6. Energy-related investments

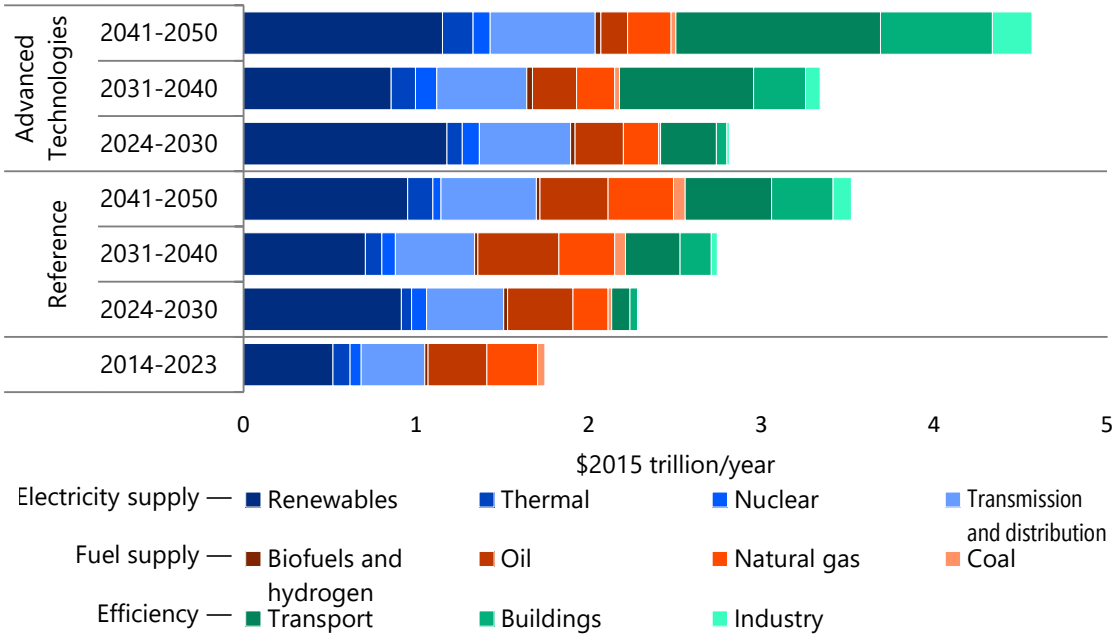
6.1 Recent trends and outlook

Most energy-related investments are made in oil production, natural gas production, and renewables. In the last decade (2014–2023, same hereafter), investments have targeted primarily electricity infrastructure such as renewables and transmission and distribution facilities, followed by facilities related to oil and natural gas production. From the 2020s (2024–2030, same hereafter), accelerated moves towards carbon neutrality will lead to significantly lower capital costs (unit prices) for renewable energy facilities, thus encouraging investments in renewables. In particular, at the 29th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP29), pledges were put forward to expand power grids and energy storage facilities in pursuit of the international goal of tripling global renewable energy capacity by 2030, with over 60 countries endorsing these commitments. Such international agreements are expected to further accelerate the expansion of renewable energy investments. Investments in energy-saving facilities will also increase to break away from dependence on fossil fuels. However, investment in fossil fuels will still need to continue to ensure stable supplies, not only in the Reference Scenario, where demand increases in Emerging and Developing Economies, but also in the Advanced Technologies Scenario.

In the Reference Scenario, energy-related investments[29] will double from an annual average of $1.8 trillion (2015 real prices, same hereafter) in the last 10 years to an annual average of $3.5 trillion in the 2040s (Figure 6-1). In the Advanced Technologies Scenario, investments in fossil fuels will be less than in the Reference Scenario. On the other hand, further investments in renewables and energy efficiency will be required, with average annual investment in the 2040s reaching $4.6 trillion, up $2.8 trillion from the last 10 years. As a result, cumulative global energy investments required by 2050 will reach $98.7 trillion.

[29] The investment amounts are estimated based on the amount of newly introduced energy technologies and capital costs in each year, while the historical investments are calculated values.

Figure 6-1 | Global energy-related investments

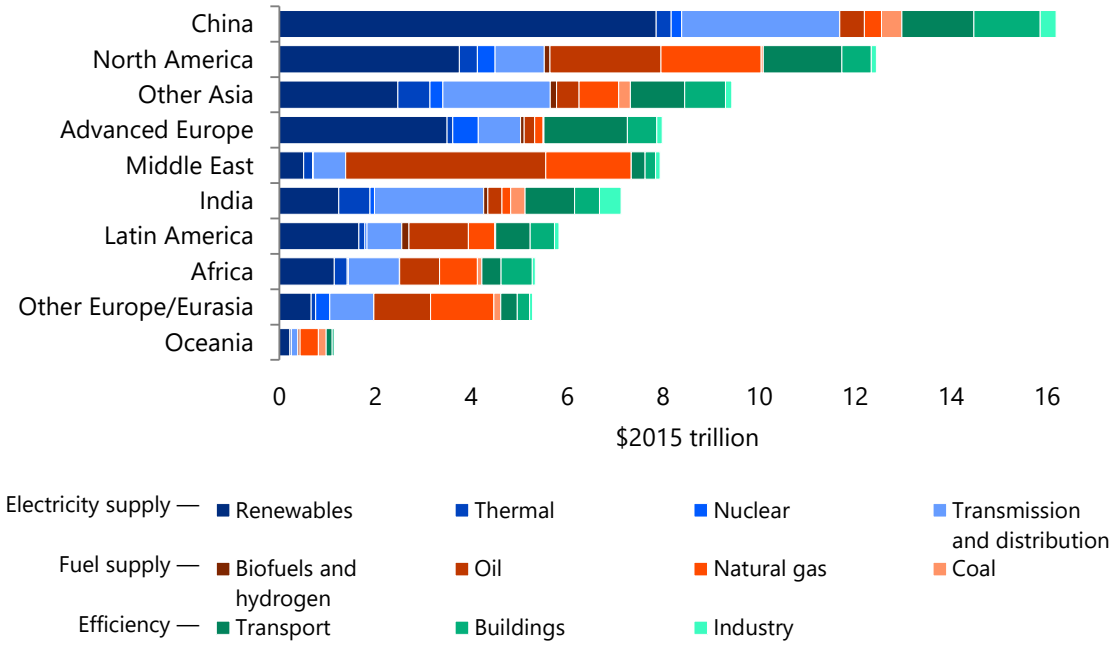


Note: Values of 2014–2023 are estimates.

The amount of energy-related investment varies by region (Figure 6-2).

In Advanced Europe, which is moving away from dependence on fossil fuels, investments in renewables and energy efficiency will account for more than 70% of total investment. On the other hand, in Oceania, which is also a fossil fuel supply region among other Advanced Economies, investments in oil and natural gas will account for about half of total investment, with renewable energy investments remaining at less than 20%. In the Middle East, another fossil fuel supply region, investments in oil and natural gas production will exceed 70%, while investments in renewables and energy efficiency will account for around 10%. In North America, investments in renewables will account for 30% of total investment, while those in the production of fossil fuels, such as the development of shale oil and gas, will account for a similar proportion. In China, investment in renewable energy facilities is accelerating, accounting for nearly half of the total, as China aims to achieve the '3060 Target', a national strategy to reach peak carbon dioxide (CO_2) emissions by 2030 and achieve carbon neutrality by 2060. In addition, China is investing heavily in power transmission and distribution, making its cumulative investment the largest of any country or region. India, a fast-growing country, will have the largest share of investment in power transmission and distribution due to the installation of new networks to meet the growing demand for electricity, while investment in energy efficiency will be under 30% and renewables will be under 20%.

Figure 6-2 | Energy-related investments [Reference Scenario, cumulative total for 2024–2050]

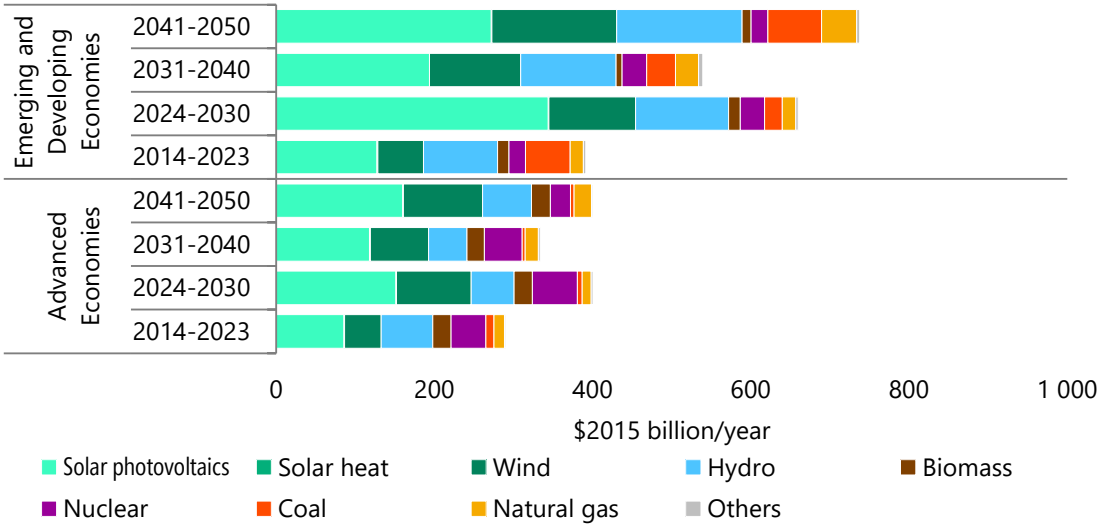


6.2 Electricity investments

Increased investment in renewable energy, especially in Emerging and Developing Economies

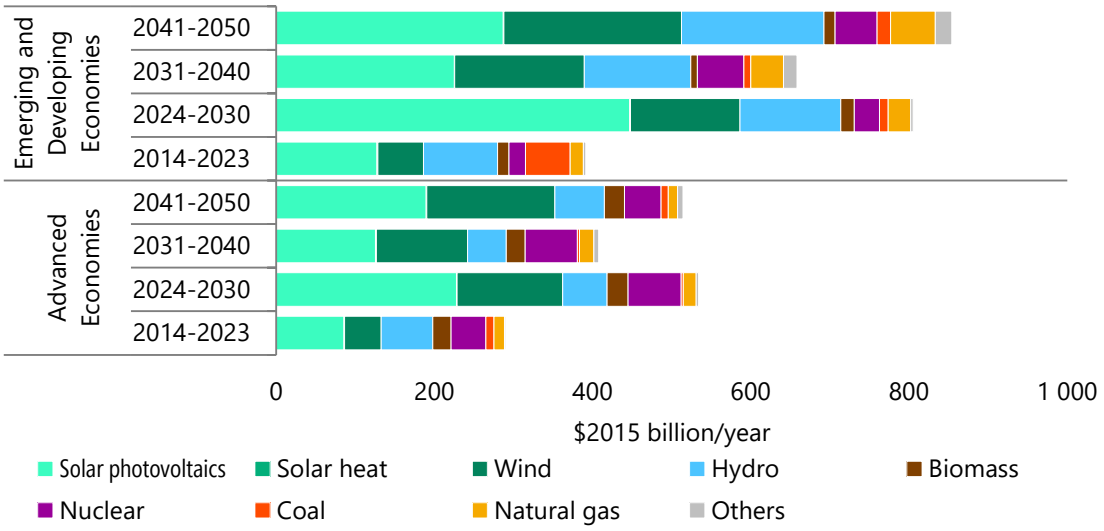
Of the investments in power generation equipment, those in renewable energy facilities account for the largest share (Figure 6-3 and Figure 6-4).

Figure 6-3 | Power generation equipment investment [Reference Scenario]



Note: Values of 2014–2023 are estimates.

Figure 6-4 | Power generation equipment investment [Advanced Technologies Scenario]



Note: Values of 2014–2023 are estimates.

In the last decade, feed-in tariffs and net metering systems contributed to active investments in renewable energy facilities in many regions. From the 2020s onwards, investments in Emerging and Developing Economies will increase significantly in both the Reference and Advanced Technologies Scenarios.

In the Reference Scenario, investments after the 2020s will be higher than in the last 10 years, both in Advanced Economies and Emerging and Developing Economies. In the 2020s, countries will continue to expand investment, particularly in renewables such as solar photovoltaics and wind, to achieve their Nationally Determined Contributions (NDCs). As a result, the average annual investment will increase significantly compared with the last 10 years, approximately 1.4 times in Advanced Economies and 1.7 times in Emerging and Developing Economies. In the 2030s, the average annual investment will decline in both Advanced Economies and Emerging and Developing Economies due to lower capital costs, such as cheaper solar panels and larger wind turbines, but will begin to increase again in the 2040s as more capacity is installed. Advanced Economies will mainly invest in solar photovoltaics, wind, and nuclear. Among fossil fuel power sources, the average annual investment in natural gas-fired power generation will continue to expand through the 2040s. Emerging and Developing Economies will continue to invest in hydro in addition to solar photovoltaics and wind. Among fossil fuel power sources, investment in coal-fired power generation will be notable, exceeding that in natural gas-fired power generation in average annual terms in the 2040s.

In the Advanced Technologies Scenario, solar photovoltaics and wind will be more actively introduced compared with the Reference Scenario. In addition, there will be a marked increase in nuclear in Advanced Economies, while nuclear and natural gas will be actively introduced in Emerging and Developing Economies. Increased investment in these areas will drive the overall increase in average annual investment under the Advanced Technologies Scenario.

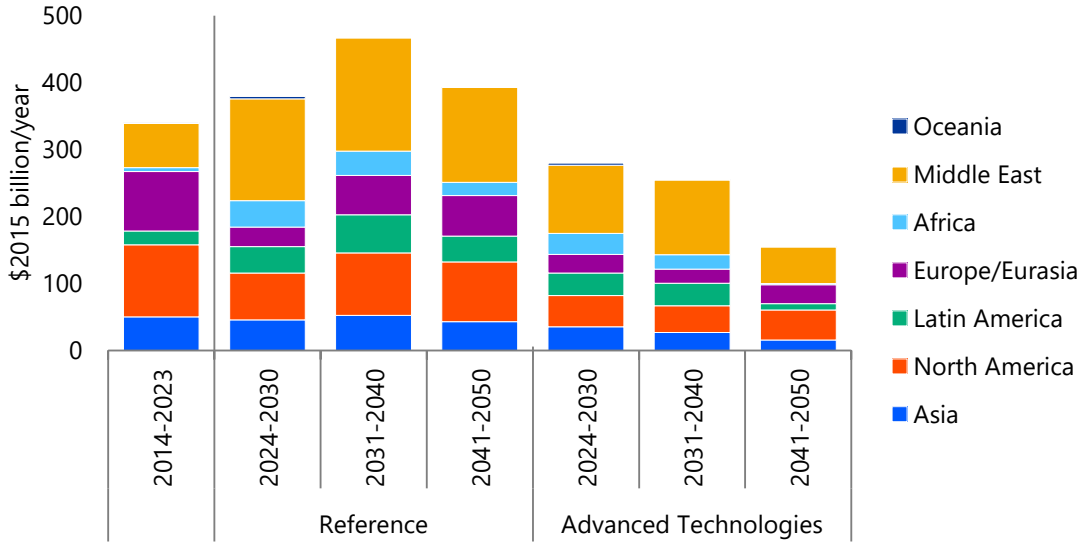
6.3 Investments in oil and natural gas

Although there are moves towards carbon neutrality and a shift from dependence on certain regions (such as Russia for fossil fuel supply), investments in oil and natural gas will not

necessarily decline, particularly as demand continues to increase in Emerging and Developing Economies.

In the Reference Scenario, average annual investment in oil will increase in the Middle East and North America due to expanding demand, reaching about 1.4 times the level of the past 10 years in the 2030s. Although declining in the 2040s, average annual investment will remain higher than in the last decade due to persistent demand, especially from Emerging and Developing Economies (Figure 6-5). In contrast, in the Advanced Technologies Scenario, progress in transportation fuel efficiency and accelerated energy substitution with biofuels and other sources will result in average annual investment from the 2020s falling below the level of the past 10 years and continuing to drop. As a result, investments in the 2040s will be about half of those in the last 10 years.

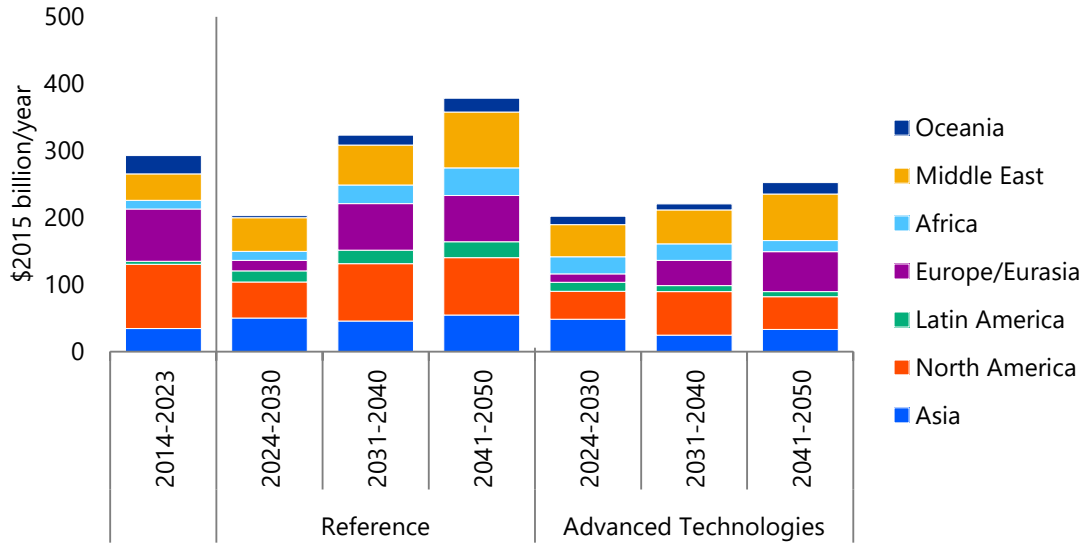
Figure 6-5 | Investment in the oil sector



Note: Values of 2014–2023 are estimates.

In the Reference Scenario, average annual investment in natural gas will continue to expand in light of growing demand, primarily in North America, the Middle East, Russia and Europe/Eurasia, and will increase by approximately 1.3 times in the 2040s compared with the most recent decade (Figure 6-6). However, in the Advanced Technologies Scenario, where renewables and nuclear increase further, from the 2020s, the average annual investment will remain lower than in the most recent decade. Even after this initial decline, a gradual increase will continue until the 2040s due to expanded demand in Emerging and Developing Economies, with investments in North America, the Middle East and Europe/Eurasia driving the increase.

Figure 6-6 | Investment in the natural gas sector

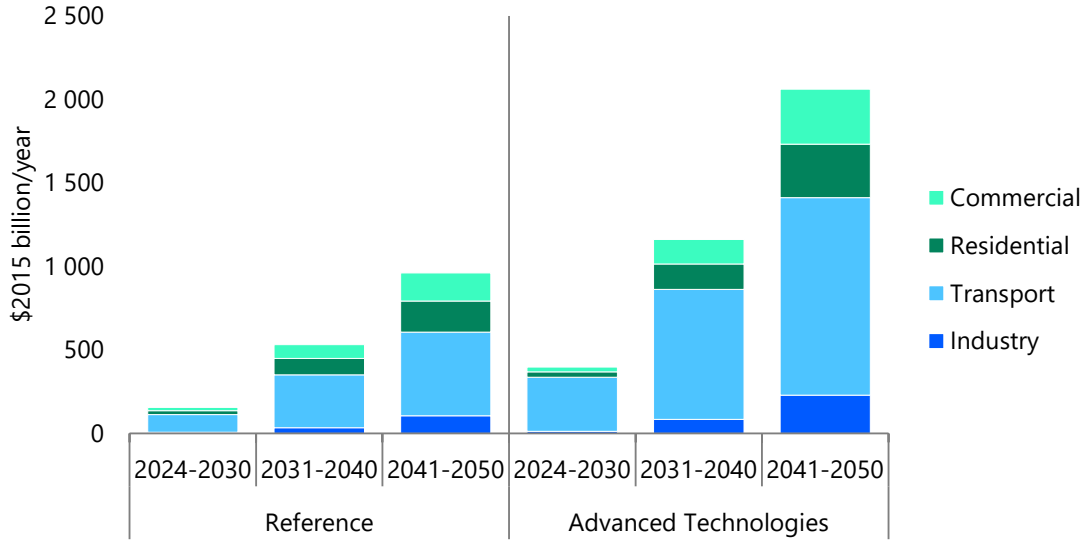


Note: Values of 2014-2023 are estimates.

6.4 Energy efficiency investments

In terms of average annual investment for introducing energy-efficient[30] equipment on the demand side, the transport sector will account for more than half, followed by the buildings sector with about 30% (Figure 6-7).

Figure 6-7 | Global energy efficiency investments



In the Reference Scenario, the transport sector will see increased average annual investment due to the shift from conventional internal combustion engine vehicles such as gasoline- and diesel-fuelled vehicles to zero-emission vehicles such as electric vehicles. In the Advanced Technologies

[30] Energy efficiency levels in 2023 are considered as the baseline.

Scenario, average annual investment will increase due to accelerated electrification driven by the expanded use of electric vehicles and the introduction of fuel cell vehicles that use hydrogen.

In the buildings sector, investments in the commercial sector will exceed those in the residential sector. Furthermore, particularly in the Advanced Technologies Scenario, the average annual investment will increase due to accelerating improvements in the efficiency of newly installed home appliances and equipment and their insulation performance, as well as the shift to electrifying space- and water-heating and cooking equipment and clean cooking solutions.