

ExxonMobil Global Outlook
EXECUTIVE SUMMARY

Our view to

2050

August 2024

In 2050, the world will be different – vastly different

ExxonMobil

Modern living standards are made possible by ready, affordable access to energy. For the billions of people without that access even the most basic tasks of life can be extremely challenging. Looking out to 2050, the global population will continue to grow, adding to the demand for energy. Any transition that fails to affordably meet this demand along with the world's ever-evolving needs is simply not just.

**~4 BILLION PEOPLE LIVE BELOW
THE MODERN ENERGY MINIMUM**



(1/2 THE WORLD'S POPULATION)

**1 MILLION
MORE PEOPLE**
every 6 days

Did you know?

The number of people in the world is expected to increase from 8 billion today to nearly 10 billion in 2050. With 2 billion more people on the planet, the world will need new ways to:

Produce more reliable, affordable energy

**Drive global economic growth to raise living standards,
particularly in the developing world**

Further reduce greenhouse gas emissions

The world will be different in 2050, but the need to provide the reliable, affordable energy that drives economic prosperity and better living standards, while reducing greenhouse gas emissions, will remain just as critical as it is today. Achieving this balance will require wind, solar, oil and natural gas, as well as nearly every other form of available energy – because access to energy drives human development and quality of life.

Defining the modern energy minimum

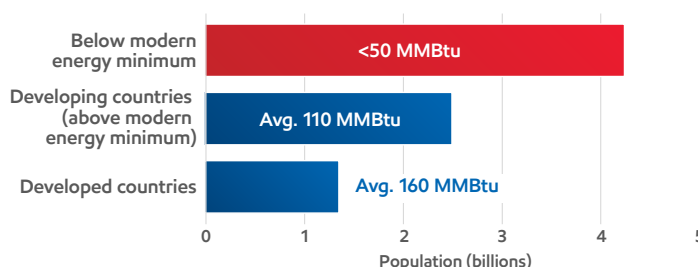
To measure the average quality of life by country, the United Nations created the Human Development Index (HDI). Scores are based on three factors: life expectancy, education, and income.

Using UN HDI data from 2022, we determined that about 4 billion people live below the “**modern energy minimum**.” That’s far below modern standards of living, which require reliable energy for housing, infrastructure, jobs, and mobility.

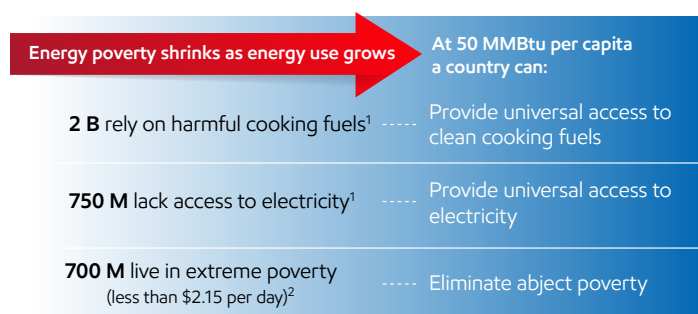
By our analysis, for a country to rise above this threshold, the average energy use per capita would need to be at **least 50 million British thermal units (MMBtu)** per year. Developed countries around the world use, on average, more than three times that amount.

Providing for the basic energy needs is a must to meet the UN’s goal to “end poverty in all its forms everywhere.”

Energy consumption per capita (2023)



Meeting the “modern energy minimum” helps break the poverty cycle:



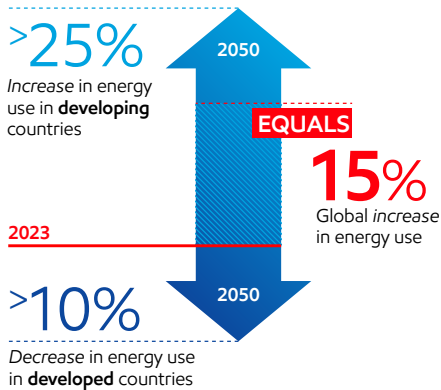
¹ International Energy Agency (IEA) Strategies for Affordable and Fair Clean Energy Transitions May 2024

² World Bank Group Understanding Poverty April 2024

Projection: Carbon emissions will fall even as oil and natural gas remain vital

The world is at a pivotal stage:

It needs to reduce carbon emissions *and* still provide the energy people need.



Lifting nations toward the modern energy minimum will drive a projected 15% increase in total energy use worldwide between now and 2050. Renewables will play an important role. So will oil and natural gas.

Nearly all of this increase enables economic growth in developing countries. By contrast, energy use in developed nations will decline by more than 10% as efficiency improves.

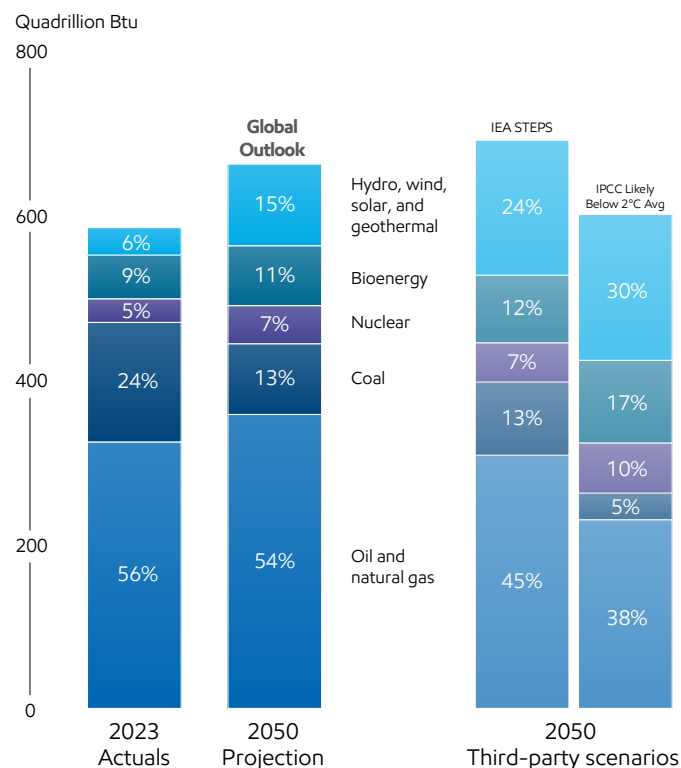


Projection: Even as developing economies grow and consume more energy, global carbon emissions will start to fall for the first time by 2030. In fact, our Outlook sees carbon emissions continuing to decline through 2050.

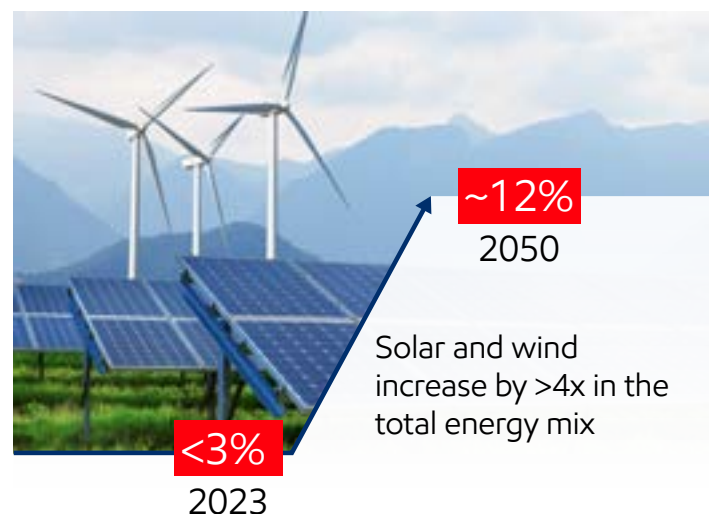
How?

- Greater energy efficiency
- More renewables
- Lower-emission technologies, including carbon capture and storage, hydrogen, and biofuels

Global energy mix



As part of the world's total energy mix, electricity use will grow by 80% by 2050. More broadly, the most significant changes in the **world's total energy mix** between now and then will be:



Coal will continue to be displaced by lower-emission sources, including natural gas, which reduces carbon emissions by up to 60% in electricity generation.

See "How we develop the Global Outlook" section on page 3 for the difference between "projections" and "scenarios."

Projection: Oil and natural gas continue to make up >50% of the world's energy mix in 2050



Sensitivity analysis: If every new car sold in the world in 2035 were electric, oil demand in 2050 would still be 85 million barrels per day. That's the same as it was in 2010.



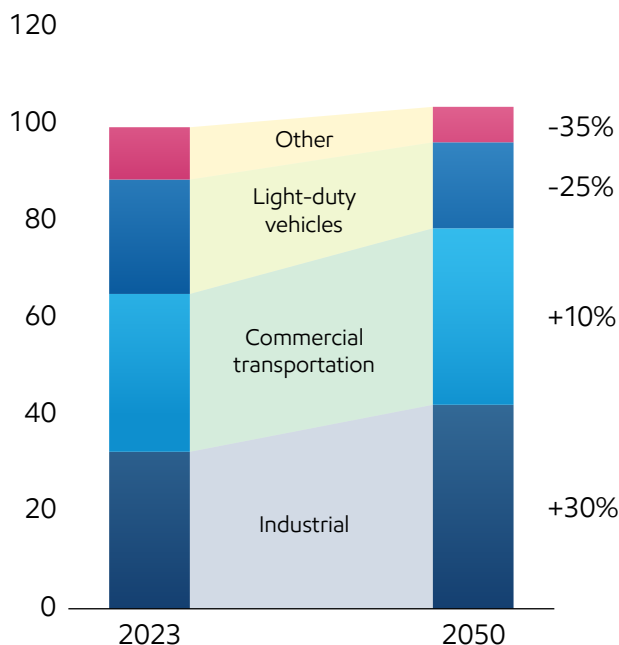
The demand for oil to make gasoline for passenger cars will drop by 2050. What many don't realize is that making gasoline is but one relatively small use for oil.

The large majority of the world's oil is and will be used for industrial processes, such as manufacturing and chemical production, along with heavy-duty transportation like shipping, trucking, and aviation. These services are needed for modern life – and they also fuel future economic growth in the developing world.

The Global Outlook sees a plateau in oil demand beyond 2030, remaining above 100 million barrels per day through 2050.

Projection: Oil demand

Million barrels per day



Yes, changes in the world's overall energy mix are coming. But the Global Outlook and various third-party scenarios are clear – oil and natural gas will remain essential.

How we develop the Global Outlook

Our Global Outlook is our latest view of demand and supply for energy and products through 2050 assuming an aggressive but practical energy transition. It forms the basis for the company's business planning and is scientifically grounded in our deep understanding of long-term market fundamentals. In addition to assessing trends in economic development, technology advances, and consumer behavior, the Outlook seeks to identify potential impacts of climate-related government policies. It is not an endorsement of a particular outcome.

We consider a range of scenarios – including those we view as remote – to help inform strategic thinking. No single pathway can be reasonably predicted, given the wide range of uncertainties. Key unknowns include yet-to-be developed government policies and advances in technology that may influence the cost, pace, and potential availability of certain pathways. What also remains uncertain is how quickly and to what extent businesses and consumers will be willing to pay for deeper carbon reductions in the products and services they use, thereby creating a market that incentivizes an accelerated path to net zero.

Unlike the company's Outlook, which is a projection, many scenarios, such as International Energy Agency's Net Zero Emissions (IEA NZE) by 2050, work backward from a hypothetical outcome to identify the factors needed to achieve that outcome. It is important to note that the IEA acknowledges that society is not on a net-zero pathway.

Global oil and natural gas supplies virtually disappear without continued investment

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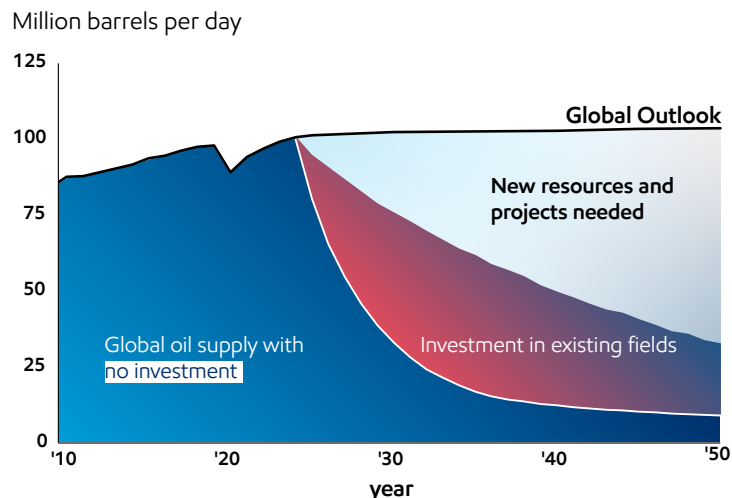
As the world's demand for oil and natural gas remains strong, sustaining investment is more important than ever.

Our Outlook reflects oil production naturally declining at a rate of about 15% per year. That's nearly double the IEA's prior estimates of about 8%.

This increase is the result of the world's shifting energy mix toward "unconventional" sources of oil and natural gas. These are mostly shale and dense rock formations where oil and gas production typically declines faster.

To put it in concrete terms: With no new investment, global oil supplies would fall by more than 15 million barrels per day in the first year alone.

At that rate, by 2030, oil supplies would fall from 100 million barrels per day to less than 30 million – that's 70 million barrels short of what's needed to meet demand every day.

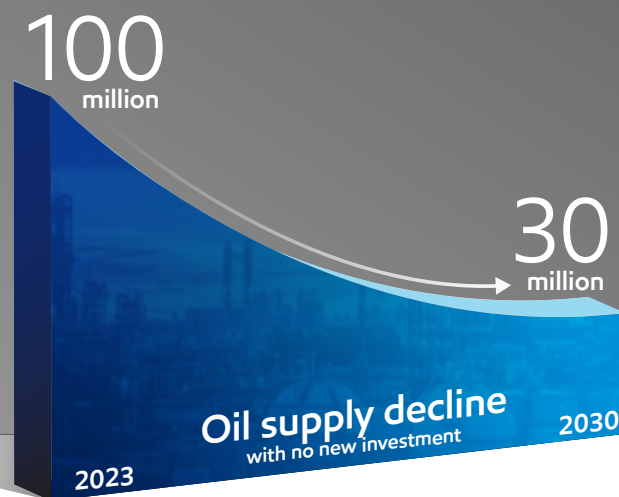


Sensitivity analysis: The economic effects of this kind of supply shock would be dire.

The world would experience severe energy shortages and disruption to daily lives within a year of investment ceasing.

Given price responses to past oil supply shocks, the permanent loss of 15% of oil supply per year could raise oil prices by more than 400%. By comparison, prices rose 200% during the oil price shocks of the 1970s.

Within 10 years, unemployment rates would likely reach 30%. That's higher than during the Great Depression of the 1930s.



Any policy that would "keep it in the ground" is not just.

As this Outlook shows, sustained investment is needed to meet the world's demand for oil and natural gas – even as companies like ExxonMobil invest billions to lower the greenhouse gas emissions associated with its own operations and help other industries lower theirs.

Robust investments in new technology are needed

To improve living standards and get to a lower-emissions future, the world needs to make sustained investments in new technologies to:

- Meet increased demand
- Fuel economic growth – especially in developing countries
- Further reduce global emissions



In 2050:

50%
world's emissions

from commercial
transportation
and industrial activity

Rapid growth in wind and solar in the energy mix – a projected fourfold increase by 2050 – will spur the biggest changes to the energy landscape. That's an important part of the solution.

Commercial transportation and industrial activity alone will account for nearly half of the world's emissions in 2050. Wind and solar will play a limited role in these sectors.

Reducing emissions in “hard to decarbonize” sectors such as aviation, cement, steel, and others with unique energy needs will require the world to rely on the expansion of biofuels, carbon capture and storage and hydrogen, among other technologies.

To preserve the cost, reliability, and infrastructure advantages of today's energy system and keep pace with demand, **the world will need to scale up solutions such as:**

H₂

Hydrogen

A fuel that, when combusted, produces only water as a byproduct. One essential way to produce virtually carbon-free hydrogen (with ~98% of CO₂ removed) is to convert natural gas into hydrogen and CO₂ – the hydrogen is used as fuel, while the CO₂ is captured and stored. This method is endorsed as part of the U.S. Inflation Reduction Act.



**Carbon capture
and storage**

A proven and safe technology that reduces emissions from manufacturing and power generation. CO₂ emissions are captured, transported by pipeline to suitable geologic formations, and permanently stored deep underground. This technology has been endorsed by the U.S. EPA, the European Union, and the United Nations.



Biofuels

A lower-emission alternative to fossil fuels that is particularly useful in commercial transportation. Growing the plants that are used to make biofuels can help offset the CO₂ produced when biofuels are combusted, resulting in fewer greenhouse gas emissions when used in place of diesel fuel.

What is needed to get to net zero?

"To get serious, three things are needed: supportive public policy, significant technology advancements, and a smooth transition from government subsidies to market-based mechanisms."

- Darren Woods, ExxonMobil Chairman and CEO



Governments, companies, universities, and others need to work together to achieve a transition that increases the supply of energy for everyone while steadily and thoughtfully reducing emissions.

Given the need to do more and do it faster at a lower cost, progress will need to occur in parallel, supported by durable policies that are focused on:

- **More transparency** to give the market more lead time to adapt to changes.
- **Outcomes** to keep the market focused on the best technologies to reduce the most emissions at the lowest price. Collaboration is key to finding the right application of technology to lower emissions in specific industries. That's why we believe governments should create a level field in which all technologies can compete without fear or favor so that the best choices emerge.

The right policy framework can speed up action by the private sector. Examples include:

- **The U.S. Inflation Reduction Act** which focuses on an outcome of carbon intensity and does not pick winners and losers
- **Canada's Clean Fuel Regulations** allows for co-processing of biofuels to achieve a lower-carbon intensity outcome

Where no market exists and initial costs are high, incentives make sense to get things started. But government incentives cannot – and should not – be in place forever. To get to net zero, markets must be developed to encourage reduced emissions.

Five key takeaways of our Global Outlook

There has been enormous progress, yet more work is needed.

When considering the world's energy future, keep these truths in mind:

1. All energy types will remain in the mix.
2. Renewables will grow the fastest.
3. Coal will decline the most.
4. Under any credible scenario, oil and natural gas remain essential.
5. Lower-carbon technology needs policy support to grow rapidly but ultimately must be supported by market forces.

This Executive Summary of the Global Outlook includes Exxon Mobil Corporation's internal estimates of both historical levels and projections of challenging topics such as energy demand, supply, and trends through 2050 based upon internal data and analyses as well as publicly available information from many external sources including the International Energy Agency. Separate from ExxonMobil's analysis, we discuss a number of third-party scenarios such as the Intergovernmental Panel on Climate Change Likely Below 2°C and the International Energy Agency scenarios. Third-party scenarios discussed in this report reflect the modeling assumptions and outputs of their respective authors, not ExxonMobil, and their use and inclusion herein is not an endorsement by ExxonMobil of their results, likelihood or probability. Work on the Outlook and report was conducted during 2023 and 2024. The report contains forward looking statements, including projections, targets, expectations, estimates and assumptions of future behaviors. Actual future conditions and results (including energy demand, energy supply, the growth of energy demand and supply, the impact of new technologies, the relative mix of energy across sources, economic sectors and geographic regions, imports and exports of energy, emissions and plans to reduce emissions) could differ materially due to changes in economic conditions, the ability to scale new technologies on a cost-effective basis, unexpected technological developments, the development of new supply sources, changes in law or government policy, political events, demographic changes and migration patterns, trade patterns, the development and enforcement of global, regional or national mandates, changes in consumer preferences, and other factors discussed herein and under the heading "Factors Affecting Future Results" in the Investors section of our website at www.exxonmobil.com. The Outlook was published in August 2024. ExxonMobil assumes no duty to update these statements or materials as of any future date, and neither future distribution of this material nor the continued availability of this material in archive form on our website should be deemed to constitute an update or re-affirmation of this material as of any future date. This material is not to be used or reproduced without the permission of Exxon Mobil Corporation. All rights reserved.