01

Introduction

1.1 Clean energy adoption is a development opportunity

The energy sector underpins economic activity. Ensuring universal access to clean, affordable and reliable energy is a critical sustainable development goal.

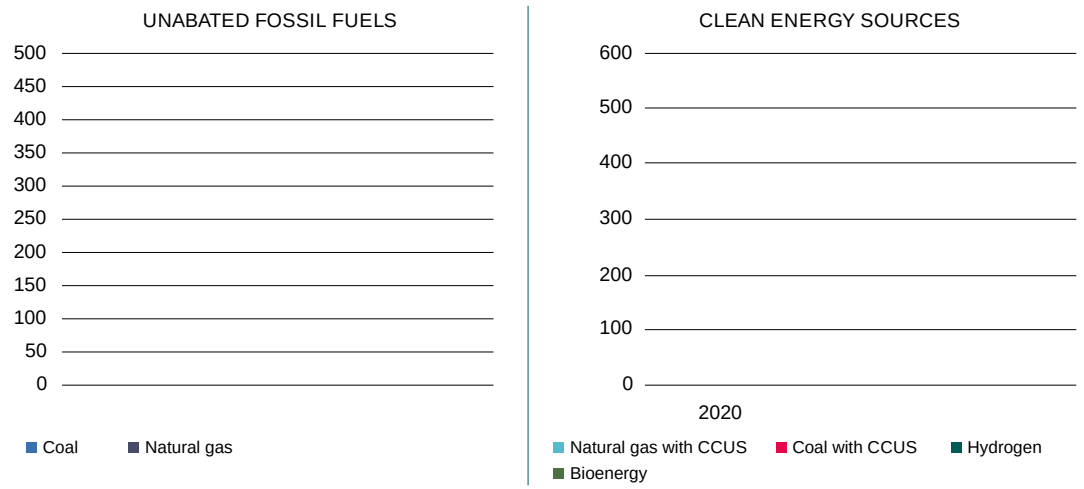
Clean energy accounted for 28 per cent of the 28,334 terawatt-hours (TWh) of electricity produced globally in 2021 (IEA, 2022a). International Energy Agency (IEA) projections indicate that clean energy could account for 90 per cent of total electricity generation by 2050 (IEA, 2023a).[1] Clean energy adoption is driven by net zero greenhouse gas (GHG) emission pledges and increasing rates of household and industrial adoption.

Enabling the clean energy transition is a signi cant global investment opportunity. In 2022, global investments worth US$ 600 billion were channelled into renewable electricity generation, a 70 per cent increase on 2017 levels. This growth is being driven by expansion of solar and wind generation capacity, which doubled over the ve-year period 2018-22 (IEA, 2023h). The IEA also estimates that investments into renewable power generation accounted for 78 per cent of all new energy generation capacity in 2022. Clean hydrogen has emerged as an area of focus over recent years, with investments into electrolysers for power generation increasing sixfold over the 2018-22 period (IEA, 2023a).

This expansion in investment is expected to result in a tangible acceleration in clean energy adoption rates. Renewable electricity adoption is expected to increase by more than 60 per cent between 2020 and 2026 (IEA, 2022e), and expected to generate 80 per cent of the global electricity supply by 2050, if net zero pledges are realized (IEA, 2023e).

Figure 1.1 provides a breakdown of supply estimates per energy source, based on the IEA's "Net Zero Emissions by 2050 Scenario".[2] It indicates that the clean energy mix is made up of diverse energy forms that include both renewable and non-renewable sources (IEA, 2021c). This scenario projects that a gradual decline in unabated fossil fuel use could be complemented by more than proportional growth in clean energy usage.

FIGURE 1.1 IEA total energy supply projections to 2050 [3]



Source: IEA (2023e).

BOX 1.1 SDG 7 – Access to affordable and clean energy

A clean energy transition is among the objectives set out in the United Nations (UN) Sustainable Development Goals (SDGs). It is framed in SDG 7, which aims to ensure "affordable and clean energy" for all. Five targets have been de ned for SDG 7, with each having important linkages to a clean energy transition:

7.1

ensure universal access to affordable, reliable and modern energy services

7.2

increase substantially the share of renewable energy in the global energy mix

7.3

double the global rate of improvement in energy ef ciency

7.3a

enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy ef ciency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

7.3b

expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing economiessustainanomiesoveme8.glmiesannve sustaestl

The energy sector accounts for approximately 60 per cent of annual global GHG (IEA, 2021b). Unsurprisingly, it has been the focus of successive United Nations Framework Convention on Climate Change (UNFCCC) Conferences of the Parties (COP) since the Paris Agreement, which was adopted in 2015. Clean energy goals have been prioritized under SDG 7, which provides ve targets with important linkages to the clean energy transition (see Box 1.1).

momentum towards a new architecture for climate nancing to achieve this goal. Additional references to the importance of a clean energy transition in this decision text can be found in Box 1.2.

Fossil fuels are expected to remain as transitional fuels in the global energy mix with limited contributions in an abated form by means of carbon capture utilization and storage (CCUS) technologies[6]. Such technologies are necessary to achieve net zero objectives, as they capture and subsequently store or utilize CO_2 emitted by fossil fuel combustion[7]. If adoption costs decline, this technology could provide breathing space for LDCs and developing economies reliant on the production and exports of fossil fuels. An appropriate technology transfer and diffusion regime is an important consideration.

Growing populations, rapid urbanization and rising living standards are driving up the demand for electricity. IEA estimates suggest that the growth in the demand for electricity among developing economies, based on the IEA's "Net Zero Emissions by 2050 Scenario", could increase by 50 per cent by 2030, and by 300 per cent by 2050 (IEA, 2021c). Many developing economies are on the cusp of a historically energy-intensive time window as their manufacturing and infrastructure expands. Taken together, these factors could stimulate the demand for energy.

BOX 1.2 Clean energy references in the 2023 COP28 decision text [8]

Article II.A.28 of the 2023 COP28 decision text recognizes the need for deep, rapid and sustained reductions in GHG emissions in line with 1.5°C pathways and calls on parties to contribute to the following global efforts, in a nationally determined manner, taking into account the Paris Agreement and their different national circumstances, pathways and approaches:

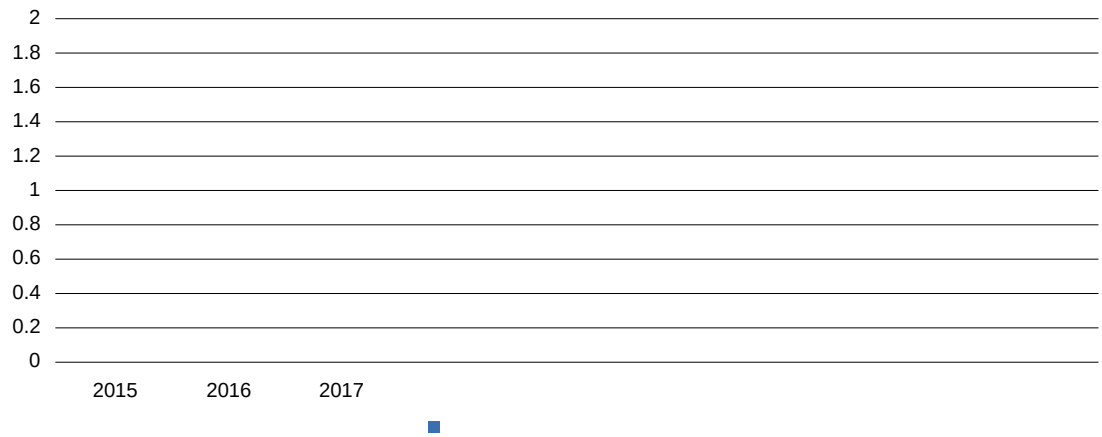
1.2 Clean energy technologies are increasingly cost-competitive

In 2021, the global installation costs of solar photovoltaic (PV) and hydropower were 11 per cent lower than those of the cheapest new fossil-fuel- red power generation option, while the global installation costs of onshore wind power were 39 per cent lower for the same amount of energy generated (IRENA, 2022a). Renewables and other clean energy sources are positioning themselves as the cheapest sources of electricity generation for green eld investments, (i.e., when a parent company builds a new venture in another country from the ground up).

The falling costs of clean energy relative to fossil fuels are indicative of an imminent in ection point for the energy transition. This refers to when clean energy adoption reaches a critical mass, so that clean energy deployment is driven by market decisions rather than the regulatory investments of the transition to clean energy. Annual investments into global fossil fuel production have witnessed a gradual decline over the past decade as clean energy, especially renewables, has become more cost-competitive. Figure 1.2, prepared using data compiled by the IEA, illustrates the gradual shift towards clean energy investments. In 2015, each dollar spent on clean energy investment was offset by a US$ 1.2 investment into brown energy (i.e., energy from polluting sources) generation. This trend had reversed by 2022, with each dollar spent on brown investment matched by a US$ 1.6 investment in clean energy capacity. In other words, clean energy investment is outpacing the pace of brown energy investment.

Accelerating investments into clean energy presents an opportunity for developing economies and LDCs, for instance, by helping these economies reduce their reliance on fossil fuel imports. Four out of ve people live in economies that import fossil fuels (UN, 2020). Nearly 90 per cent of the energy requirements in the Paci c islands are currently satis ed through oil and coal imports. A clean energy transition – particularly in the context of renewables such as wind and solar energy – could have long-term cost bene ts, as the installation

FIGURE 1.2 Investments into clean energy a[redacted]il fuels 2015-23



Source: IEA (2023a).

BOX 1.3 The Fossil Fuel Subsidy Reform Initiative (FFSR)

Forty-eight WTO members are co-sponsoring joint action at the WTO with the aim of achieving effective WTO disciplines on fossil fuel subsidies.

of capital equipment is an infrequent expense requiring less recurrent expenditure. In this context, a clean energy transition could help to lessen current account pressures and improve scal sustainability by reducing the need for fuel subsidies.

The war in Ukraine has sharpened policy attention to the role of clean energy technologies in addressing energy security issues. Installed clean energy capacity has absorbed some of the shock from the turbulence in fossil fuel energy markets. As reported by the International Renewable Energy Agency (IRENA), renewable capacity added in 2021 helped economies to save US$ 55 billion in 2022 by reducing the need for fossil fuel imports. In Europe between January and May 2022, as a result of solar PV and wind generation, it was possible to forego US$ 50 billion in fossil fuel imports, predominantly gas. IRENA estimates that in

1.3 Developing economies and LDCs are key stakeholders in a clean energy transition

Many developing economies and LDCs have a potential "latecomer" energy advantage in the adoption of clean energy infrastructure. For instance, Africa's grid infrastructure remains insuf cient to sustain reliable and affordable power supply. In 2017, the length of transmission lines in the entire continent was 247 km per million people (Lerner et al., 2017). This collective gure was well below that of other developing regions. Extending this infrastructure now offers signi cant potential to integrate transmission systems that can align with clean energy needs, and that can stimulate backward industrial and services linkages.

Several economies have rapidly expanded their domestic renewable capacity over recent decades. China stands as a prominent example. Over the past 10 years, Chinese renewable energy capacity has increased by around 90 times, and by 2025, China expects its renewable energy generation capacity, driven by wind and solar power output, to account for more than 50 per cent of total generation capacity (Zheng, 2022).

Morocco is an example of an economy with accelerated renewable energy adoption. Renewables contribute to almost 40 per cent of Morocco's installed energy capacity, and they are targeted to exceed 50 per cent by 2030. Morocco's Noor Ouarzazate Solar Complex is the largest concentrated solar power plant in the world, spread over 3,000 hectares of desert and with an overall capacity of 580 megawatts (MW) of power. The economy has also developed more than a dozen large-scale windfarms, as well as providing incentives for businesses and residences to invest in their own solar panels to save on energy costs (Papathanasiou, 2022).

Latin America and the Caribbean have made remarkable progress in renewable energy adoption. According to data from the Latin American Energy Organization (Organización Latinoamericana de Energía – OLADE), more than a half (59 per cent) of electricity generation now comes from renewable sources. The ambition is to reach 70 per cent by 2030 (OLADE, 2023).

BOX 1.4 The Noor Ouarzazate Solar Complex Project [9]

The NOOR Ouarzazate Solar Complex Project, with a capacity of approximately 580 MW, represents a pivotal milestone in Morocco's National Energy Strategy (2010-2030). This initiative is part of the broader NOOR Program and aims to develop integrated solar energy projects with a cumulative capacity of at least 2,000 MW by 2030. The Ouarzazate solar power station (OSPS) stands as the agship endeavour within Morocco's new energy strategy, striving to elevate the proportion of renewable energy sources to 52 per cent by 2030.

Supported by international partners, Morocco is progressing toward energy independence and sustainable development, reversing its previous reliance on imported fossil fuels for up to 95 per cent of its electricity. The objectives of constructing the Ouarzazate solar power station include diminishing Morocco's energy dependence, mitigating the adverse scal and trade balance effects of imported fossil fuels, increasing electricity production through harnessing sunlight ef ciently, fostering the growth of a national solar energy industry, and reducing long-term GHG emissions.

The project's bene ciaries encompass Moroccan communities, businesses and various sectors such as industry, transportation and agriculture. These stakeholders stand to gain not only from an improved electricity supply but also from the cleaner and more sustainable nature of power generation. At the local level, the Ouarzazate province, with an estimated population of 583,000 and a poverty rate of around 23 per cent, anticipates socio-economic advantages from the project.

the use of clean energy sources (such as wind, solar and hydropower) in their NDCs. For example, various economies have set targets for increasing the share of

BOX 1.5 Examples of clean energy targets in developing-economy NDCs [13]

BANGLADESH

Increase the share of renewable energy in power generation to

10% by 2021 and to
15% by 2025

BRAZIL

Increase the share of renewable sources in its energy mix to

45% by 2030

ETHIOPIA

Achieve
100%
access to electricity from renewable energy sources
by 2025

INDIA

Achieve
40%
cumulativeelectric power capacity from non-fossil-fuel-based energy resources

by 2030

1.4 The clean energy transition is a trade integration opportunity

The demand for products and activities associated with clean energy is picking up pace. OECD research reveals that over the period 2017-19, the trade of critical raw materials used in clean energy products expanded more quickly – at an average growth rate of 38 per cent – than trade in all merchandise products, which had an average growth rate of 31 per cent (Przemyslaw and Legendre, 2023). IEA projections (under the Announced Pledges Scenario) indicates that the global market for manufactured clean energy technologies will be worth around US$ 650 billion a year by 2050, which is triple the value of current market estimates (IEA, 2023b).[14] Clean energy adoption would also boost the need for ancillary services, such as maintenance, operations and management, thus creating additional job and value generation possibilities.

Developing economies and LDCs can leverage the clean energy transition to achieve trade growth and export diversi cation. Key to meeting this target is integrating into value chains catering to the mineral, manufacturing and service inputs required for clean energy generation. Aid for Trade can play an important role in this process. Subsequent chapters of this report will further explore how Aid for Trade can help in achieving this integration.

Endnotes

1. Projections are based on the IEA's "Net Zero Emissions by 2050 Scenario" (https://www.iea.org/reports/global-energy-and-climate-model/net-zero-emissions-by-2050-scenario-nze). The scenario is designed to show what is needed across the main sectors by various actors for the world to achieve net zero energy-related CO_2 emissions.
2. See https://www.iea.org/reports/global-energy-and-climate-model/net-zero-emissions-by-2050-scenario-nze.
3. Projections are per the IEA's "Net Zero Emissions by 2050 Scenario".
4. See https://www.un.org/sustainabledevelopment/energy/.
5. See https://unfccc.int/sites/default/ les/resource/cma2023_L17_adv.pdf.
6. According to the OECD, abatement refers to technology applied, or measures taken, to reduce pollution and/or its impacts on the environment.
7. https://www.iea.org/fuels-and-technologies/carbon-capture-utilisation-and-storage.
8. See https://unfccc.int/sites/default/ les/resource/cma2023_L17_adv.pdf
9. See https://www.afdb.org/en/documents/morocco-noor-ouarzazate-solar-complex-project-phase-iii-noor-ouarzazate-iii-power-plant-project-completion-report.
10. The term "energy poverty" is de ned by the G20 as occurring "when households or territorial units cannot ful l all of their domestic energy needs as a result of lack of access to energy services, an inability to afford them, or their poor quality of unreliability in order to, at minimum, safeguard their health and provide for opportunities to enhance their well-being".
11. See https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs.
12. See the United Nations Environment Programme (UNEP) NDC Registry at https://unfccc.int/NDCREG.
13. See https://unfccc.int/NDCREG.
14. The Announced Pledges Scenario (APS) projections by the IEA illustrates the extent to which announce ambitions and targets can deliver the emissions reductions needed to achieve net zero emissions by 2050.