 2019 to 2022, and can constrain industrial expansion. Implementing energy efficiency and demand response measures can decrease and shift peak demand to less congested periods when electricity prices are lower and there is less stress on grid infrastructure. Demand response has seen rising uptake around the world, but further electrification and demand decarbonisation are expected to significantly increase its importance. For instance, in Australia, where various mechanisms have been successfully demonstrated, the value of demand response capacity could reach USD 11 billion per year by 2042. Globally, it could provide up to 50% of short-term flexibility needs in 2050.

Need more information?

IEA (2024), World Energy Outlook.
IEA (2023), Smart Grids.
IEA (2024), Digital Demand-Driven Electricity Networks Initiative (3DEN).
CREDS (2021), The role of energy demand reduction in achieving net-zero in the UK.