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International Renewable Energy Agency

GLOBAL LANDSCAPE OF RENEWABLE ENERGY FINANCE

2023

EXECUTIVE SUMMARY

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About IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security, and low-carbon economic growth and prosperity.

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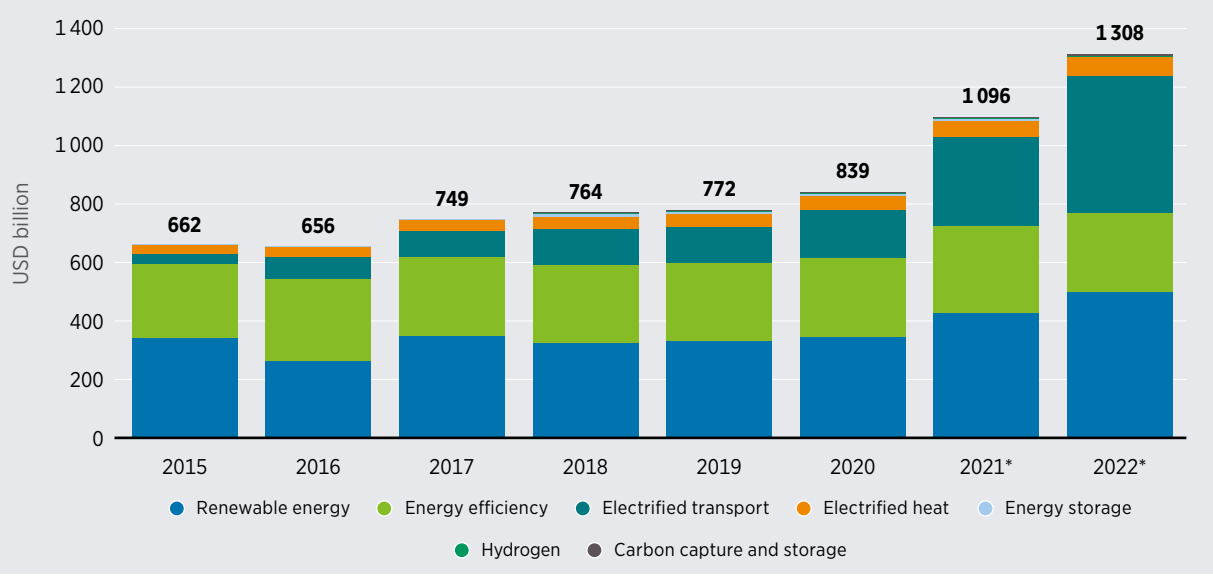
EXECUTIVE SUMMARY

Global investments in energy transition technologies reached USD 1.3 trillion in 2022, a record high. Yet, the current pace of investment is not sufficient to put the world on track towards meeting climate or socio-economic development goals.

In 2022, global investments in energy transition technologies – renewable energy, energy efficiency, electrified transport and heat, energy storage, hydrogen and carbon capture and storage (CCS) – reached USD 1.3 trillion despite the prevailing macroeconomic, geopolitical and supply chain challenges. Global investments were up 19% from 2021 levels, and almost 70% from 2019, before the COVID-19 pandemic (Figure S.1). This trend demonstrates a growing recognition of the climate crisis and energy security risks associated with over-reliance on fossil fuels.

Yet, the current pace of investment is not sufficient; annual investments need to at least quadruple. Keeping the world on track to achieving the energy transition in line with the 1.5°C Scenario laid out in IRENA's *World energy transitions outlook 2023* will require annual investments of more than USD 5 trillion on average between 2023 and 2030 (IRENA, 2023a).

Figure S.1 Annual global investment in renewable energy, energy efficiency and other transition-related technologies, 2015-2022



Notes: Renewable energy investments for 2021 and 2022 represent preliminary estimates based on data from Bloomberg New Energy Finance (BNEF). As BNEF has limited coverage of large hydropower investments, these were estimated at USD 7 billion per year, the annual average investment in 2019 and 2020. Energy efficiency data are from IEA (2022a). These values are in constant 2019 dollars, while all other values are at current prices and exchange rates. Due to the lack of more granular data, the units could not be harmonised across the databases. For this reason, these numbers are presented together for indicative purposes only and should not be used to make comparisons between data sources. Data for other energy transition technologies come from BNEF (2023a).

Based on: IEA (2022a) and BNEF (2023a).

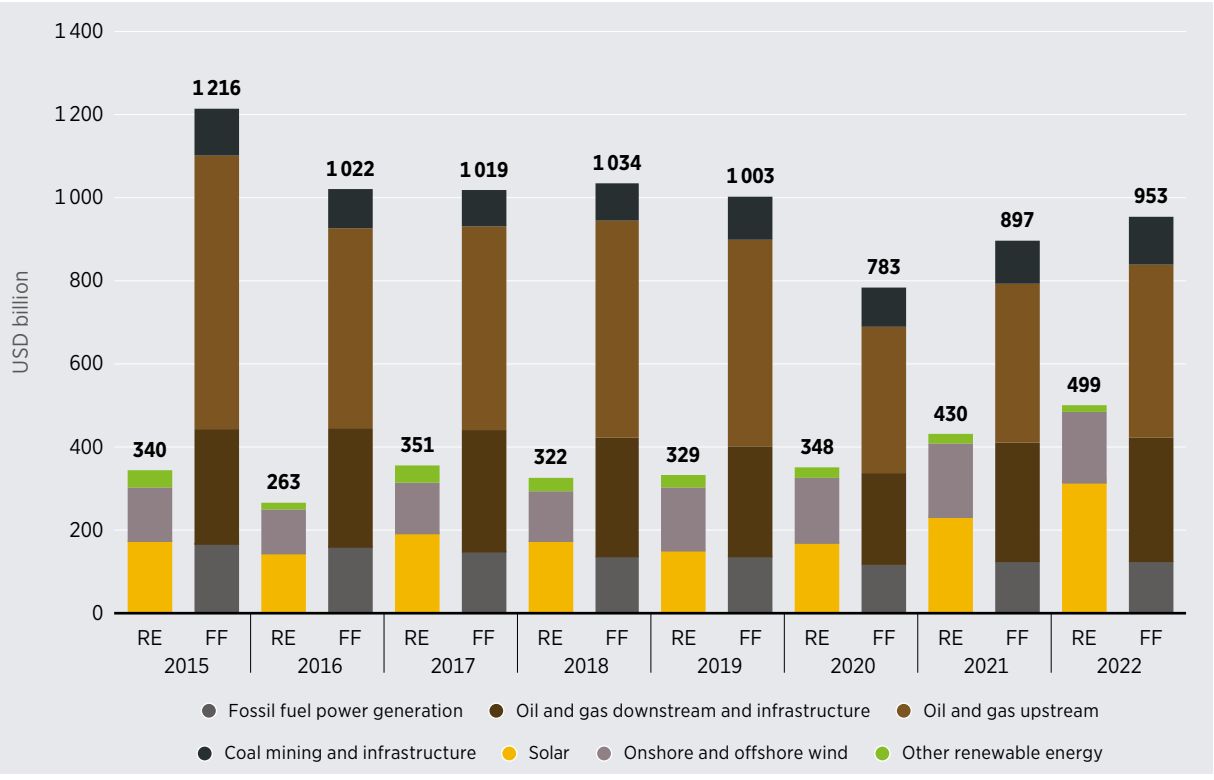
Achieving an energy transition in line with the 1.5°C Scenario requires the redirection of USD 1 trillion per year from fossil fuels to energy-transition-related technologies; but fossil fuel investments are still on the rise.

Fossil fuel investments had declined in 2020 (down 22% from the USD 1 trillion invested in 2019) mainly due to the impacts of the COVID-19 pandemic on global energy markets (IEA, 2022c). Nevertheless, 2021 saw fossil fuel investments bounce back up 15% to USD 897 billion (Figure S.2), and preliminary data for 2022 suggest they might have almost returned to their pre-pandemic levels (+6%), reaching USD 953 billion (IEA, 2022c).

Investment in energy is still going into funding new oil and gas fields instead of renewables and it is estimated that USD 570 billion will be spent on new oil and gas development and exploration every year until 2030 (IISD, 2022).

Investors and banks have already committed to financing fossil fuel development over and above the limit needed to meet the 1.5°C target. Over the six years following the Paris Climate Agreement, some large multi-national banks maintained and even increased their investments in fossil fuels at an average of about USD 750 billion dollars per year (Environmental Finance, 2022a). The world's 60 largest commercial banks invested around USD 4.6 trillion in fossil fuels between 2015 and 2021, more than one-quarter of which came from US banks (Environmental Finance, 2022a).

Figure S.2 Annual investment in renewable energy vs. fossil fuels, 2015-2022

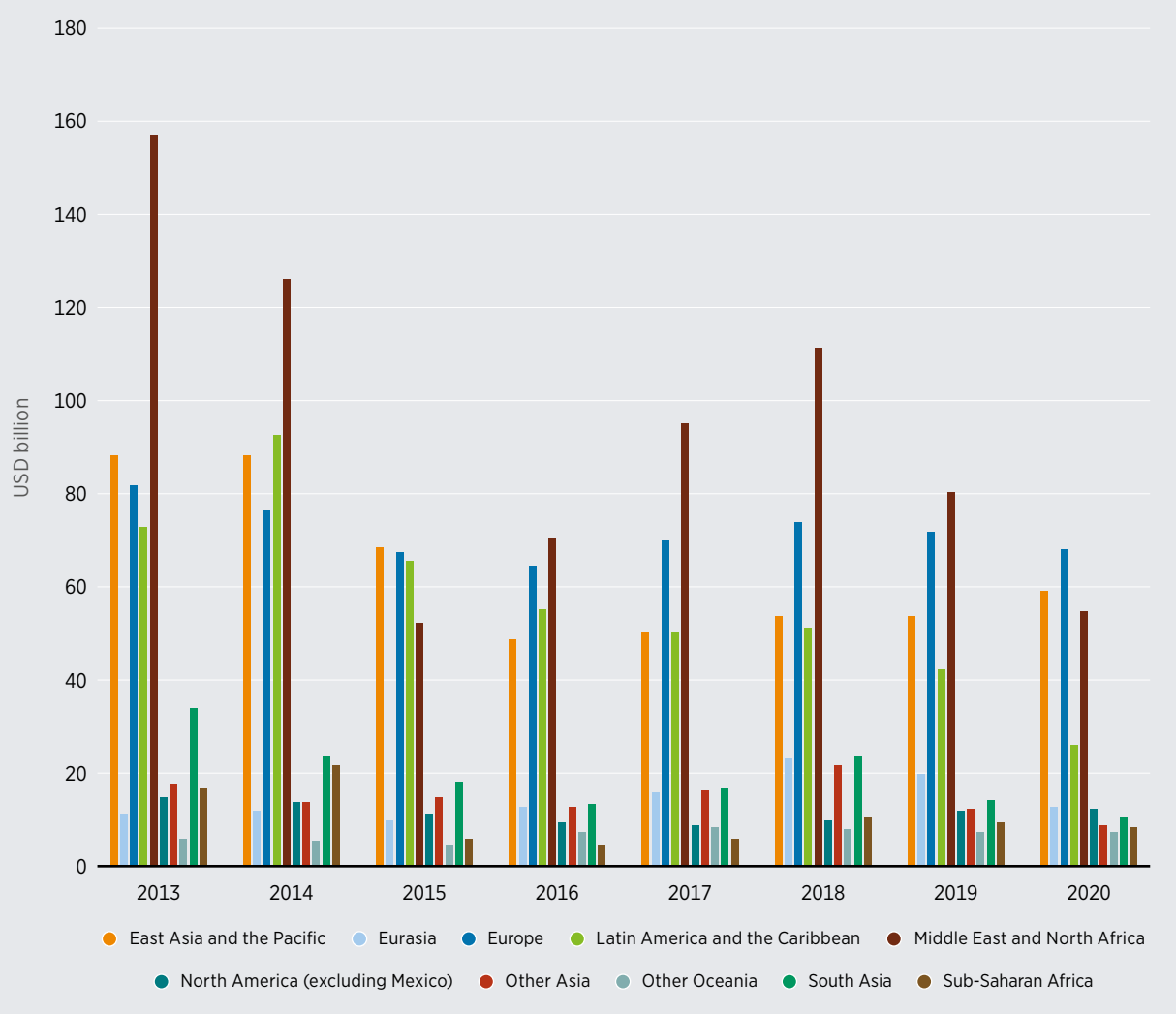


Note: FF = fossil fuel; RE = renewable energy.
Based on: CPI (2022a) and IEA (2022b).

Fossil fuel companies based in emerging markets and developing economies have continued to attract substantial volumes of financing. Between 2016 and 2022, their outstanding debt rose by 400% for coal and 225% for oil and gas, despite the need to align investments with the goals outlined in the Paris Agreement (IMF, 2022a). In Africa, capital expenditures for oil and gas exploration rose from USD 3.4 billion in 2020 to USD 5.1 billion in 2022. African companies accounted for less than one-third of this sum.

In addition to direct investments in assets, the fossil fuel industry continues to receive considerable support through subsidies. Between 2013 and 2020, USD 2.9 trillion was spent globally on fossil fuel subsidies (Fossil Fuels Subsidy Tracker, 2022). In 2020, Europe was the region providing the most subsidies, having overtaken the Middle East and North Africa (MENA) (Figure S.3). On a per capita basis, fossil fuel subsidies in Europe totalled USD 113 per person, more than triple those in MENA (USD 36 per person). However, fossil fuel subsidies in MENA make up 1.56% of the gross domestic product (GDP) while in Europe, they constitute only 0.3% of GDP.

Figure S.3 Annual fossil fuel subsidies by region, 2013-2020



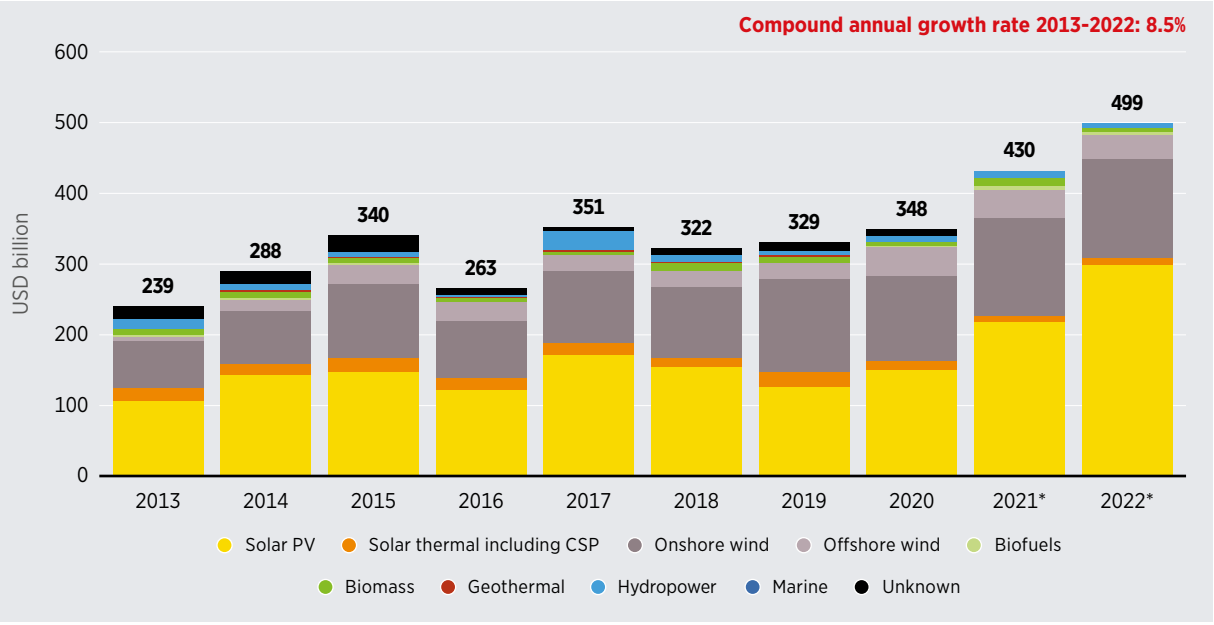
Source: Fossil Fuels Subsidy Tracker (2022).

Subsidies doubled in 2021 across 51 countries, from USD 362 billion in 2020 to USD 697 billion, with consumption subsidies expected to have risen even further in 2022 due to contemporaneous price pressures (OECD and IEA, 2022). The phasing out of investments in fossil fuel assets should be coupled with the elimination of subsidies to ensure that the full costs of fossil fuels are reflected in their price and to level the playing field with renewables and other energy-transition-related technologies. However, the phaseout of subsidies needs to be accompanied by a proper safety net to ensure adequate standards of living for vulnerable populations (IRENA, 2022a).

Investments in renewable energy continue to grow, but not at the pace needed to achieve climate, energy access and energy security objectives along with other socio-economic development goals by 2030.

Despite multiple economic, social and geopolitical challenges, annual investments in renewable energy continued a positive trend that began after 2018 (see Figure S.4). Preliminary data suggest that in 2021, investments reached USD 430 billion (24% up from 2020) and in 2022 they further increased by 16% reaching almost USD 0.5 trillion (BNEF, 2023b).[1] Yet, investment in 2022 was less than one-third of the average investment needed each year between 2023 and 2030 (about USD 1.6 trillion in renewable power and the direct use of renewables) according to IRENA's 1.5°C Scenario (IRENA, 2023a).

Figure S.4 Annual financial commitments in renewable energy, by technology, 2013-2022



Note: CAGR = compound annual growth rate; CSP = concentrated solar power; PV = photovoltaic.

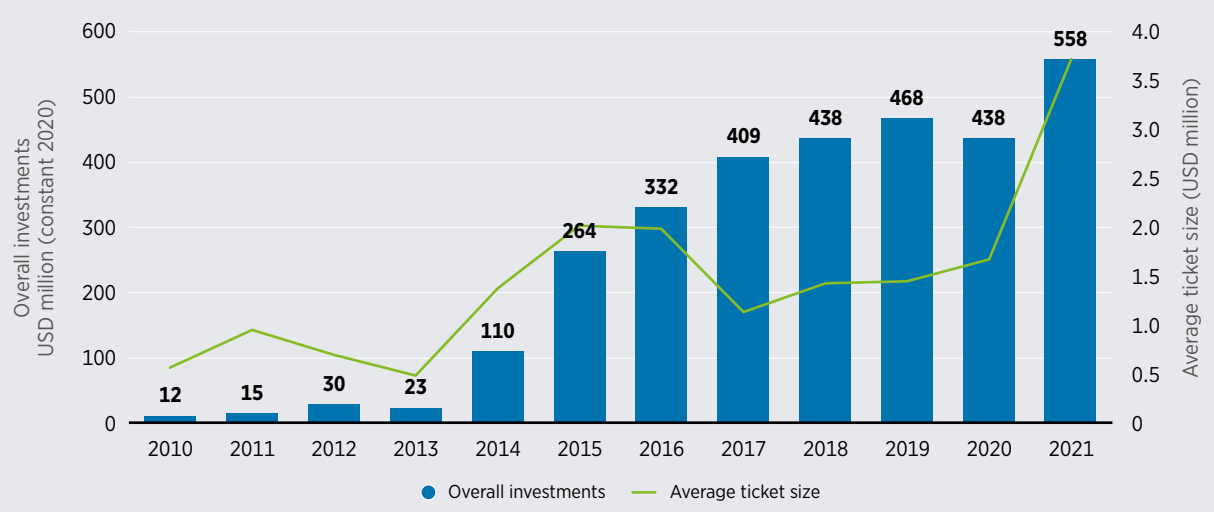
Source: CPI (2022a). Investments for 2021 and 2022 are preliminary estimates based on data from BNEF (2023b). As BNEF data has limited coverage of large hydropower investments, these were assumed to be USD 7 billion per year, equivalent to the annual average investment for the preceding two years.

[1] *These figures represent "primary" financial transactions in both large- and small-scale projects that directly contribute to deployment of renewable energy, and therefore exclude secondary transactions, e.g. refinancing of existing debts or public trading in financial markets. Note that this is different from investments discussed in Chapter 3 for the off-grid renewable energy sector which relates to corporate-level transactions (both primary and secondary) and is therefore different from investments discussed in Chapter 2 (although some overlap is possible). For more details, please see the methodology document (Appendix). As previously noted, 2021 and 2022 investment numbers in Chapters 1 and 2 are preliminary estimates based on BNEF (2023b).*

Investments are also not flowing at the pace or scale needed to achieve the improvements in livelihoods and welfare envisioned in the 2030 Agenda for Sustainable Development. Despite progress in energy access, approximately 733 million people had no access to electricity and nearly 2.4 billion people relied on traditional fuels and technologies for cooking at the end of 2020 (IEA, IRENA, *et al.* 2022). Between 2010 and 2021, the off-grid renewables sector attracted more than USD 3 billion (Wood Mackenzie, 2022a). Investments in off-grid solutions reached USD 558 million in 2021, a 27% increase from 2020 (Figure S.5). But this amount is far short of the USD 2.3 billion needed annually in off-grid solar products alone (not including mini-grids) between 2021 and 2030 to accelerate progress towards universal energy access (ESMAP *et al.* 2022a).[2]

Although on the rise, off-grid investments are concentrated among seven large incumbent companies that have already reached scale and are looking to further solidify their market position through their ability to attract capital. The average transaction size climbed from USD 1.1 million in 2017 to 1.7 million by 2020, before more than doubling to USD 3.7 million in 2021 (Figure S.5). While a trend of growing ticket size is a sign of sector growth and maturity, it may also indicate existing challenges for enterprises looking for smaller investments.

Figure S.5 Annual investment in off-grid renewable energy and average transaction size, 2010-2021



Based on: Wood Mackenzie (2022a).

Investments have become further concentrated in specific technologies and uses. To best support the energy transition, more funds need to flow to less mature technologies and to sectors beyond power.

While annual renewable energy investments have been growing over time, these have been concentrated in the power sector. Between 2013 and 2020, power generation assets attracted, on average, 90% of renewable investments each year, and up to 97% in 2021 and 2022.

[2] *This will be needed on both the supply side for off-grid renewable energy companies and demand side (mainly in the form of public funding) to enhance affordability for consumers.*

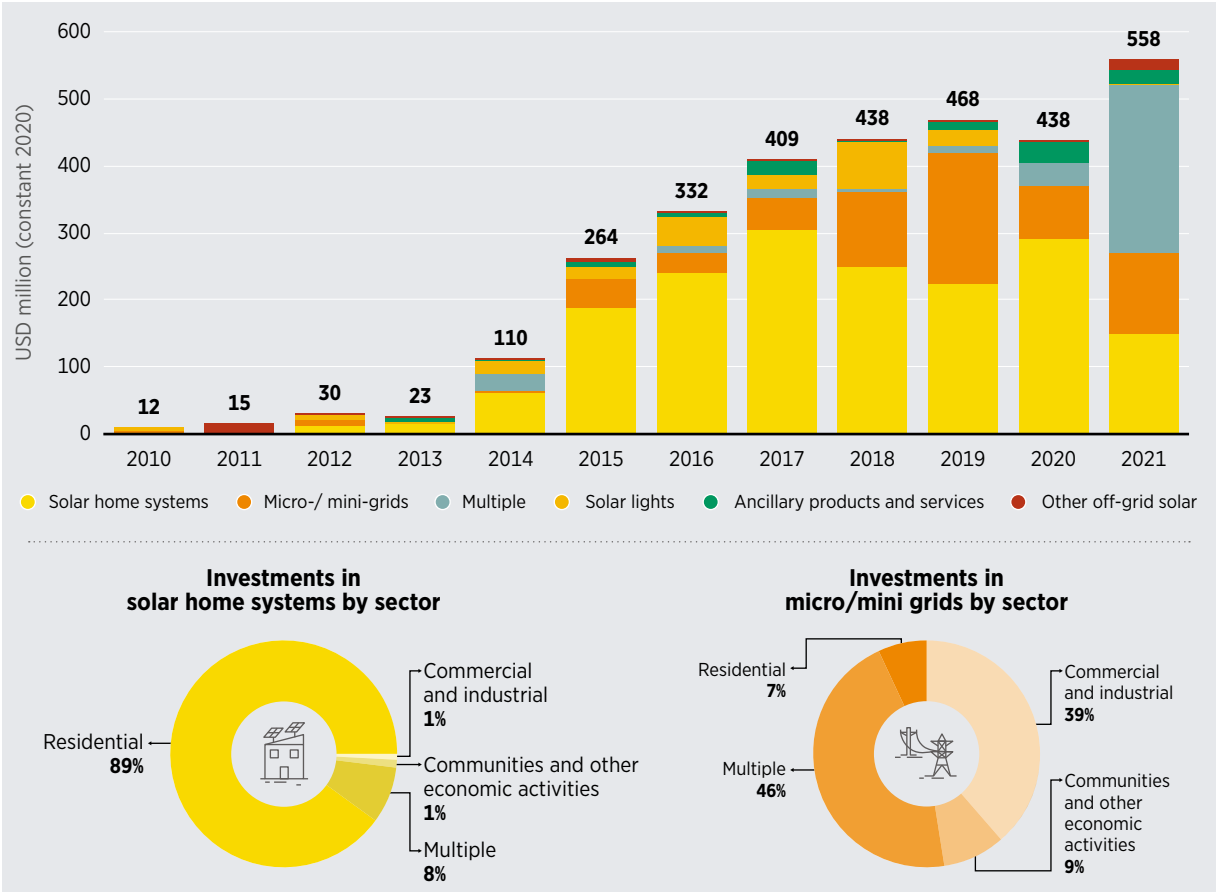
Solar and wind technologies consistently attract the largest share of investment by a wide margin. In 2020, solar photovoltaic (PV) alone attracted 43% of the total, followed by onshore and offshore wind (at 35% and 12%, respectively).

Investments in end uses, *i.e.* direct applications, which include heat generation (*e.g.* solar water heaters, geothermal heat pumps, biomass boilers) and transport (*e.g.* biofuels) are lagging; they will need to increase from USD 13 billion in 2022 to an average USD 269 billion each year between now and 2030 (IRENA, 2023a).

In the off-grid space, solar PV products also dominate, attracting 92% of overall investments in 2010-2021, owing chiefly to their modular and distributed characteristics, and their adaptability to a wide variety of applications. Solar home systems (SHSs) are the most funded technology (Figure S.6).

Even though the majority of off-grid investments went to residential applications between 2010 and 2021, the share going to commercial and industrial (C&I) applications has been expanding over time (from 8% in 2015 to 32% in 2021) as consumer needs grow beyond basic household access to more energy-intensive uses in local industry and agriculture. Powering C&I applications can promote local economies by creating jobs and spurring economic growth, while also enhancing food security and resilience against the impacts of climate variability on agri-food chains (IRENA, 2016b).

Figure S.6 Annual investment in off-grid renewable energy, by off-grid product, and energy use, 2010-2021



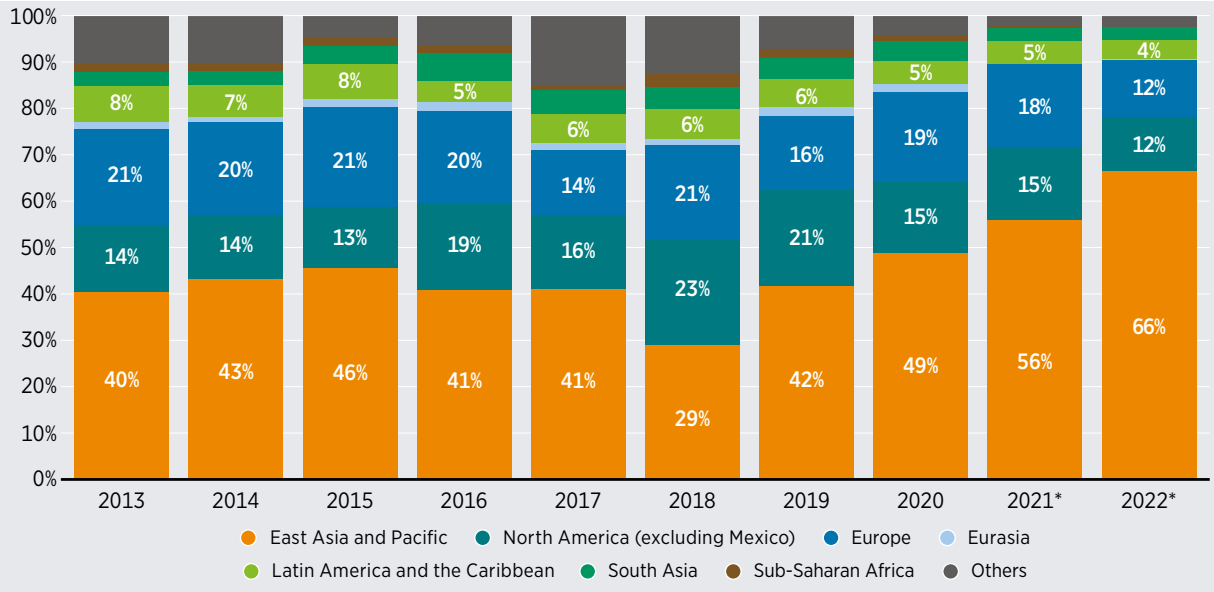
Based on: Wood Mackenzie (2022a).

Investments are increasingly focused in a number of regions and countries. They need to be more universal for a more inclusive energy transition.

Although renewable energy investments are on the rise globally, they continue to be focused in a number of countries and regions. The East Asia and Pacific region continues to attract the majority of investment – two-thirds of the global total in 2022 (Figure S.7) – primarily led by China. A suite of policies including tax exemptions have driven investments in solar and wind in China, putting the country on track to meeting the targets set out in the 14th Five-Year Plan (Carbon Brief, 2021). Viet Nam saw investment in solar PV grow by an average of 219% per year between 2013 and 2020, driven mainly by feed-in tariffs (Lorimer, 2021). North America excluding Mexico attracted the second-largest share of investment in 2022, mainly driven by the production tax credit in the United States, followed by Europe, where net-zero commitments and extensive policies to phase out fossil fuels are driving growth in renewables.

In the United States, the 2022 Inflation Reduction Act – encompassing new tax credits, USD 30 billion in grants and loans for clean energy generation and storage, and USD 60 billion in support of manufacturing of low-carbon components – is expected to attract USD 114 billion investment by 2031. In Europe, the European Commission presented a *Green Deal Industrial Plan for the Net-Zero Age*, which would provide investment aid and tax breaks towards technological development, manufacturing, production and installation of net-zero products in green sectors including renewables and hydrogen (Bloomberg, 2023; European Commission, 2023). The plan looks to mobilise EUR 225 billion in loans from its existing Recovery and Resilience Facility, and an additional EUR 20 billion in grants (European Commission, 2023).

Figure S.7 Investment in renewable energy by region of destination, 2013-2022



Note: "North America (excluding Mexico)" includes Bermuda, Canada and the United States. "Others" include the Middle East and North Africa, Other Oceania, Transregional, Other Asia and Unknown. For more details on the geographic classification used in the analysis, please see methodology document (Appendix).

Source: CPI (2022a).

Regions home to about 120 developing and emerging markets continue to receive comparatively low investment. Across these regions, the bulk of renewable energy investments is captured by a handful of countries: Brazil, Chile and India. In other words, more than 50% of the world's population, mostly residing in developing and emerging countries, received only 15% of global investments in renewables in 2022. Further, the share of renewable energy investments going to these regions has been progressively declining year on year (*e.g.* from 27% in 2017 to 15% in 2022). In absolute terms, annual investments have been declining precipitously since 2018 at an average rate of 36%. Countries defined as "least developed" by the Intergovernmental Panel on Climate Change attracted only 0.84% of renewable energy investments on average between 2013 and 2020.

Looking at investments on a per capita basis further reveals the disparity in investments. In East Asia and Pacific, investment per capita increased by 51% between 2015 and 2021 from USD 70/person in 2015 to USD 105/person in 2021. The bulk of the increase took place in China, while Japan experienced a 45% decline over the same period. Excluding these two countries, the region experienced a more than 6-fold increase led by countries such as Viet Nam and Republic of Korea. In South Asia, investments per capita declined by 6% between 2015 and 2021, however the true extent of the decline is masked by India which saw investment per capita grow by 34% in the same period. Excluding India, investment per capita declined by 61% from USD 12/person in 2015 to USD 5/person in 2021. The most striking – and rapidly growing – disparity is between Sub-Saharan Africa and both North America (excluding Mexico) and Europe. In 2015, renewable energy investment per capita in North America (excluding Mexico) or Europe was almost 23 times higher than that of Sub-Saharan Africa. In 2021, investment per capita in Europe was 41 times that in Sub-Saharan Africa (which in 2021 fell to just USD 3/person from USD 6/person in 2015), and North America was 57 times more.

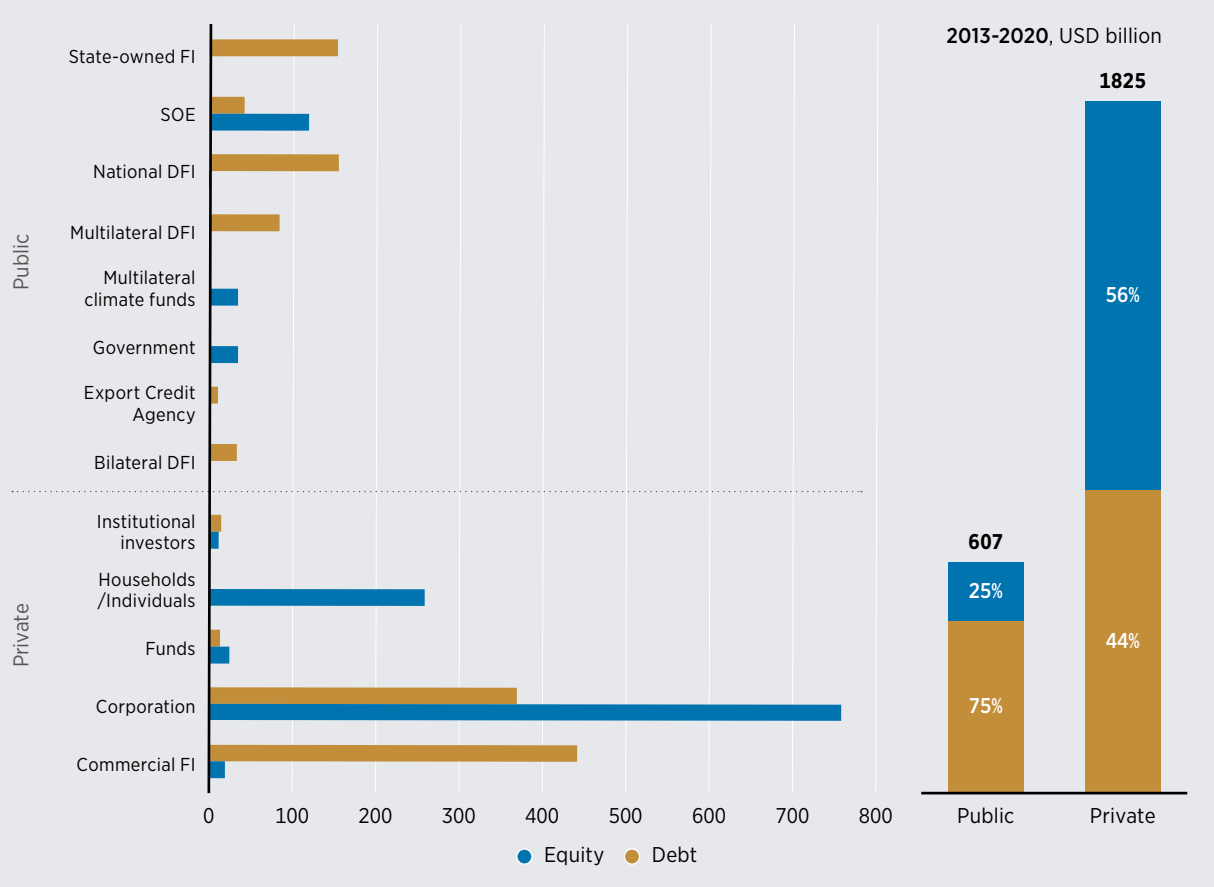
Sub-Saharan Africa remains the primary destination for investment in off-grid renewables. The region attracted USD 2.2 billion in 2010-2021 – more than 70% of global off-grid investments. Electrification rates in this region are among the lowest in the world, with 568 million people lacking access to electricity in 2020 (IEA, IRENA *et al.* 2022). Within Sub-Saharan Africa, East Africa – home to three of the top five recipient countries of off-grid investment (Kenya, the United Republic of Tanzania and Rwanda) - attracted 43% of the total. Investment in these destinations benefited from the existing mobile money ecosystem, which was leveraged by the pay-as-you-go (PAYG) business model. Approximately 78% of the total commitments in off-grid renewables in 2010-2021 (or USD 2.4 billion) involved the funding of companies or projects using PAYG, with East Africa accounting for USD 917 million.

During the COVID-19 pandemic, off-grid renewable energy investments in Southeast Asia declined by 98%, leaving key off-grid markets even more vulnerable. Although the majority of countries in the region have achieved high or near-universal rates of electricity access, parts of the populations in countries such as Myanmar and Cambodia (26% and 15%, respectively in 2020) still lack access to electricity (World Bank, 2022). Whereas the region attracted USD 137 million in off-grid renewable energy investments over 2018-2019 (led primarily by Myanmar), during 2020-2021, investments plummeted to USD 3 million, likely due to the impacts of the COVID-19 pandemic and political developments (ESMAP *et al.* 2022b).

Investments have been primarily made by private actors. Private capital flows to the technologies and countries with the least risks – real or perceived.

The private sector provides the lion's share of global investments in renewable energy, committing around 75% of the total in the period 2013-2020 (Figure S.8). The share of public versus private investments varies by context and technology. Typically, lower shares of public finance are devoted to renewable energy technologies that are commercially viable and highly competitive, which makes them attractive for private investors. For example, in 2020, 83% of commitments in solar PV came from private finance. Meanwhile, geothermal and hydropower rely mostly on public finance; only 32% and 3% of investments in these technologies, respectively, came from private investors in 2020.

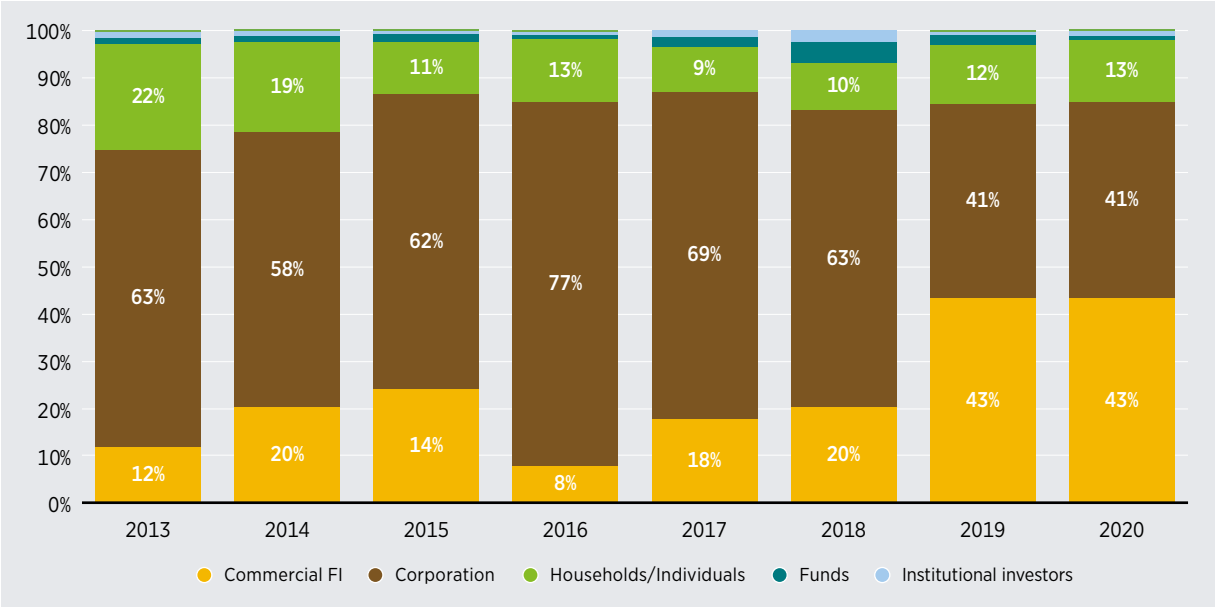
Figure S.8 Debt and equity investment by type of investor, 2013-2020



Note: DFI = development finance institution; FI = finance institution; SOE = state-owned enterprise.
Source: CPI (2022a).

Globally, commercial financial institutions and corporations are the main private finance providers, accounting together for almost 85% of private finance for renewables in 2020 (Figure S.9). Up until 2018, private investments came predominantly from corporations (on average, 65% during 2013-2018), but in 2019 and 2020 the share of corporations went down to 41% per year, and a larger share of investments was filled by commercial financial institutions (43%).

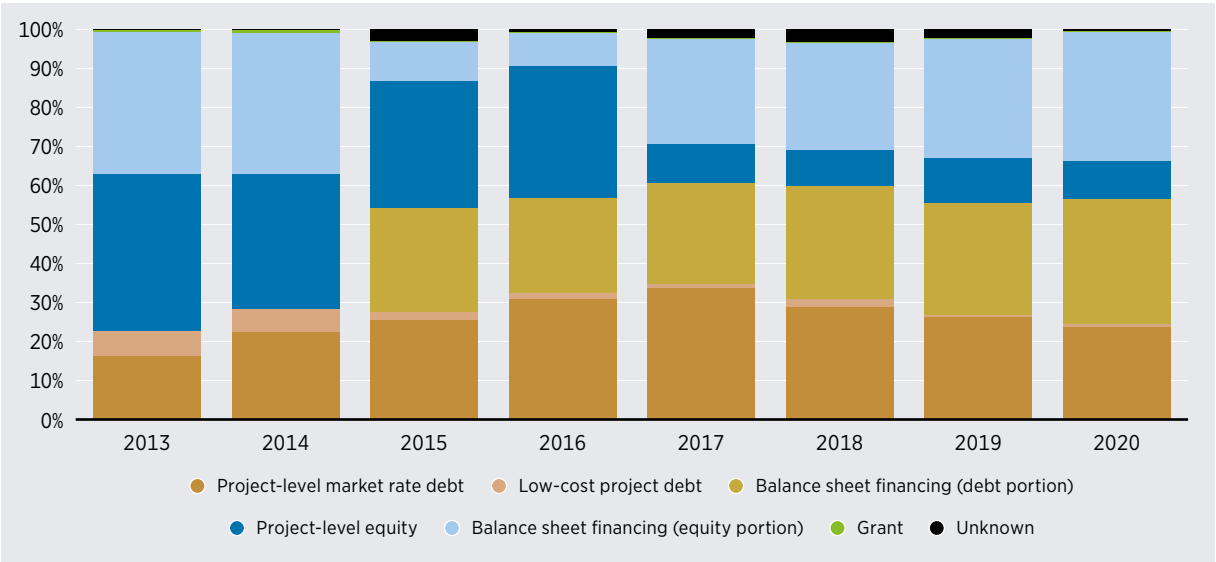
Figure S.9 Private investment in renewable energy by investor, 2013-2020



Note: FI = finance institution.
Source: CPI (2022a).

This aligns with the falling share of equity financing globally, from 77% in 2013 to 43% by 2020 (Figure S.10) as corporations together with households/individuals provided 83% of equity financing during 2013-2020 (Figure S.8). During this time, the share of debt financing increased from 23% in 2013 to 56% in 2020 (Figure S.10). This is likely linked to the maturation and consolidation of major renewable technologies such as solar PV and onshore wind that are able to attract high levels of debt, as lenders are able to envision regular and predictable cash flows over the long term, facilitated by power purchase agreements (PPAs) in many countries.

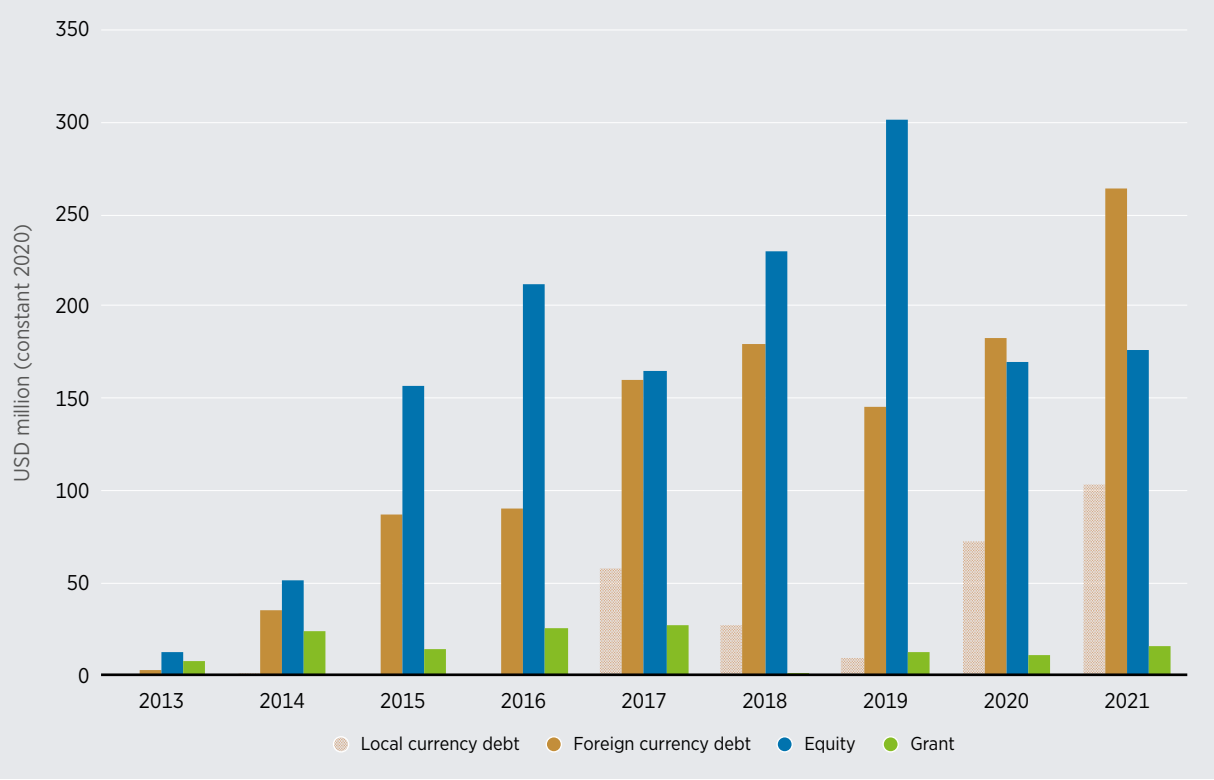
Figure S.10 Investment in renewable energy, by financial instrument, 2013-2020



Source: CPI (2022a).

In the off-grid space, debt and equity investments contributed about 47% and 48% of the overall financing, respectively between 2010 and 2021, with an additional 5% contributed by grants. By technology, debt financing constituted the majority of the investments in solar home systems and solar lights (54% of the total and rising over time) while equity financing dominated the micro-/mini-grid space. Prior to the COVID-19 pandemic, the majority of off-grid financing came from equity investments owing to the domination by private equity, venture capital and infrastructure funds and the lack of debt access for the sector. Ever since, the share of private equity has seen a relative decline (Figure S.11), in part due to the uncertainties posed by the pandemic, and the limited track record of exits and capital recycling in the sector. The contribution of debt has increased sharply over the past two years, particularly as debt-preferring DFIs bolstered their support during the pandemic (Figure S.14) and major off-grid companies were able to capitalise on their strong market position to secure (large-size) predominantly debt-based deals from both public and private investors (ESMAP *et al.* 2022b). Another remarkable trend is the increase in local currency debt, driven mainly by markets in Kenya and Nigeria.

Figure S.11 Annual investment in off-grid renewable energy, by financing instrument and local versus foreign currency debt, 2013-2021



Based on: Wood Mackenzie (2022a).

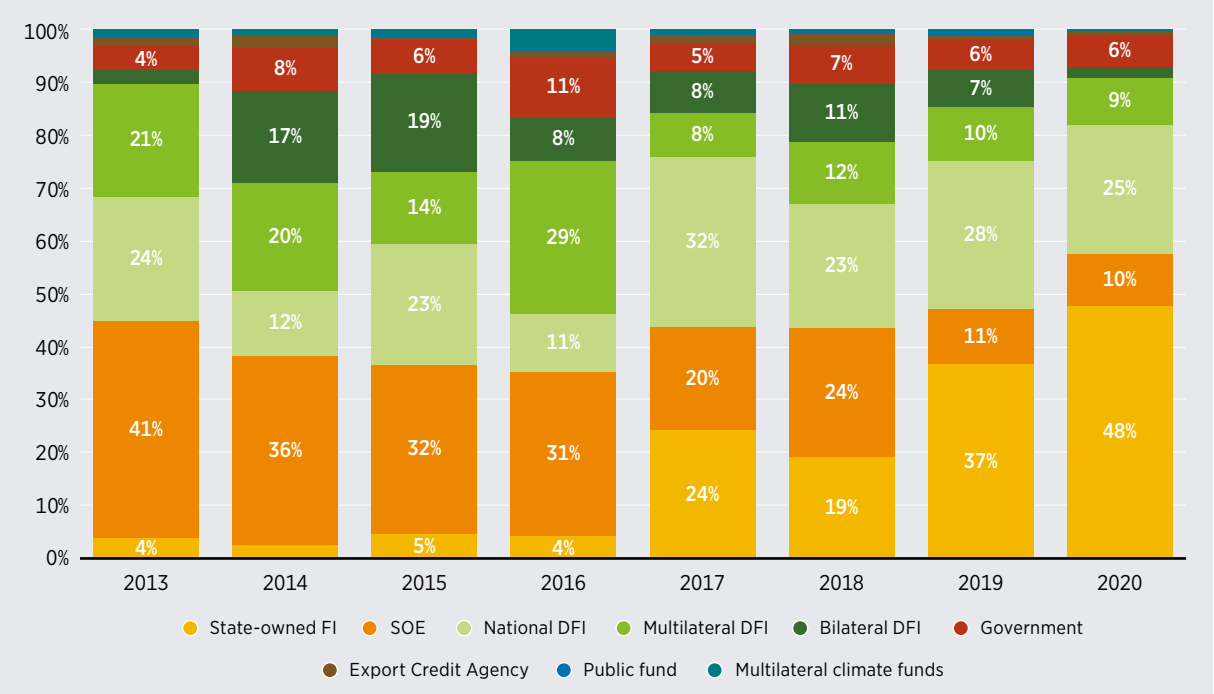
Going forward, widespread mobilisation of low-cost debt will be critical for deployment of capital-intensive renewable energy projects, while equity financing will also remain key, particularly to kick-start relatively less mature technologies, and finance projects in relatively high-risk or credit-constrained contexts.

The majority of public investments are made domestically with relatively little international collaboration. The international flow of public money to renewable energy has been in decline since 2018.

Public funds are limited, so governments have been focusing what is available on de-risking projects and improving their risk-return profiles to attract private capital.

Globally, the public sector provided less than one-third of renewable energy investment in 2020. State-owned financial institutions, national DFIs and state-owned enterprises were the main sources that year, providing more than 80% of public finance (Figure S.12). Multilateral DFIs provided 9% of public finance – in line with their past annual commitments – and accounted for about half of international flows coming from the public sector. Commitments from bilateral DFIs in 2020 fell 70% compared to 2019, largely due to a 96% decline in international commitments by the German Development Bank (KfW). This means that multilateral and bilateral DFIs provided less than 3% of total renewable energy investments in 2020.

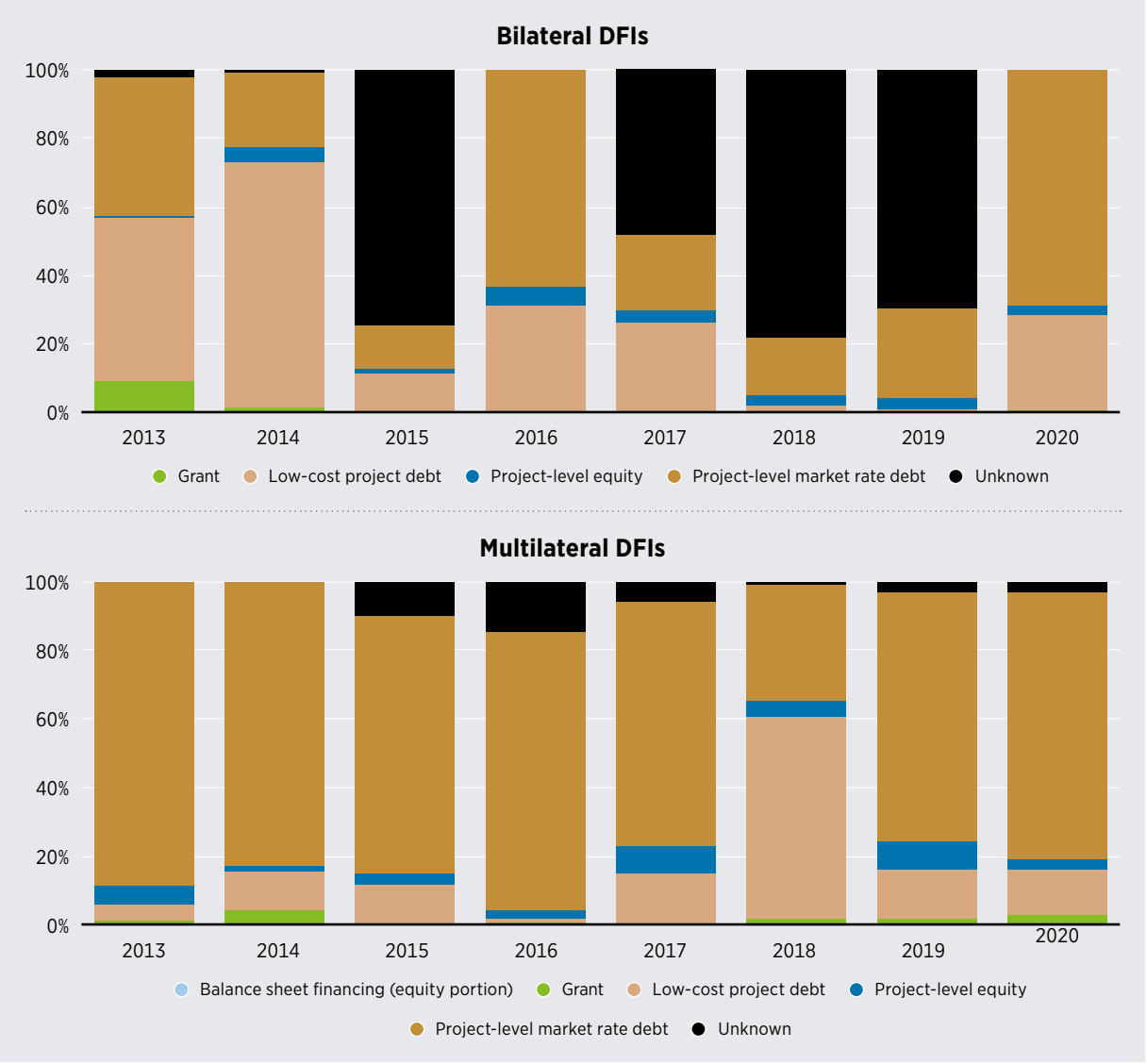
Figure S.12 Public investment in renewable energy by investor type, 2013-2020



Note: DFI = development finance institution; FI = finance institution; SOE = state-owned enterprise.
Source: CPI (2022a).

In addition, financing from DFIs was provided mainly in the form of debt financing at market rates (requiring repayment with interest rates charged at market value). Grants and concessional loans amounted to just 1% of total renewable energy finance, equivalent to USD 5 billion. Since the interest rates are the same, the only difference that DFI financing provides is to making finance available, albeit at the same high costs for users. Figure S.13 illustrates the portion of DFI funding provided in the form of grants and low-cost debt.

Figure S.13 Portion of DFI funding in the form of grants and low-cost debt

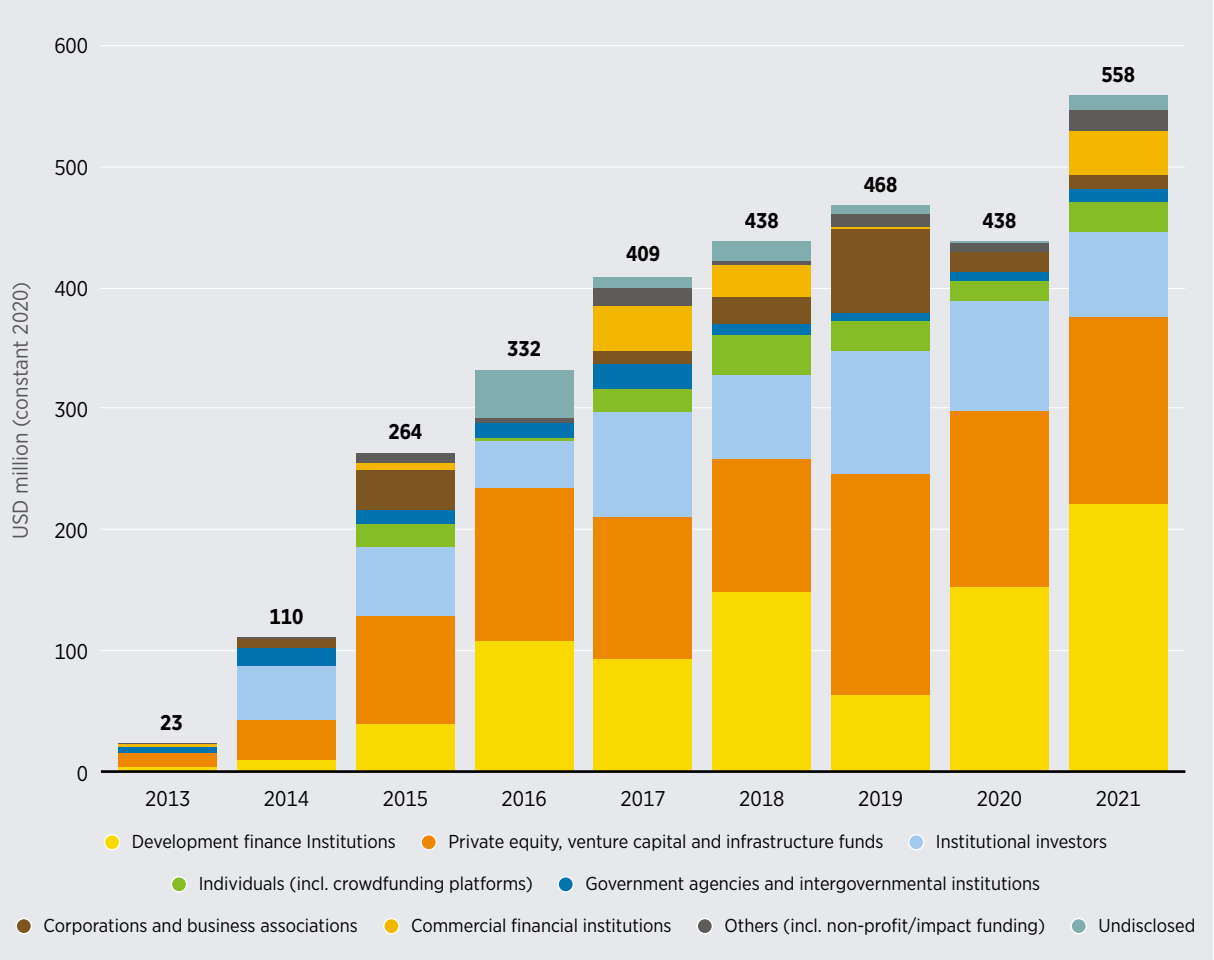


Note: DFI = development finance institution.
Source: CPI (2022a).

In the off-grid space, the role of the public sector, in particular DFIs, is much more important. DFIs were the largest public capital providers (accounting for 79% of the public investments in off-grid solutions and 27% of the total investments in off-grid solutions in 2010-2021). Notably, DFIs' contributions after the pandemic constitute half of their overall contributions since 2010 (Figure S.14).

Public finance flows to the Global South are essential to achieving the 1.5°C Scenario and its socio-economic benefits (together with progressive fiscal measures and other government programmes such as distributional policy, as outlined in IRENA [2022a]). In fact, almost 80% of the off-grid investments between 2010 and 2021 involved North–South flows. However, the international flow of public finance going to renewable energy in the broader context has been in decline since 2018 (IEA, IRENA *et al.* 2022). Preliminary data show that the downtrend continued through 2021.

Figure S.14 Annual commitments to off-grid renewable energy by type of investor, 2015-2021



Note: Definitions of all investor type included in this analysis are provided in the accompanying methodology document (Appendix).
Based on: Wood Mackenzie (2022a).

To achieve a just and inclusive energy transition, public financing – including through international collaboration – has a critical role to play across a broad spectrum of policies.

Among risk mitigation instruments, sovereign guarantees have been preferred for lenders looking to obtain a "one-size-fits-all" solution for credit risks. But such guarantees are treated as contingent liabilities and may hamper a country's ability to take on additional debt for critical infrastructure development and other investments (IRENA, 2020a). Moreover, sovereign debts are already stressed to their breaking point in many emerging economies grappling with high inflation and currency fluctuations or devaluations in the wake of the COVID-19 pandemic. In this macroeconomic environment, many countries cannot access affordable capital in international financial markets or provide sovereign guarantees to mitigate risk.

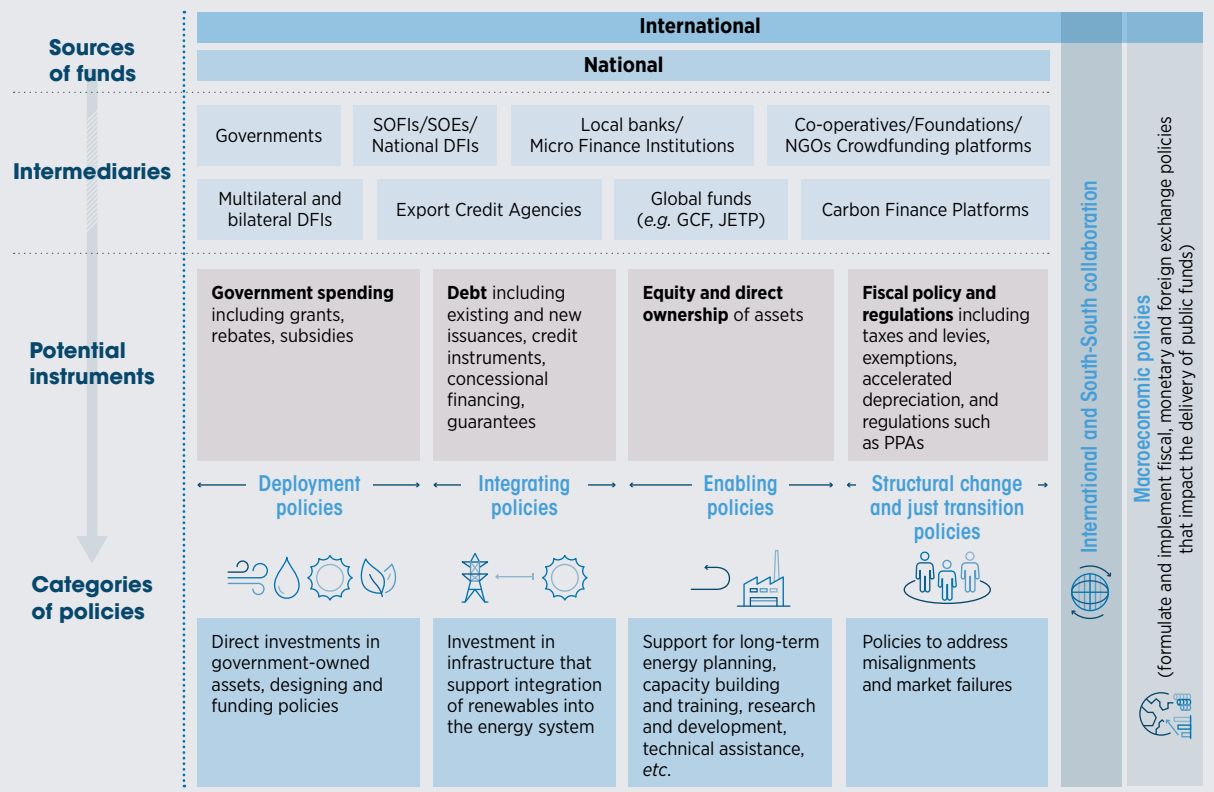
Given the urgent need to step up the pace and geographic spread of the energy transition, and to capture its full potential in achieving socio-economic development goals, more innovative instruments are needed that help under-invested countries reap the long-term benefits of the energy transition without putting their fiscally constrained economies at a further disadvantage.

Public funding must flow into the renewable energy sector (covering all segments of the value chain), the wider energy sector and the economy as a whole, for a just and equitable energy transition. Public funds can be mobilised and provided using a variety of instruments. Figure S.15 shows the types of instruments that can be used to channel public finance, the sources of public funds (domestic or international through collaboration) and the intermediaries that can help channel them (*e.g.* governments, national DFIs, local banks, multilateral and bilateral DFIs, export credit agencies, global funds including the Just Energy Transition Partnership [JETP] and UN-linked funds such as the Green Climate Fund).

These instruments can be existing or newly designed and may include (1) government spending such as grants, rebates and subsidies; (2) debt including existing and new issuances, credit instruments, concessional financing and guarantees; (3) equity and direct ownership of assets (such as transmission lines or land to build projects) and (4) fiscal policy and regulations including taxes and levies, exemptions, accelerated depreciation, deferrals and regulations such as PPAs (especially when the tariffs paid to producers – in addition to the cost of running the system – are lower than what is collected by consumers and the difference is paid through a government subsidy). However, such instruments should be used with caution as to not concentrate the benefits among a small number of players in the industry, and instruments should be designed in a way that distributes the benefits in an equitable and fair way.

As shown in Figure S.15, public finance flows via instruments in various policy categories of IRENA's broad policy framework. Examples include the following:

Figure S.15 The flow of public finance for a just and inclusive energy transition



Note: DFI = development finance institution; GCF = Green Climate Fund; JETP = Just Energy Transition Partnership; NGO = non-governmental organisation; PPA = power purchase agreement; SOFI = state-owned financial institution; SOE = state-owned enterprise.

1. Under **deployment policies**, public funds can flow as direct investments in government-owned energy-transition-related assets, public-private partnerships, or in designing and funding policies that can attract or support private investment (*e.g.* capital subsidies, grants and tariff-based mechanisms such as auctions, feed-in tariffs and feed-in premiums).

2. Under **integrating policies**, public investments can go into infrastructure and assets that support the integration of renewables into the energy system (*e.g.* regional and national transmission lines, pumped hydroelectric energy storage facilities).

3. Under **enabling policies**, public money can support long-term energy planning, capacity building and training, research and development, the development of local industry and value chains, as well as technical assistance offered via multilateral development banks (MDBs) and inter-governmental organisations such as IRENA.

4. Under **structural change and just transition policies**, public funds can go into the redesign of power markets to make them more conducive for large shares of variable renewable energy, towards compensation for the phasing-out of fossil fuels, as well as policies to ensure that the energy transition promotes gender equality and social inclusion, among many other priorities.

5. The **global policy framework** defines international and South-South collaboration, which is key to structuring and ensuring the international flows from the Global North to the Global South.

6. In addition, although not directly related to any specific sector, there are **macroeconomic policies** (fiscal, monetary and currency exchange policies) that affect the delivery of public funds towards the energy transition.

Some elements presented in the framework (Figure S.15) might overlap. For example, tax incentives are at the same time fiscal or macroeconomic policies while acting as deployment policies, and funding grid infrastructure can be viewed as an enabling or an integrating policy. While funding capacity building is part of an enabling policy, these funds also facilitate structural change, being part of social development programmes, and education, social protection and compensation policies, *etc.* Thus, there are complex inter-linkages and feedback loops between the different policies and instruments. By understanding the broad structural workings underlying the renewable energy "economy", public policy and financing can be strategically used to advance the energy transition.

Governments from developed and developing countries will play a central role in providing an enabling environment for both public and private investments.

A more comprehensive way of defining risk (including risk sharing) is needed. A narrow investor-centric focus on the risk of investment in energy assets not paying off needs to be broadened to include environmental, planetary and social risks. These include the risk of leaving a large part of

the population out of the energy transition and locked in underdevelopment, and the risk of the Sustainable Development Goals remaining far from being met. This is how investment risks must be viewed from the perspective of governments and the international community. And with the very limited public funds available in the developing world, the international community must step up.

The availability of capital for public investments in renewable energy will need to be increased, and lending to developing nations transformed.

Today's environment calls for a fundamental shift in how lending is made to developing nations, especially those affected by economic and climate crises, and particularly how countries in the Global North support countries in the Global South to cope with and adapt to crises related to climate change, the cost of living and debt. The situation in developing countries is being made more difficult amid tightening monetary policies and a strengthening US dollar. One in five countries is experiencing fiscal and financial stress, which left unaddressed would deepen hardship, increase debt defaults, widen inequality and delay the energy transition.

At the 27th United Nations Climate Change Conference (COP27) a decision was reached to establish a loss and damage fund, particularly for those nations most vulnerable to climate events. Details regarding the amounts involved, and how the facility will be set up and operationalised are yet to be negotiated. The fund is expected to address adverse effects of climate impacts such as droughts, floods, rising seas and other disasters that impair the deployment of renewable energy.

Tapping pools of public funds for both developed and developing countries without burdening the fiscal space remains a key priority. Governments should adopt a "doing more with what is available" approach through enhanced collaboration among DFIs and MDBs, and by exploring the following mechanisms:

Capital release from balance sheets of DFIs. Balance sheets of investors and financial institutions disclose rights and obligations connected to the owning and lending of assets. It is possible for DFIs to use those elements to raise additional funds through posting existing assets as collateral (provided their value is free and clear of any encumbrances), and partially repackaging receivables from guaranteed loan repayments (*e.g.* loans that are guaranteed by insurers) into new financial structured products in the market. The DFIs could offer a (high rated) new debt product (*e.g.* a collateralised debt obligation)[3] guaranteed and managed by a bank such as an MDB to qualified investors (*e.g.* pension funds, insurers, institutional investors, *etc.*) and traded on international exchanges. However, such a product should be used with rigorous due diligence.

[3] *Collateralised debt obligations are asset-backed securities that bundle together a diversified portfolio of instruments (e.g. loans, bonds). Cash flows from underlying assets are used to repay investors.*

Product innovation among MDBs. Multilaterals benefit from the convening power granted by shareholders in both developed and developing countries, to craft, implement and operate innovative frameworks to mobilise capital and mitigate risks. In particular, liquidity facilities can be scaled up to assist renewable energy investors in fulfilling their business obligations by ensuring an uninterrupted flow of payments from off-takers – without posing a burden on the fiscal space of developing countries (local-currency-denominated PPAs can also benefit from this facility). These liquidity facilities can evolve to incorporate the role of guarantor supported by MDBs and DFIs in compliance with guidelines issued by multilaterals and agreed by shareholders. The highly capitalised guarantor becomes a supranational facility to mitigate credit and foreign exchange risks for renewable energy investors and lenders. MDBs, under the approval of host governments, can allocate funds and credit lines to the facility up to prudent limits determined by ministries of finance and central banks.

Broadening capitalisation routes for MDBs. Capital calling from shareholders has been the common approach adopted by multilaterals to expand technical assistance and lending programmes. The new capital increases MDBs' fund availability and enables them to place bonds in the global capital market, thereby raising additional capital. Bonds are placed as AAA-rated obligations guaranteed by MDBs – de facto, such institutions have an enviable track record recognised by countries and market participants in managing risks – that can be placed in the market, if appropriate financing vehicles are used and target markets are identified. MDBs should now consider risk-tiered debt obligation placements with a different investment grade (BBB+ and above, *e.g.* multi-rated green bonds), implying different level of returns to bondholders. The initiative broadens access to the investor base – from institutional investors and sovereign wealth funds to corporate/qualified investors – increasing the amount of capital that could become available and deployed in renewable energy investments.

Meanwhile, public finance and policy should continue to be used to crowd in private capital. Policies and instruments beyond those used to mitigate risks are needed.

Public finance should continue to be used strategically to crowd in additional private capital. Risk mitigation instruments (*e.g.* guarantees, currency hedging instruments and liquidity reserve facilities) will still play a major role, but public finance and policy must go beyond risk mitigation. Examples include funding capacity building, support for pilot projects and innovative financing instruments such as blended finance initiatives, *etc*. In addition, policy makers may consider the following:

Incentivise an investment swap from fossil fuels to renewable energy by banks and national oil companies. Incentivising investors to divert funds towards the energy transition can be done through measures such as phasing out of fossil fuel subsidies and adapting fiscal systems to account for the environmental, social and health impacts of a fossil-fuel-based energy system. However, the phaseout of subsidies should be accompanied by a proper safety net to ensure adequate standards of living for vulnerable populations (IRENA, 2022a).

A supplemental way of incentivising this shift is through highlighting and recognising the leadership role of those institutions that are paving the road through early investments in the energy transition. More than 30 significant financial institutions including banks, insurers, asset owners and asset managers have committed to stop financing fossil fuels. Governments and civil societies can take action to reward their leadership and encourage other institutions to take similar steps. After that, public pressure, along with policy and regulation, can further influence financial decision-making in favour of renewable energy and other energy transition technologies (Environmental Finance, 2022a).

Mobilise institutional investment and promote greater use of green bonds for renewables. With about USD 87 trillion of assets under management, institutional investors have a key role to play in reaching the investment levels required for the ongoing global energy transition. Greater participation of institutional capital will require a combination of effective policies and regulations, capital market solutions that address the needs of this investor class (*e.g.* green bonds), as well as a variety of internal changes and capacity building on the part of institutional investors (IRENA, 2020d).

Green bonds can help attract institutional investors and channel considerable additional private capital in the renewable energy sector, helping to fill the significant outstanding investment gap. Green bonds have experienced significant growth over the past decade (about 103% a year in 2011-2021), increasing from about USD 800 million of issuances in 2007 to about USD 545 billion of issuances in 2021 – an all-time annual high despite pandemic-induced economic challenges. The cumulative value of green bond issuances broke the USD 1 trillion threshold at the end of 2020 and stood at about USD 1.64 trillion as of the end of 2021 (Environmental Finance, 2022b). Some recommended actions for policy makers and public finance providers to further increase green bond issuances include the adoption of green bond standards in line with international climate objectives, the provision of technical assistance and economic incentives for green bond market development and the creation of bankable project pipelines (IRENA, 2020e).

Implement regulatory sandboxes for broadening access to capital and credit instruments. Regulatory sandboxes designed to serve broader social and environmental goals can help unlock more investments. By enacting regulatory sandboxes for start-ups and investors for both grid and off-grid initiatives, new solutions may emerge towards enabling access to pools of capital/credit instruments. Such initiatives can benefit from MDBs' support (Barbalho *et al.* 2022) in connection with other available funding agencies at local, regional and global levels. Furthermore, companies can be invited to participate in the sandbox with a view to pilot innovative concepts that facilitate risk mitigation, including foreign exchange risks in electricity exchanges.

Facilitate local currency lending and denominate PPAs (at least partially) in local currencies. Local currency PPAs are helpful to address the risks of currency devaluations which may otherwise cripple power off-takers' ability to make payments to power producers in hard currency (such as the USD) at times when the domestic currency plummets. Relatively established markets in the off-grid space, for instance, such as Kenya and Nigeria are seeing more local currency debt financing.

During 2020-2021, about 28% of debt in the two countries was denominated in local currencies (primarily the Kenyan shilling, followed by the Nigerian naira), compared with just 11% during the pre-pandemic years. Going forward, low-cost local currency financing will be preferred for the next phase of the off-grid renewable energy sector's development. A complementary mechanism to address foreign currency risks is to facilitate local currency lending for projects with development capital channelled through intermediaries including national banks or non-banking financial institutions. Several countries, including Bangladesh, Brazil and Jordan, have piloted such approaches to catalyse investment into the renewable energy sector.

Enhance the participation of corporate actors. Although companies that produce renewable energy are already providing substantial investment in the sector, non-energy-producing corporations have a preeminent role to play in the energy transition by driving demand for renewable energy. By setting up the right enabling framework, policy makers can encourage active corporate sourcing and unlock additional capital in the sector. Recommended actions include, for example, establishing a transparent system for the certification and tracking of renewable energy attribute certificates, enabling third-party sales between companies and independent power producers, and creating incentives for utilities to provide green procurement options for companies (IRENA, 2018b).

Incentivise the participation of philanthropies. According to Oxfam's report titled *Survival of the Richest: How We Must Tax the Super-Rich Now to Fight Inequality*, the richest 1% own almost half of the world's wealth while the poorest half of the world own just 0.75% (Oxfam, 2023). To tap into the existing wealth, governments should look at incentivising philanthropies to mobilise additional funds into support for renewable energy that can help fight poverty, inequality, climate change and humanitarian crises. Philanthropies are playing an increasingly important role in bridging funding gaps, especially in the energy access context, where funds have gone into market development (*e.g.* technology innovation funds) and delivering financing for end users and enterprises through various instruments, such as results-based grants and equity. Individuals (high-net-worth individuals, families or households) invested an average of USD 20 million per year in off-grid renewables during 2015-2021, primarily through dedicated crowdfunding platforms (IRENA, 2022f). In 2021, individuals, bequests, foundations and corporations gave an estimated USD 485 billion to charities in the United States alone. These were distributed towards education, human services, foundations, public-society benefit organisations, health, international affairs, and environmental and other social services (Giving USA 2022). The energy transition being tied to all these objectives, tapping into these funds can help fill gaps left by governments, and support the livelihoods and well-being of relatively poor populations without relying on fossil fuels (Dennis, 2022).

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