NOVEMBER 2023 ISSUE 26

INVESTMENT POLICY MONITOR

UNITED NATIONS
UNCTAD

INVESTMENT POLICIES FOR THE ENERGY TRANSITION

INCENTIVES AND DISINCENTIVES

HIGHLIGHTS

- UNCTAD's World Investment Report 2023 highlights a worrisome increase in the SDG investment gap, surpassing $4 trillion annually in developing countries alone, with energy investment needs estimated at $2.2 trillion per year. Successful energy transition necessitates significant investment in renewable energy projects, the phased decommissioning of fossil fuel assets and the promotion of cleaner power generation solutions. At the recent World Investment Forum (WIF), global stakeholders emphasized the need to redirect net-zero finance toward developing economies.
- Existing policy frameworks aimed at promoting investment in the energy transition are notably inadequate, especially in poorer nations. Around the world, two-thirds of countries have adopted renewable energy policies. However, only half of the Least Developed Countries (LDCs) and one-third of Small Island Developing States (SIDS) have done so. While developed and emerging economies have integrated private investment promotion mechanisms into over 70 per cent of their renewable energy policies, the same holds true for only 24 per cent of policies in LDCs and 17 per cent of those in SIDS.
- While most developed economies use targeted investment promotion policies, many developing countries use generic tax incentives – applicable to investment in any industry – that do not address the specificities of energy investment projects. In recent times, auctions and tenders for renewable energy projects have gained traction across all country groups.
- The value of fossil fuel subsidies has reached a staggering $1 trillion, far surpassing support for renewable energy. Gradually phasing out these subsidies, although complex for many countries, would incentivize investments in renewables.
- Policies to encourage the phased retirement of fossil fuel infrastructure are also needed, as emphasized during the WIF. However, thermal power plants will continue to play a role in ensuring energy security for many countries in the years to come. To curb their environmental impact, broader adoption of technologies such as carbon capture, utilization and storage, cofiring, and low-carbon fuels is key. At present, policies and initiatives to promote investment in such technologies are predominantly confined to developed countries and large emerging economies.
- The Global Action Compact for Investment in Sustainable Energy for All, proposed by UNCTAD in the World Investment Report 2023, aims to address these challenges and achieve a balanced energy transition. It emphasizes three key objectives: achieving climate targets, ensuring affordable energy access for all, and maintaining energy security.

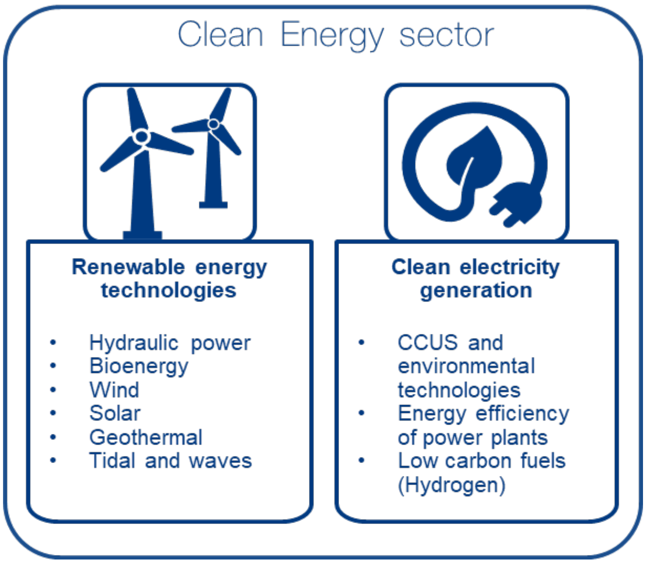
Introduction

Climate change is an existential threat to human society. The Intergovernmental Panel on Climate Change (IPCC) has warned that the world is likely to reach global warming of 1.5ºC above pre-industrial levels within 15 years unless we achieve drastic cuts in carbon emissions now. This would result in large-scale drought, famine, heat stress, species die-off, loss of entire ecosystems and habitable land, throwing more than 100 million into poverty (IPCC, 2022a). The experts, however, have also pointed out that we have the technologies and policy tools to achieve climate change mitigation, but solutions should be scaled up rapidly (IPCC, 2022b). For this to happen, the policy response should be commensurate with the challenge.

The energy system is at the centre of the policy response to climate change and national policies are crucial for driving the shift towards clean energy. The clean energy transition needs to accelerate, while at the same time, energy access needs to expand significantly. In this context, emerging and developing economies, in particular, are faced with the dual challenge of ensuring energy security and meeting the growing energy needs of their expanding population, while simultaneously speeding up mitigation solutions and cutting carbon emissions.

Since the adoption of the Paris Agreement in 2015, international investment in renewable energy has nearly tripled. However, this growth has predominantly occurred in developed countries. According to UNCTAD's World Investment Report 2023, the investment gap across all SDG sectors has increased from $2.5 trillion in 2015 to more than $4 trillion per year today. The largest gaps are in energy, water, and transport infrastructure. Energy investment needs in developing countries are estimated at $2.2 trillion per year (WIR23).

Figure 1: Key technologies of the clean energy transition of the power sector



Source: UNCTAD

As discussed during various sessions of the UNCTAD World Investment Forum (WIF) 2023, in parallel with this big push for investment in renewable energy, the clean energy transition will require the phased decommissioning of fossil fuel assets and the promotion of cleaner power generation solutions (box 1). These solutions integrate environmental technologies to decrease CO2 emissions from existing fossil fuel power plants, such as carbon capture, utilization and storage (CCUS) technologies, the use of clean fuels, as well as technologies that increase the efficiency of fossil fuel power plants (figure 1).

Box 1: The Climate Finance and Investment Track at the World Investment Forum

The 8th edition of UNCTAD's World Investment Forum (WIF) took place in Abu Dhabi from 16 to 20 October 2023, and saw the convergence of 8,000 participants, including government officials, international organizations, policymakers, 700 CEOs and investors, sovereign wealth funds, sustainable stock exchanges and key capital markets actors. The WIF featured a dedicated Climate Finance and Investment Track, which included the second COP28 preparatory Global Dialogue and several Investment Focused Events, to continue the preparation of decisions for adoption at COP28, with a particular focus on climate finance and investment. The Global Dialogues and Investment Focused Events were agreed by the Parties at COP27 with the aim to identify challenges, barriers and roadblocks in accelerating the just energy transition; develop actionable solutions and innovations for policies, institutional arrangements, finance and technologies; and explore opportunities to direct finance flows towards the implementation of mitigation projects on the ground.

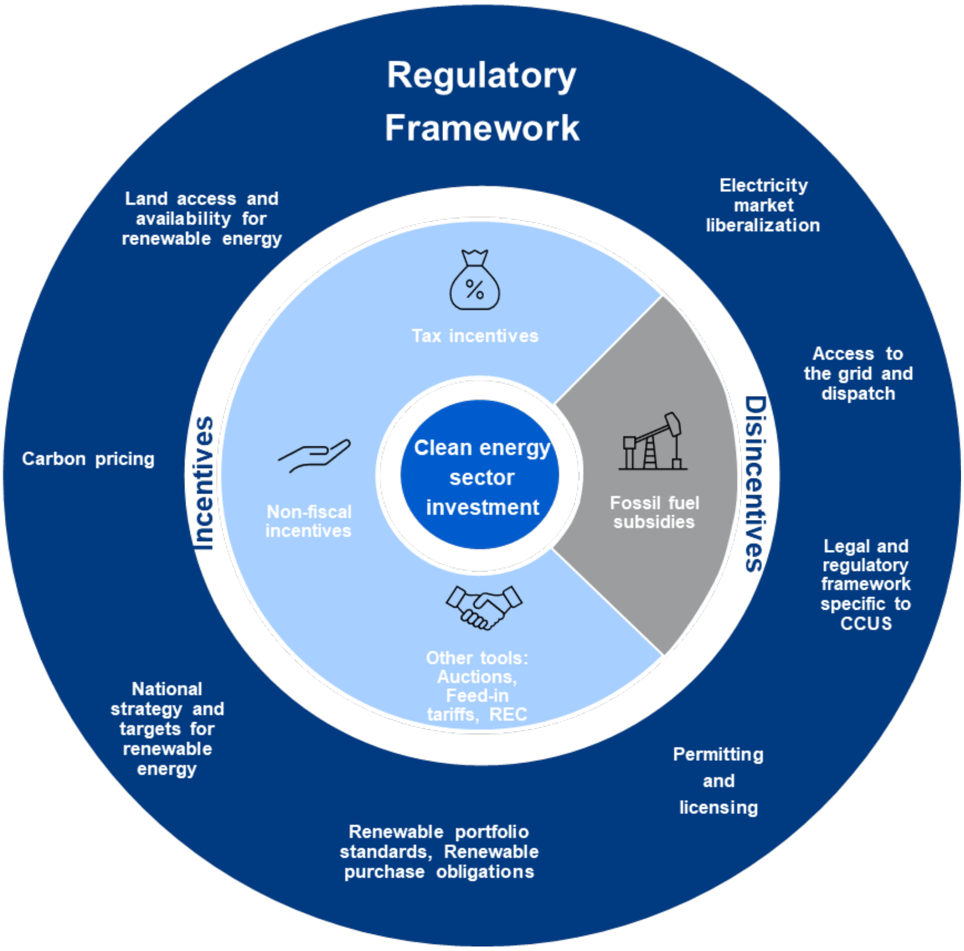
Some of the issues discussed during the WIF in this track included:

- Net zero finance and financing the just energy transition;
- Carbon markets;
- FDI, hydrogen and the greening of emerging markets;
- Strategic minerals for decarbonization;
- Stock exchange action on climate disclosure;
- The role of trade and investment policies in promoting climate action and boosting NDCs implementation;
- Financial instruments for early retirement of fossil-fuel-assets;
- Sustainable infrastructure.

Source: UNCTAD

While recognizing that a well-designed regulatory framework that comprehensively addresses the legal, regulatory and institutional aspects is a key determinant of investment in the clean energy transition (figure 2), this Investment Policy Monitor focuses on some of the main incentives and disincentives to clean energy investment. It expands on the findings and analysis presented in the World Investment Report 2023: Investing in sustainable energy for all (WIR23) and further draws from the insights and the discussion at the WIF. First, it reviews and analyses renewable energy policies around the world and identifies the key policy tools utilized by countries in different regions and at different levels of development to promote investment in renewables (section 1). Second, it provides an overview of existing clean energy transition policies in technologies and fuels that would allow the decarbonization of the traditional power sector (section 2). Third, it highlights trends in the evolution of fossil fuel subsidies around the world, which represent a disincentive to the promotion of investment in clean electricity generation (section 3). Finally, it highlights the main findings and policy implications (section 4).

Figure 2: Key policy determinants of investment in the clean energy sector



Source: UNCTAD

1. Renewable energy policies – a review of key investment incentives

a. The universe of renewable energy policies

Although the cost of renewable energy (especially wind and solar) has fallen substantially in the last decade, increasing its competitiveness in comparison to fossil fuel generation technologies (IRENA, 2022), risks and barriers to renewable energy investment remain, which hamper their development, especially in emerging and developing economies (box 2). Power generation technologies based on renewable energy typically require higher upfront investment than those based on fossil fuel. The cost of capital thus represents a higher importance in the investment decision. Given the intrinsic connection between the cost of capital and risks, this cost varies between countries and tends to be higher in emerging and developing economies.

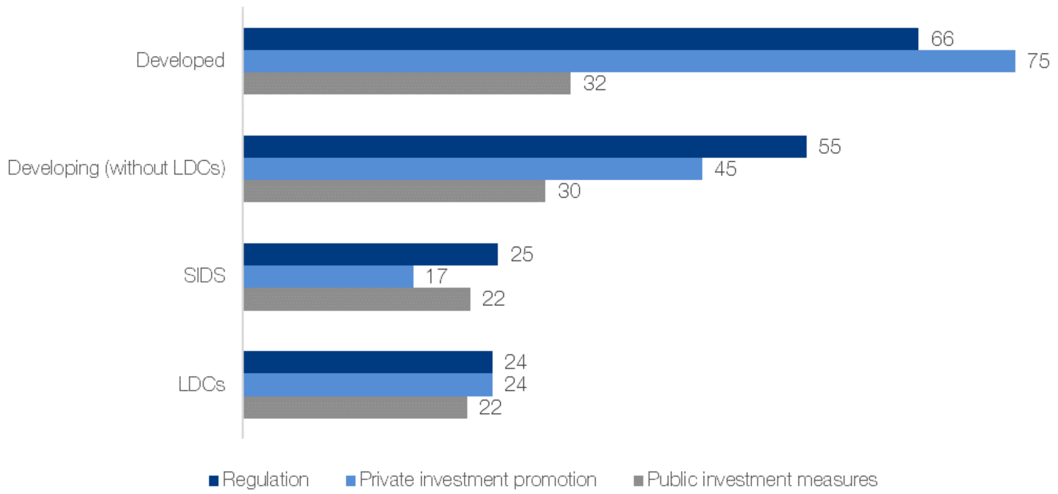
De-risking investment in renewables allows the cost of capital to decrease and thus enables renewable energy projects to better compete financially with fossil fuel generation technologies, especially in emerging and developing countries, where the cost of capital is higher (Polzin et al., 2021; Bachner, Mayer and Steininger, 2019). In this context, policies and regulatory frameworks can lower investment risks, promote the deployment of renewable energy generation technologies and help better correlate renewable energy potential with private investment.

The universe of renewable energy policies is complex, as countries adopt various laws, policies, and regulations depending on their legal and regulatory systems.[1] Based on the review of 798 renewable energy policies, covering 192 economies, this section analyses investment promotion instruments and incentives used around the world to foster private investment in renewable energy sectors.

Two-thirds of the countries around the world have enacted policies and laws specifically dedicated to renewable energy, but all countries have at least incorporated some aspects of renewable energy regulations or promotion into energy laws, energy and climate change strategies, electricity acts, or national development plans. In contrast, only 33 per cent of SIDS and 54 per cent of LDCs have laws specifically addressing renewable energy.

Policies on renewable energy typically focus on three main policy aspects: regulation, private investment promotion, and public investment measures (figure 3).

Figure 3: Policy aspects addressed in renewable energy policies, by type and category of countries
(Per cent of countries)



Source: UNCTAD, based on Climate Change Laws of the World database.

Regulation encompasses a wide range of policies, including licensing and permitting systems, land access, industry structure, and renewable energy-specific aspects like priority access to the grid (figure 2). They also include general policies and strategies aimed at achieving emission reduction targets or promoting access to energy that align with climate goals or the energy-related sustainable development goals (SDGs). Such policies provide long-term vision and certainty, which are crucial for attracting investment. Private investment promotion policies include all types of incentives and risk reduction mechanisms aiming to attract investment to the sector. They will be further analyzed below. Public investment measures include direct investment by the State in generation capacities, through public enterprises and PPPs, as well as direct investment in research and development (R&D) in the sector.

The use of these three policy aspects varies across country groups. While two thirds of developed economies prioritize improving the regulatory framework and promoting private investment in their renewable energy policies, only 24 per cent of LDCs and 25 per cent of SIDS do the same. Similarly, private investment promotion is a policy focus for over 75 per cent of developed countries, but only less than 30 per cent of LDCs and SIDS (figure 3). About a third of developed and developing economies emphasize on the role of public investment but only 22 per cent of LDCs and SIDS do the same.

[1] See for instance, the "G20 Compendium on promoting investment for sustainable development", prepared by UNCTAD under the guidance of the Indonesian Presidency of the G20, and with inputs from all G20 members and some associated countries, September 2022. https://investmentpolicy.unctad.org/publications/1272/g20-compendium-on-promoting-investment-for-sustainable-development

Box 2: Risks and barriers to investing in renewable energy generation

In addition to the risks and barriers affecting all investment, such as macro-economic and political instability, renewable energy investment faces a range of specific risks and challenges. These include:

Policy uncertainty

The policy stability and the longer-term perspective are shown to be of particular importance in investment decisions (Criscuolo and Menon, 2015; Hafner, James and Jones, 2019), as the capital intensity of renewables usually implies a longer payback period and thus a higher need for policy stability to ensure positive return on investment. In Germany, for example, while Feed-in tariffs and other incentives to the sector have been crucial (Gawel, Strunz and Lehmann, 2016), their effectiveness has consistently decreased when policy uncertainty has increased (Agnolucci, 2006).

Sector regulations

Regulatory aspects of the renewable energy sector such as access to the grid are a critical determinant of FDI in the sector (Keeley and Ikeda, 2017; Mahbud et al., 2022; Ragosa and Warren, 2019). The energy market structures, regulations and governance, including the dispute resolution mechanisms, need to be clearly set to not be perceived as a risk for investors (e.g. vertical integration, the efficiency of licensing and permitting procedures; effectiveness of governing bodies, rule of law etc.). Moreover, regulations that favour fossil fuel industries are still in place in many countries which undermines the comparative advantage of renewable energy technologies (section 3).

Electricity infrastructure

Solar and wind represent a large share of the newly installed capacity today, but they are intermittent, depending on weather conditions. The integration of intermittent and more decentralized sources of energy requires higher flexibility of the grid and investment in storage systems. Grid flexibility depends on several factors, such as the balancing systems, generation capacities, storage options, and grid intelligence (smart grid). Moreover, the transmission and distribution networks are crucial for grid flexibility because a larger network makes it easier to transport energy from areas with excess capacity to areas with higher demand. Thus, the integration of renewable energy capacities depends on the investment made in transmission and distribution networks.

Technology

Renewable energy technologies have been available for some time, but their large-scale adoption is still relatively new, and there may be concerns about their long-term performance and reliability. Furthermore, the profitability of a renewable energy project is highly dependent on the location of the power plant, as it relies on the availability of wind and solar resources, but obtaining accurate and sufficient data on these critical geographic and climate factors can be challenging. Finally, a lack of in-country expertise for the construction and operation of renewable energy power plants can also pose challenges that may ultimately impact the project's profitability.

Financing

One of the main obstacles to investment in renewable energy is accessing affordable finance. The high upfront costs associated with renewable energy technologies require long-term financing, but the cost of capital can quickly escalate in countries perceived as riskier, which can pose a significant burden, particularly for developing economies (IEA, 2021a). In this context, the availability of international public finance is a critical determinant of FDI in renewable energy in developing countries (Ragosa and Warren, 2019; Haščič et al., 2015). Additionally, a lack of knowledge and awareness of renewable energy technologies among potential sponsors and investors is another significant barrier that needs to be addressed.

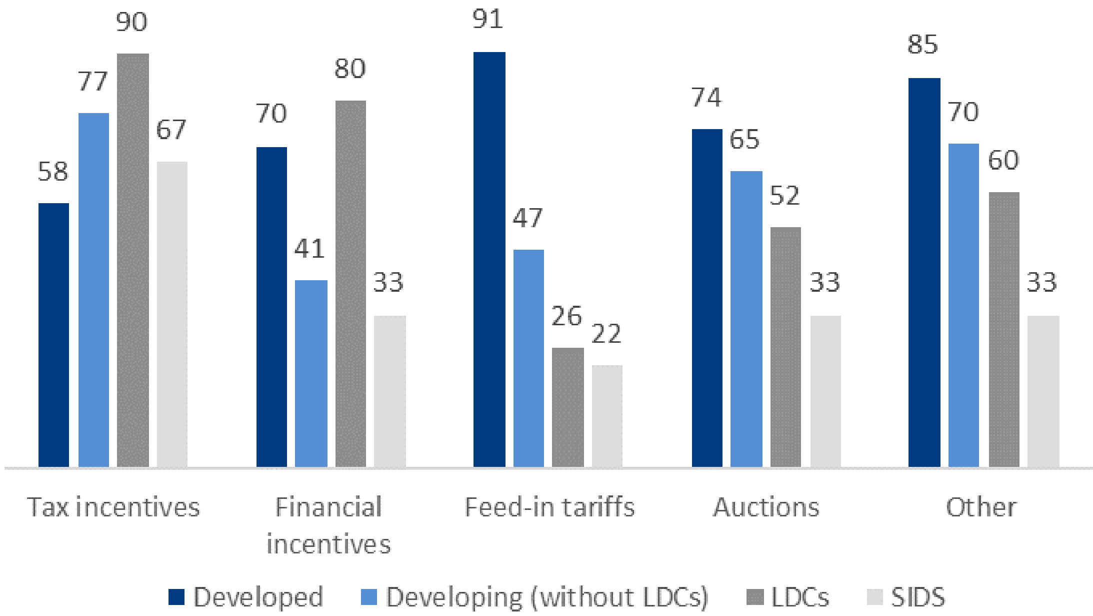
Source: UNCTAD

b. Policy tools for the promotion of renewable energy investment

Based on the review and mapping of 212 laws and policies[2], covering 94 developing and developed economies (49 and 51 per cent respectively), this section analyses the investment promotion instruments and incentives used around the world to foster private investment in renewable energy. Countries have adopted various types of incentives (table 1). Among these, tax incentives are the instrument most often used for promoting renewable energy investment in developing countries (77 per cent), LDCs (90 per cent) and SIDS (67 per cent). In contrast, developed countries favour more targeted and complex policy instruments, with FITs, auctions and financial incentives adopted by 91 per cent, 74 per cent and 70 per cent respectively (figure 4).

Figure 4: Prevalence of private investment promotion instruments, by type

(Per cent of countries)



Source: UNCTAD and Climate Change Laws of the World database.
Note: The graph covers laws adopted during the period 2000–2022, as well as amendments of some laws that were adopted before 2000. Feed-in tariff and auction data is based on other sources, covering 193 countries. "Other" includes quota-based instruments, guarantee schemes and business facilitation.

[2] These are based on the review of 798 renewable energy policies and laws, covering 192 economies. These 212 laws and policies were selected because they include at least one type of investment promotion tool as defined in Table 1.

Table 1 Investment promotion instruments for the renewable energy sector

Fiscal incentives	
Profit-based	Reduction of the standard corporate income tax rate or profit tax rate, tax holiday, loss carry forward
Expenditure-based	Accelerated depreciation, investment and reinvestment allowances, R&D tax incentives, tax credits
Indirect taxes and duties	Exemption or reduction of VAT on capital material, exemption on import taxes and duties
Production-based	Production-based tax credits
Financial incentives	
Grants and subsidies	Direct subsidies to cover (part of) capital, production or marketing costs
Loans	Subsidized loans
Other tools	
Auctions	Stimulate investment through government calls for tenders to install a certain capacity of renewable energy-sourced electricity, with the best bidder typically winning a long-term power purchase power agreement that guarantees sales and prices and the auctions structured as packages that include additional incentives such as access to land or low-cost grid connections
Feed-in tariffs	Incentivize the deployment of renewable energy by offering long-term contracts to producers with a guaranteed above-market price tariff, in a triple guarantee – certainty of sale, price and duration – that reduces project risk and encourages investment
Renewable portfolio standards or quotas, and renewable energy certificates	Renewable portfolio standards (RPS) or quotas: define the share of renewable energy that must be present in the electricity mix of targeted entities, typically utility suppliers, companies or consumers Renewable energy certificates: represent the environmental benefits of one MWh of renewable energy generation, which can be bought and sold separately from the electricity itself Usually introduced together
Other guarantee schemes	Financial guarantees, including guarantees covering geological risks or other non-financial elements
Business facilitation	A range of measures aimed at facilitating the implementation of and investment in renewable energy companies, which may include dedicated single windows, facilitated access to land and simplified permitting and licensing, as well as access to information related to the renewable energy potential and needs of the country

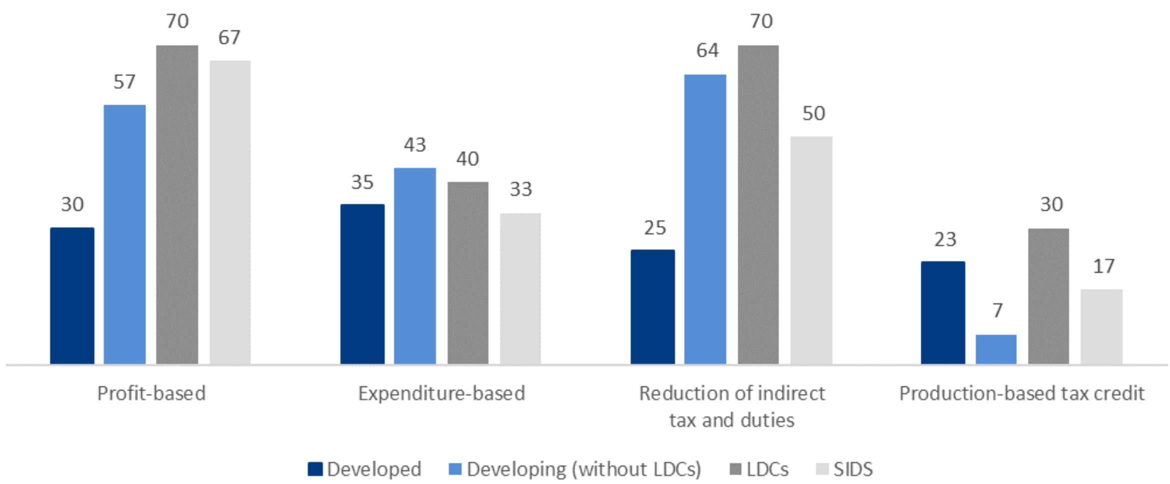
Source: UNCTAD

i. Tax incentives

Tax incentives are well-established and well-known tools used by countries around the world to promote investment. The literature on their pros and cons is extensive. UNCTAD recently carried out a detailed mapping of their use across the globe (WIR22). Tax incentives can be customized to achieve certain policy objectives, and although they require governments to forgo tax revenue that could be used for other purposes, they do not typically require direct public spending. However, tax incentives may not directly address the main barriers to investment in renewable energy such as access to finance, market and infrastructure risks, and high upfront capital (box 1).

Nonetheless, tax incentives are a common policy tool for promoting renewable energy investment, particularly in developing economies and LDCs (figure 5). Profit-based tax incentives such as corporate income tax reductions and tax holidays are particularly popular among developing countries (57 per cent of countries) and LDCs (70 per cent). The reduction or exemption of VAT and import duties is also very common in developing countries, as they often import most of the required capital goods and inputs. This instrument is used by 64 per cent of developing countries and 70 per cent of LDCs. In contrast, developed countries tend to favour the use of expenditure-based incentives and production-based tax credits. These findings are consistent with the broader analysis on the use of tax incentives for investment in developed and developing countries carried out by UNCTAD in the World Investment Report 2022.

Figure 5: Tax incentives in renewable energy policies, by type and country group (Per cent of countries)



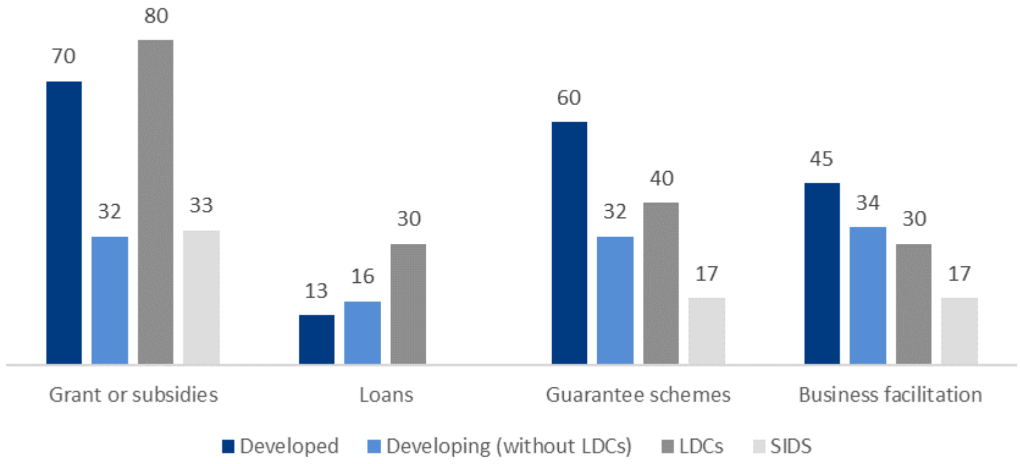
Source: UNCTAD, based on Climate Change Laws of the World database.
Note: The graph covers laws adopted during the period 2000–2022, but it also includes amendments of laws that were adopted before 2000.

ii. Non-fiscal incentives

Non-fiscal incentives to encourage investment in renewable energy include traditional policy instruments already used in the promotion of investment in other sectors, such as financial incentives (e.g. loans at preferred rates and traditional grants and subsidies), risk reduction mechanisms (e.g. guarantee schemes) and business facilitation measures. In addition, the unique specificities of the low-carbon transition have led to the development of more targeted, more complex policy instruments designed specifically to facilitate the deployment of renewable energy technologies. These new investment promotion tools include tariff-based instruments, auctions and quota-based instruments (discussed later).

Grants and subsidies are the most common investment promotion instrument among traditional investment incentives. They can partially address the issue of high upfront cost associated with renewable energy projects. They are particularly favoured by developed countries. They are mentioned in the majority of the renewable energy policies that include investment promotion provisions in LDCs (figure 6). Loans, however, are not commonly used in investment promotion policies for renewable energy. In fact, only 16 per cent of developing countries and 13 per cent of developed countries use them.

Figure 6: Non-fiscal incentives in renewable energy policies, by type and country group (Per cent of countries)



Source: UNCTAD, based on Climate Change Laws of the World database.
Note: The graph covers laws adopted during the period 2000–2022, and amendments of laws that were adopted before 2000.

Guarantee schemes include financial guarantee schemes and other "in kind" type of guarantees, such as priority access to the grid, or industrial guarantees on the availability of network or spare parts for the renewable energy sector. Due to the intermittency of renewable energy sources such as solar and wind, priority access to the grid, in particular, is a key element to foster investment in the deployment of such technologies. Guarantee schemes are popular among developed countries (60 per cent of them have adopted at least one such scheme), but less utilized in developing countries (32 per cent) and LDCs (40 per cent).

Business facilitation of renewable energy projects encompasses measures such as simplifying registration and licensing processes, providing easier access to land, and streamlining town planning authorizations. In addition to these measures, business facilitation may also involve the creation of specific tools to support renewable energy projects such as national-level solar, wind, or geothermal resource maps. Business facilitation instruments are employed in developed (45 per cent) and developing countries (34 per cent), but their use is slightly less prevalent in LDCs, where only 30 per cent of LDCs included them in their promotion policies for renewable energy (see figure 6).

FITs were the first targeted incentive developed specifically to promote investment in renewable energy (see box 3). They offer guaranteed payments and have a longer-term perspective, which significantly reduces uncertainty about the return on renewable energy investments. They have led to the establishment of hundreds of MWh from renewable sources across the world. Policymakers have reformed FITs over the years to make them more efficient and more responsive to technology changes and market prices, and to decrease their impact on public finance. While the success of these instruments varies from country to country and on policy design (see policy examples in box 4), they have been widely implemented (in at least 106 countries) as a means of promoting adoption of renewable energy.

Box 3: Feed-in tariffs

Feed-in tariffs (FITs) are a mechanism implemented by governments to incentivize the deployment of renewable energy. They rely on a promise: they ensure renewable energy producers that their electricity will be bought at a predefined price over long periods. This triple guarantee — certainty of sale, price and duration — reduces project risk and encourages project developers. To give an example, a government will commit to buy all wind power produced in its country for $0,15/kWh over a period of twenty years.

To define an optimal FIT scheme, policy makers need to take different elements into account:

1) Finding the right tariff level is a crucial step. If it is too low, the financial incentives will not convince project developers to invest. If it is too high, society will have to bear an unnecessary cost. The optimal price is usually based on an estimation including investment costs, grid connection costs, operation and maintenance costs, interest rates for the invested capital and profit margins for the investors. The tariff level is often *degressive*, meaning that it will decline each year according to a fixed percentage. This allows to take into account the expected decreasing costs of technology and to make sure that companies do not delay their investments (Alizamir, de Véricourt and Sun, 2016). In some cases, the subsidy consists of a payment rewarding the production of renewable energy which is added to the electricity market price: this system is known as *feed-in premiums*. The latter offer less certainty than classic FITs, given the fluctuation of the electricity market.

2) Efficient FITs are technology-specific. This helps targeting the type of renewable energy which should be developed, but also integrating the variations in terms of costs implied by each technology.

3) Determining who bares the extra cost of feed-in tariffs can impact the policy's outcome. The national context plays an important role here. The possibility of charging the extra cost directly to users in developing countries, for example, is rather limited.

4) The contract duration is a key factor for profitability. FIT schemes can run from five to twenty years, though the majority last over fifteen years.

5) Reducing the administrative burden, like facilitating the delivery of permits and authorizations, helps improving the results of FITs.

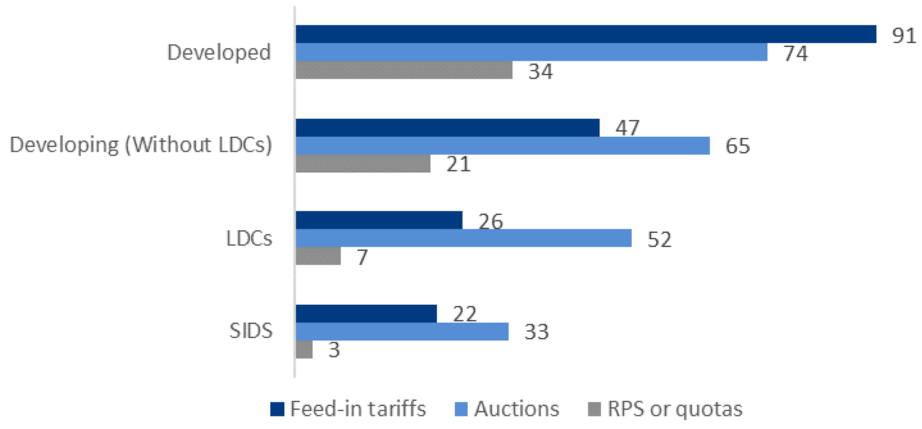
After having dominated renewable energy policies in the 2000s, FITs were criticized for their high cost and the lack of control over the quantity of renewable electricity produced they imply. Nonetheless, some developing countries are still adopting them with success. Between 2012 and 2017, for instance, the Philippines multiplied its solar, biomass and wind energy capacity by eight thanks to feed-in tariffs (Guild, 2019) (see box 3).

Source: UNCTAD

FITs have been particularly popular among developed countries, featuring in over 90 per cent of them. Yet, tariff-based instruments do not address the challenge of the high upfront costs associated with renewable energy projects and, depending on their features, can be relatively expensive for countries that have limited fiscal space, which explains why developing countries use FITs less frequently. Less than 50 per cent of developing countries, only 26 per cent of LDCs and only 22 per cent of SIDS have put FITs in place (figure 7). Indeed, smaller countries have often focussed instead on promoting the development of renewable energy production units at the household or small company level. SIDS, for instance tend to favour net-metering and net-billing schemes (box 5).

Figure 7: Use of feed-in tariffs, auctions and quota-based instruments, by country group, 2005–2022

(Per cent of countries)



Source: UNCTAD

Box 4: Feed-in tariffs: policy examples and key lessons

In 2000, *Germany* introduced the Renewable Energy Act, a FIT policy offering all producers of renewable energy an above-market fixed price for a twenty-years period. The first beneficiaries of this program saw it ended in 2021. The impact on renewable energy production was important: between 2000 and 2021, the share of renewable energy in electricity consumption rose by 35 per cent (ZSW, 2022). But in the late 2000s, as the production costs of photovoltaic systems decreased, the policy started to appear particularly expensive. Germany decided to reform the Renewable Energy Act and, since 2017, only small facilities under 100 kW have kept on benefiting from the FIT, while large renewable energy producers are subject to auctions (Sutton, 2021).

In 2009, *South Africa* established a renewable energy FIT scheme. Initially, the National Energy Regulator of South Africa developed a sector-specific project that ensured rates for 15 years, with tariffs that would decrease annually. To determine the project's feasibility, public hearings were held with prospective investors, who indicated that the incentives were insufficient, resulting in an increase in the tariffs and a lengthening of the guaranteed period to 20 years. Despite these adjustments, the FIT scheme was never put into effect and was replaced by auctions after two years. According to critics, tariff rate uncertainty, bureaucratic delays, and conflicting messages from various government bodies resulted in an atmosphere of policy uncertainty that led to the scheme's demise (Pegels, 2014).

Despite a decreasing interest for FITs in the 2010s, several countries continued using them.

The Philippines, for instance, adopted FITs in 2012 with impressive results. Five years after the start of the programme, the country's capacity in solar, biomass and wind energy had been multiplied by eight. This success shows that policy design and implementation are as crucial as rates. Indeed, project developers give a lot of importance to factors such as administrative processing times, grid access and legal security (Lüthi and Prässler, 2011; Lüthi and Wüstenhagen, 2012). The Government of the Philippines followed a list of best practices, by adopting a long-term framework and associating feed-in tariffs with financial incentives. The extra cost implied by FITs was put on the consumers (Guild, 2019).

Source: UNCTAD

Box 5: Net-metering and net-billing in small island developing States

For the last ten years, SIDS have privileged net-metering and net-billing instead of feed-in tariffs to promote renewable energy production. At least 44 per cent of them have adopted these schemes, and up to 62 per cent for SIDS located in the Caribbean region (Kersey, Blechinger and Shirley, 2021; REN21, 2021). These policies seek to incentivize citizens to adopt their own units of renewable energy production, by providing guarantees.

With net-metering, households upload their electricity surplus into the grid, and when they do not produce enough electricity, they are able to take some from the grid. In other words, the grid is used as a free energy storage. At the end of the year, the power utilities check the balance. If the household has produced more than it has consumed, the balance is paid at the retail electricity tariff. If the household has consumed more than it has produced, it has to pay the difference.

With net-billing, households with electric capacity production are also connected to the grid, but the electricity price change according to the demand. When the electric utilities face a high demand, they are ready to buy households' production at a higher price than when the demand is low. This system gives households the incentive to produce a surplus when the global demand is high, and to consume when the demand is low (IRENA, 2019b).

By targeting households and promoting the development of small-scale renewable energy production, net-metering and net-billing are particularly adapted to SIDS' unique characteristics.

Source: UNCTAD

Another policy tool designed specifically to foster investment in the deployment of renewable energy is the renewable energy auction (see table 1). Since the 2010s, auctions have boomed in popularity because they are both cost-efficient and adaptable to different economic contexts. They are used in all continents, independently of countries' development levels, and have helped to lower renewable energy prices.

The purchase power agreement and other non-financial incentives resulting from the auctions offer a long-term guarantee on price and sales that incentivizes investors to participate. For policymakers, however, the complexity of auctions lies in their design and organization, which are crucial to their success. The design should include factors such as the auctioned volume, qualification requirements for bidders, auction format and site selection. These factors will depend on a government's policy goals and on country characteristics. It is not uncommon for countries to require multiple auction rounds to achieve an optimal design, as policymakers must bypass several pitfalls when designing an auction, such as undersubscription, underbidding, delays and underbuilding (see policy examples in box 6).

Auctions have become the main mechanism for increasing renewable energy capacity worldwide, with at least 125 countries holding auctions over the last decade. Three quarters of developed countries and two thirds of developing countries have held renewable energy auctions; the shares are lower for LDCs (52 per cent) and SIDS (33 per cent) (see figure 7). The complexity of designing and holding auctions may explain the lower prevalence in these countries.

A third policy instrument specifically designed to foster investment in renewable energy is the combined use of quotas, also referred to as renewable portfolio standards or renewable purchase obligations, and renewable energy certificates, which are mechanisms to certify the origin of the renewable energy (see box 7). Companies can then sell these certificates, which should, in theory, provide a bonus in revenue to renewable energy producers. Renewable portfolio standards policies are typically complex to administer. Although they are used by one third of developed countries, their adoption has been more limited in developing countries (21 per cent), LDCs (7 per cent) and SIDS (3 per cent) (see figure 7).

Box 6: Examples of renewable energy auctions in SIDS and LDCs

Maldives has held several auctions between 2014 and 2022, managing to convince project developers over time. In 2014, an auction aiming to create 1.5 MW of solar capacity attracted only four bidders, resulting in high electricity prices. Six years later, an auction for a 5 MW project attracted 25 project developers, leading to a drop in the price by 50 per cent. In 2022, an 11 MW solar project attracted 63 investors and resulted in one of the lowest tariffs ever achieved in SIDS. Investors have been convinced by the risk mitigation package supported by the World Bank, which includes guarantees, a currency convertibility clause and payment security (Chen, Jain and Stolp, 2023).

Uganda launched its first solar photovoltaic auction in 2014, for a total capacity of four 5 MW facilities. Based on qualification requirements, 7 of the 23 companies that expressed interest were allowed to submit bids. Site selection was left to project developers, with the condition that the power stations would be within 3 km of the grid. Moreover, if the project was located in a set of predefined priority zones, the application would be granted more points in the evaluation. Different penalties were defined for cases of delays and underperformance. This sealed-bid auction was supported by international development partners, which committed to paying part of the electricity price. Consequently, the four winners of the auction had two contracts: a power purchase agreement of 20 years in dollars with the State-owned utility company and a premium payment contract in euros signed with the German Development Bank. Uganda also benefited from European Union support, from the development of standardized documents to the payment of the tender agent that conducting the auction (IRENA, 2018). The winning bid was $163.7/MWh – lower than the average retail tariff in 2013, but more than double the results achieved in Ethiopia, Namibia, South Africa or Zambia (Kruger, Eberhard and Swartz, 2018).

Zambia was the first African country to take part in the Scaling Solar Programme, which includes multiple guarantees and technical support. Led by the World Bank, this programme aims to develop large solar power plants through auctions. In 2015, the country signed off on two projects representing a total capacity of 88 MW generated through solar photovoltaic power (IRENA, 2019). The Scaling Solar Program has benefited other countries in Sub-Saharan Africa, such as Ethiopia, Madagascar and Senegal. In 2019, Zambia awarded 120 MW of capacity for a solar photovoltaic project. This tender achieved a low-price record for Sub-Saharan Africa. It is worth noting that the auction did not define the location of the operating site, nor did it finance the connection to the grid (Parnell, 2019).

Source: UNCTAD

Box 7: Quotas and renewable energy certificates (RECs): key policy aspects

Some governments have adopted a system of quotas and certificates to control the quantity of renewable energy produced. Accordingly, authorities set goals in terms of renewable electricity and the involved entities develop strategies to meet them, either by producing renewable energy themselves or by delegating this task.

A system of tradable certificates, commonly known as renewable energy certificates, helps companies or electricity suppliers proving that they respect quotas. Knowing that there is a demand, companies specialized in renewable energy production are incentivized to develop new capacity. For each MWh of renewable energy produced and delivered to the grid, they will receive a certificate, which can be sold. They usually have two sources of revenue: the sale of electricity itself at market price and the sale of the certificates. The difference between the two covers the extra costs implied by renewable energy production and allows profits.

This system follows a market mechanism. The prices of electricity and of certificates fluctuate, meaning that actors have less certainty. If there is too much offer, the certificates will see their prices decrease, leading inefficient producers to cease their activity. If there is too little offer, the certificates will see their prices increase, inviting renewable energy producers to invest.

In this picture, governments usually play the role of regulators. They try to develop the best system of certificates by playing on different factors:

1) The non-respect of the quotas usually involves *penalties*. It is the fear of having to pay these fines which motivates the purchase of certificates. The latter are logically less expensive than penalties. The design of penalties plays an important role on the policy’s efficiency.

2) The *organisation of the certificates system* is key. Policymakers need to ensure that certificates are traceable and forgery-proof. To avoid double counting, certificates can usually only be sold once. They also have a fixed validity period, commonly one year, ensuring that the system remains dynamic. The optimal policy facilitates both the production and the trading of these certificates.

Since their creation, quotas have been introduced in at least 41 countries, often in combination with a renewable energy certificate system. While they have been popular in developed economies, developing ones have also adopted them. These include Bolivia, China, Ghana, the Islamic Republic of Iran, Senegal, Sri Lanka and the United Arab Emirates, among others.

RECs do not necessarily come with obligations. The European Union, for example, launched in 2001 the Guarantees of Origin certificates. Their purchase is entirely voluntary and, nonetheless, they have been widely sold. Thanks to them, private companies can prove their efforts in achieving clean energy goals. Similarly, citizens buy these certificates to show their commitment to the energy transition.

RECs are still attracting policymakers' attention. To support its efforts to reach a share of 35 per cent of clean energy in its electricity mix by 2024, Mexico adopted in 2018 a combined system of quotas and market of certificates: Certificados de Energías Limpias (CEL). CEL must be bought by large electricity consumers and electricity suppliers to prove that they respect the imposed quotas. From a 5 per cent quota of clean electricity set for 2018, the share gradually increases up to 13.9 per cent in 2022. The Energy Regulatory Commission verifies the compliance of obliged entities and may impose fines. In this programme, the accepted energy is not limited to wind, solar, hydro, wave, geothermal and biomass power, but also include nuclear and efficient cogeneration. According to official data from Sener, 29 per cent of the electricity generated in 2022 in Mexico was from a clean source.

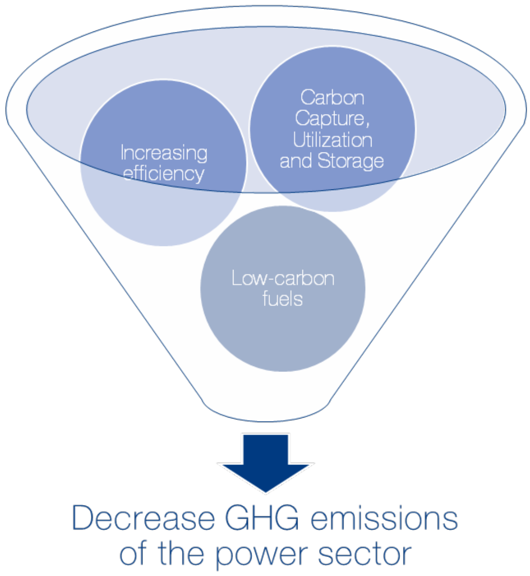
Source: UNCTAD

2. Clean energy – new technologies and complex policies

Besides the need for significant investments in renewable energy, a rapid transition to low-carbon energy also requires parallel investments for greening existing and future fossil fuel power plants. Indeed, despite the expansion of renewable energy, thermal generation remains the primary source of both electricity and heat worldwide (IEA, 2021b) and new thermal capacity is still being built around the world every year. Thermal power plants will still have useful technical lives, even in a time when countries should have already reduced their use of fossil fuels to comply with climate targets. In emerging economies, 83 per cent of these power plants are expected to remain technically useful in 2030, and 61 per cent in 2040, in light of recent investments (IEA, 2021b).

In this context, while ultimately the objective is to phase out fossil fuels, it is important to include thermal power plants into the low-carbon transition and consider a mix of technologies to reach global energy and climate goals. To decrease greenhouse gas emissions from fossil fuel plants, three main levers can be considered: increasing their efficiency, developing CCUS technologies, and using cofiring and low-carbon fuels (figure 8).

Figure 8: Key aspects of the clean energy transition of the power sector



Source: UNCTAD

a. Increasing the efficiency of fossil fuel power plants

Several technologies can increase the efficiency of fossil fuel power plants by reducing the amount of fuel required to generate a given amount of electricity, which can lower costs and decrease greenhouse gas emissions. One of them is combined heat and power (CHP) technologies. CHP technologies, also known as cogeneration, produce both electricity and heat. They capture the heat that is usually released into the environment in traditional power plants and use it for other purposes. CHP technologies are very efficient. For example, in the United States, the average efficiency of fossil-fueled power plants is 36 per cent. In comparison, CHP technologies can achieve energy efficiency levels of up to 90 per cent.[3]

[3] These number comes from the US Environmental Protection Agency (https://www.epa.gov/chp/chp-benefits#:~:text=By%20recovering%20and%20 using%20heat,achieve%20efficiencies%20approaching%2090%20percent, accessed on 16 March 2023). EPA uses the “total system efficiency” to calculate CHP efficiency: the total electricity and useful thermal energy output of the system divided by the fuel used to produce the electricity and useful thermal energy.

Despite the theoretical benefits and the maturity of CHP technologies, investment in their deployment is still limited. The first European Union Directive on the promotion of cogeneration has been adopted in 2004. However, the share of CHP in total electricity generation has been relatively stable since 2005 (11 per cent in 2005 and 12 per cent in 2019). [4] Indeed, although CHP technologies were encouraged in several European countries, promotion mechanisms often proved little effective, as the prices of certificates of origin were kept at relatively low levels (Stoltmann et al, 2019). Other barriers remain, such as the lack of district heating networks,[5] access to the grid, especially for smaller projects, low demand for heat, and high upfront costs. The adoption of CHP technologies has been considerably slower in developing countries, except for larger countries like China and India (box 8).

Box 8: Examples of policies to promote CHP technologies

China's 14th Five-Year Plan prioritized energy security and decarbonization in its energy strategy. Since the 2000s, cogeneration has been a significant aspect of China's energy policy, and the country has a well-established district heating system. However, China's district heating system still primarily relies on coal-based cogeneration power plants, which have caused significant environmental problems, particularly in terms of air quality. Consequently, China has focused its efforts on promoting efficient gas-based cogeneration power plants and developing nuclear-based cogeneration units. The country's nuclear development policy emphasizes the development of small and micro nuclear units, which facilitate cogeneration and the use of nuclear energy for heating. In 2022, Haiyang became the first Chinese city to benefit from a nuclear-based district heating system (1).

In 2004, *the European Union* issued a directive to promote cogeneration (2). This directive mandates member States to publish a cogeneration report every four years. In 2012, the European Union's Energy Efficiency Directive was introduced, which requires member States to encourage the use of highly efficient cogeneration technologies and to conduct energy efficiency assessments of CHP systems. The directive also stipulates that European Union member States ensure the traceability of electricity generated from high-efficiency cogeneration through guarantees of origin (3).

In 2017, *Greece* introduced feed-in premiums to combined heat and power plants through tenders.

In 2020, *Poland* introduced financial incentives for high-efficiency power cogeneration, in the form of premiums paid to producers of electricity from cogeneration units.

In *the United States*, the promotion of CHP technologies has been facilitated through a variety of policies and regulations at both the Federal and State levels. These policies include loans, grants, feed-in tariffs, production incentives, and tax incentives. Some States have also implemented CHP Portfolio Standards in the past decade, which require utilities to generate a certain percentage of their electricity from CHP systems. More recently, the Inflation Reduction Act, enacted in 2022, provides a 30 per cent investment tax credit for CHP projects that begin construction before January 1, 2025.

Source: UNCTAD based on IEA/IRENA Global Renewable Energy Policies and Measures Database and (1) http://french.peopledaily.com.cn/n3/2022/0411/c96851-10082319.html; (2) https://eur-lex.europa.eu/leg al-content/EN/ALL/?uri=CELEX:32004L0008; (3) https://energy.ec.europa.eu/topics/energy-efficiency/cogeneration-heat-and-power_en

[4] Eurostat data on Combined Heat and Power 2005-2019 (https://ec.europa.eu/eurostat/web/energy/data, accessed on 16 March 2023).
[5] District heating is a system for supplying heat to residential and commercial buildings for space heating and water heating needs, utilizing a network of insulated pipes to distribute heat generated from a centralized location.

b. Carbon capture, utilization and storage

CCUS technologies involve capturing CO2 from large point sources, such as industrial or power generation facilities that use fossil fuels or biomass, or directly from the atmosphere. Once captured, the CO2 is compressed and transported by pipeline, rail, ship, or truck for various applications or injected into deep geological formations, such as depleted oil and gas reservoirs or saline formations, for permanent storage. CCUS technologies can be retrofitted in existing fossil fuel power plants and can become critical to achieve global climate goals, while also ensuring universal energy access.

CCUS technologies deployment is fairly recent, and to achieve net zero by 2050, investment in CCUS technologies needs to be scaled up. In 2022, according to the IEA, there were only around 35 commercial facilities applying CCUS to industrial processes, fuel transformation and power generation. However, in recent years, there has been a significant increase in momentum, with approximately 300 CCUS projects at various stages of development throughout the CCUS value chain. More than 200 new capture facilities are expected to become operational by 2030, capturing over 220 million tons of CO2 annually. Despite this fast progress, at current levels, CCUS deployment would still fall well short of what is required to achieve the net zero scenario (IEA, 2022a). In addition, it should be noted that CCUS is not yet mature technology and negative environmental impact can also arise from the use of CCUS in combination with traditional fuels. When CCUS technologies are added to a thermal power plant, more energy is needed to generate the same amount of electricity, which can lead to increased environmental damage throughout the value chain, such as methane leaks and other forms of environmental degradation (UNEP, 2016).

Promoting the development and deployment of CCUS technologies requires a regulatory framework that addresses the entire value chain. This framework should include legal and regulatory measures to ensure safe and secure CO2 storage, protection of public health and the environment, and effective management of CCUS activities through the whole value chain (e.g. capture, transport, use and long-term storage). Laws and regulations must be put in place to clarify the rights and responsibilities of CCUS stakeholders, particularly in long-term storage resource management (IEA 2022b). Such policies will provide certainty to investors, build public confidence, and increase acceptance of this technology.

While several countries have already developed comprehensive legal and regulatory frameworks for CCUS, these efforts have largely been limited to developed economies (e.g. Australia, Canada, Norway, the United States, and the European Union), with some notable exceptions in developing countries (e.g. China, Singapore). So far, governments have adopted a mix of regulations (e.g. CO2 emission limitation, carbon pricing) and promotion instruments (e.g. R&D and investment incentives) to foster the deployment of CCUS (box 9).

Box 9: Examples of policies to promote CCUS technologies

In 2017, *China* established technology targets focused on achieving cost-effective large-scale CCUS, with its Special Program Plan for Scientific and Technological Innovation to Address Climate Change, part of the 13th Five-Year Plan. It aimed to bolster the global competitiveness of China's low-carbon industry and reach its emissions peak by 2030.

In 2021, *Australia* launched a program worth AUD 250 million to deploy CCUS technologies at scale. The CCUS Hubs and Technologies program aims to enhance Australia's CCUS capabilities by promoting collaborations between domestic and international researchers and reducing the cost of technology adoption.

In 2021, *Singapore* created the Low-Carbon Energy Research Funding Initiative, which aims to develop low-carbon energy technologies in hydrogen and CCUS, to support the decarbonization of the power and industry sectors.

In 2021, *Sweden* announced subsidies to players investing in bio-CCS facilities, the process of capturing, separating and storing CO2 from renewable sources. The first reversed auction is planned for 2023.

In 2022, *Canada* implemented an investment tax credit for CCUS, including direct air capture projects and equipment for transportation, storage and use.

In 2022, the *United Kingdom* published the "Carbon Capture, Usage, and Storage (CCUS): Investor Roadmap", which outlines key opportunities for investment in CCUS in the country. Additionally, the United Kingdom has implemented an R&D policy to foster innovation in the sector. The CCUS Innovation 2.0 program is a funding initiative worth £20 million aimed at reducing the expense of capturing and storing CO2 in the country. The programme intends to showcase and mitigate the risks of next-generation CCUS technologies, allowing for their commercial deployment from 2025. It also aims to decrease the cost of deploying CCUS and create competitive pressures on existing technologies.

In 2022, *the United States*' Inflation Reduction Act modified and extended to January 2033 the existing federal tax credit (named 45Q) that rewards companies for each ton of carbon dioxide that has been securely stored geologically in approved reservoirs and aquifers.

Source: UNCTAD based on IEA/IRENA Global Renewable Energy Policies and Measures Database

c. Cofiring low-carbon fuels

Co-firing techniques, which involve mixing a low-carbon fuel (such as sustainable biomass and waste, low-carbon hydrogen, or low carbon ammonia) with the fossil fuel in a power plant, have made significant progress in recent years. [6] The transition of fossil fuel power plants to low-carbon fuels combustion and cofiring can therefore be an important tool for decarbonizing the power sector while utilizing existing assets and their related infrastructure. To achieve decarbonization at larger scale, however, the price and the GHG emission of these low-carbon fuels must decrease further and for that, investment in low carbon fuels need to increase further. Indeed, while hydrogen is always low carbon in its usage, it is not always low carbon in its production (box 10).

In order to promote investment in green hydrogen, a country needs to promote the development of both the necessary infrastructure for producing, storing and transporting hydrogen, as well as the production facilities themselves. The adoption of a dedicated strategy can be a tool to address these inter-related aspects. Since Japan introduced the first national hydrogen strategy in 2017, 45 countries around the world have implemented a national hydrogen strategy or roadmap, as of February 2023 (figure 9), including 18 member States of the European Union, 9 Latin American and Caribbean countries, 4 African countries, and 9 countries in the Asia-Pacific region.

[6] Co-firing of up to 20 per cent of ammonia and over 90 per cent of hydrogen has been achieved at small power plants. Low-carbon ammonia (NH_3) is produced by using hydrogen (H_2) from water electrolysis and nitrogen separated from the air. These are then fed into the Haber process (also known as Haber-Bosch). The ammonia is green when it is produced with low-carbon hydrogen and the Haber process powered by sustainable energy.

Box 10: The "colours" of hydrogen

Green hydrogen is produced from renewable energy sources through a process called electrolysis, which involves splitting water into hydrogen and oxygen using an electric current. Since the electricity used to trigger the chemical reaction comes from renewable sources, green hydrogen is considered a clean fuel with no emissions during the production process.

Black or brown hydrogen is produced using black coal or lignite (brown coal). The gasification of coal, the method used to produce black hydrogen, is a very polluting process, as both CO2 and carbon monoxide are produced as by-products and released into the atmosphere. It is the most environmentally harmful type of hydrogen.

Grey hydrogen is produced from fossil fuels, usually natural gas, through a process called *steam methane reforming*. The term "grey" refers to the fact that this process produces large amounts of carbon dioxide, released into the atmosphere.

Blue hydrogen is produced using the same process as grey hydrogen, but with the addition of CCUS technology to capture the carbon dioxide emissions and store them underground. While blue hydrogen is sometimes considered as an important transitional fuel that can help reduce emissions, greenhouse gas emissions from the production of blue hydrogen are far from insignificant, particularly due to the release of fugitive methane, a powerful GHG.

Purple hydrogen is produced from nuclear energy sources through a process called high-temperature electrolysis.

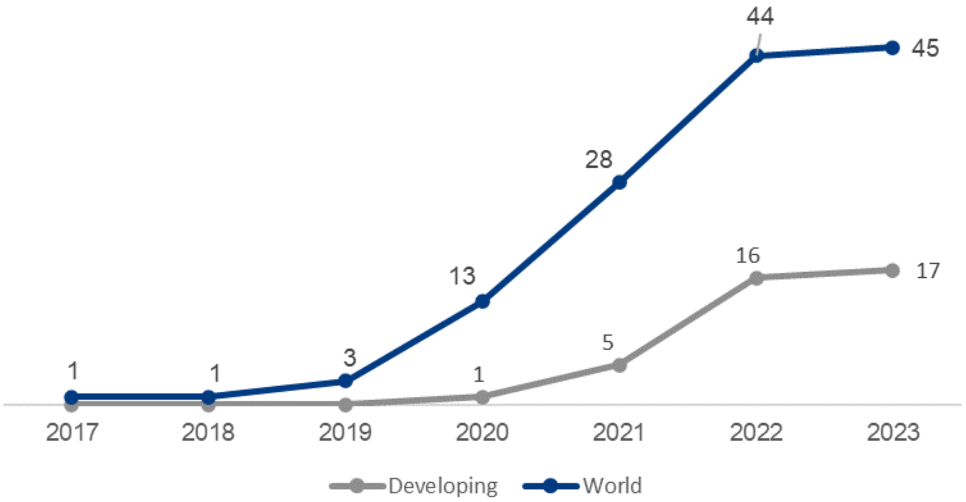
Pink hydrogen is produced through the same electrolysis processes as green hydrogen, but the electricity used in the process comes from nuclear power plants.

White hydrogen is the naturally occurring hydrogen in underground deposits. Identified deposits are still very limited and there is no strategy to exploit them at present.

Source: UNCTAD

Figure 9: Countries that have adopted a national strategy for hydrogen

(Number of countries)



Source: UNCTAD

3. Fossil fuel subsidies: a disincentive to clean energy investment

Countries adopt fossil fuel subsidies for a variety of reasons, including job creation, economic growth, energy security, consumer benefits, and political and strategic interests. By artificially lowering the cost of producing and consuming fossil fuels, subsidies make such fuels more appealing to consumers and investors. This, in turn, makes it more challenging for renewable energy sources to compete to attract investment, particularly when they do not receive the same level of support.

Fossil fuel subsidies also create an incumbent advantage, reinforcing the position of fossil fuels in the electricity system (IISD, 2014). While recognizing the economic, social and political complexity of such reform, phasing out these subsidies can help increase investment in renewable energy. In recent years, fossil fuel subsidies represented on average about half a per cent of world GDP, and up to 1 per cent of GDP in developing countries (for some countries, up to 7 per cent of GDP)[7]. Phasing them out and redirecting those funds to support renewable energy can therefore make clean energy a more viable option. Finally, reducing these subsidies can also send a clear signal to the market that governments are committed to transitioning to a low-carbon economy and to attracting investment in the renewable energy sector.

Despite reiterated commitments on major international forums to discontinue these inefficient subsidies (box 11), the global level of support in 2021 remained similar to that of 2010, totalling over $500 billion.[8] In 2022, according to IEA estimates, global fossil fuel subsidies doubled from the previous year to an all-time high of $1 trillion (IEA, 2023). This is almost eight times the amount of global subsidies granted to renewable power generation technologies in 2017, as estimated by the International Renewable Energy Agency (IRENA) (Taylor, 2020).

Box 11: Key international commitments on fossil fuel subsidies reduction

United Nations Sustainable Development Goals (SDGs): In 2015, the United Nations included fossil fuel subsidy reform as part of its sustainable development agenda. SDG 12.c calls for countries to "rationalize inefficient fossil fuel subsidies that encourage wasteful consumption".

Paris Agreement: The Paris Agreement, adopted in 2015, includes a commitment to "making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development." This commitment includes the phase-out of fossil fuel subsidies.

The recent **United Nations Climate Change Conference** COP27 in Sharm El-Sheikh reiterated a commitment made at the COP26 held in Glasgow in 2021, where a number of countries and organizations agreed to reduce fossil fuel subsidies. The Glasgow Leaders' Declaration on Clean Energy Transitions, signed by over 100 countries, includes a commitment to "accelerate action to phase out inefficient fossil fuel subsidies that encourage wasteful consumption and increase emissions." The declaration also calls for increased funding for the clean energy transition in developing countries.

In addition, **the G7 and G20** have made several statements regarding the reduction of fossil fuel subsidies. Among them, in 2015, G7 leaders committed to "phase out and rationalize over the medium-term inefficient fossil fuel subsidies that encourage wasteful consumption". In 2009, G20 leaders reiterated that commitment, "recognizing the need to support the poor", and in 2019, G20 leaders acknowledged "the need for transitioning to a low-carbon economy, and the importance of phasing out inefficient fossil fuel subsidies."

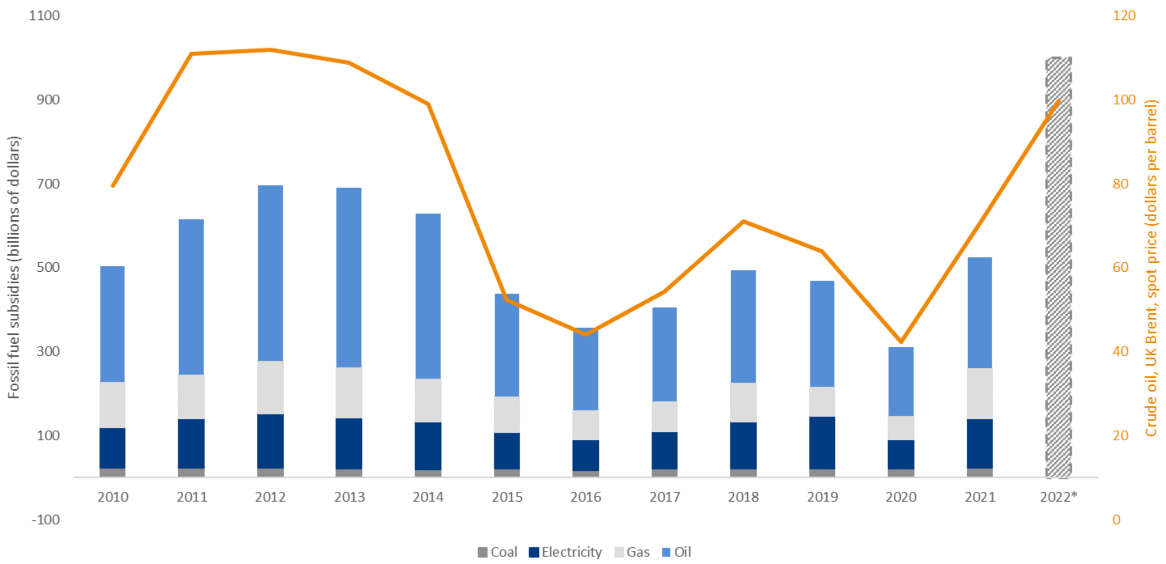
Source: UNCTAD.

[7] UNCTAD computations based on data from FossilFuelSubsidytracker.org
[8] According to the IMF, this figure rises to almost $6 trillion (or 6.8 per cent of world GDP), if the hidden costs of fossil fuels, including their impact on air pollution and global warming are taken into account (IMF, 2021).

Data on fossil fuel subsidies at the global level show that they are closely tied to the evolution of oil prices, rather than to deliberate policy decisions aimed at their reduction. The correlation is particularly strong for oil, electricity and gas subsidies, but less so for coal subsidies, which have remained stable throughout the period, hovering around $20 billion per year (see figure 10).

Figure 10: Global fossil fuel subsidies by type and the price of oil, 2010–2022

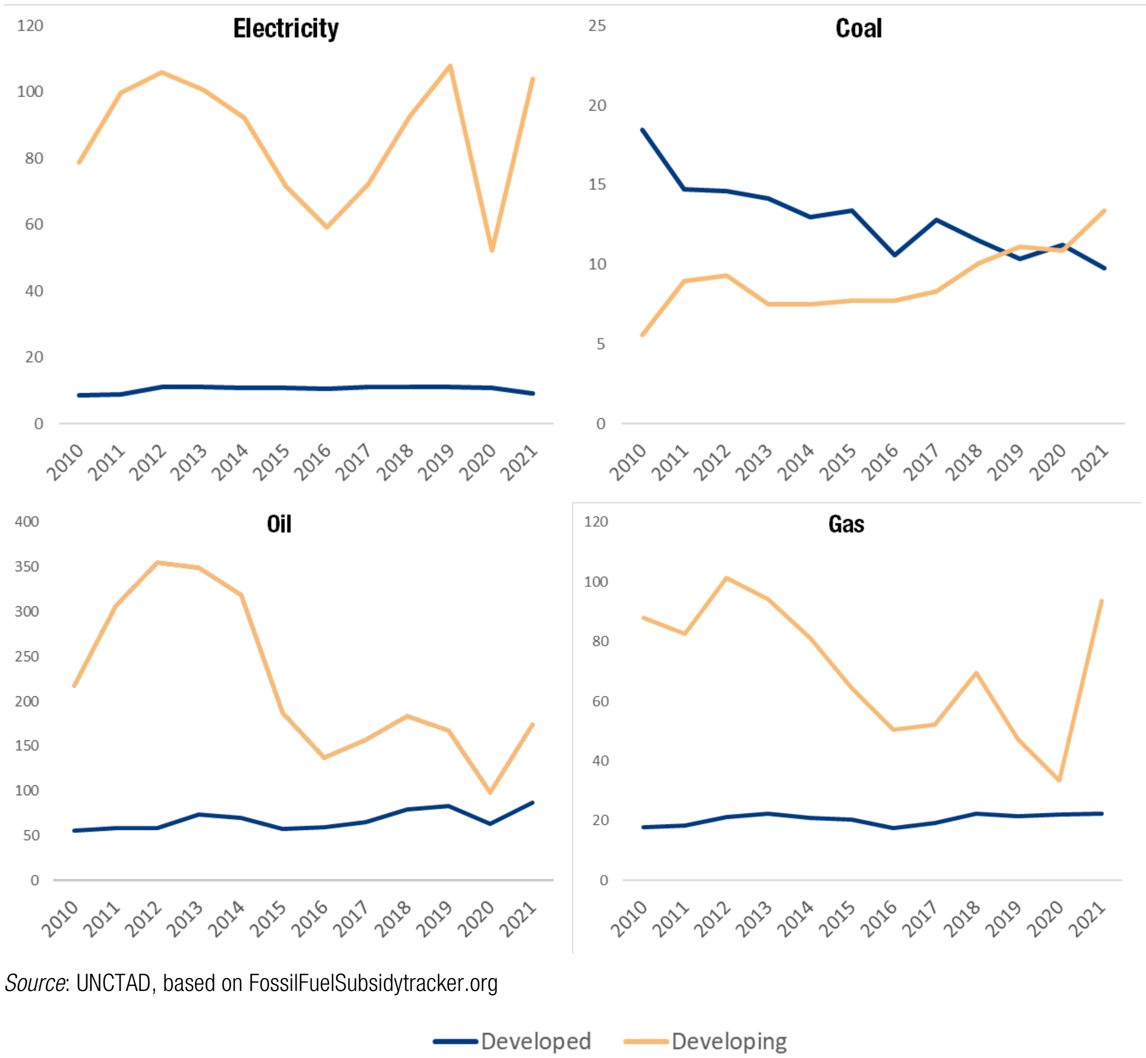
(Billions of dollars and dollars per barrel)



Source: UNCTAD, based on FossilFuelSubsidytracker.org
Note: *Estimate from IEA (2023)

Global trends mask the differences in the evolution of subsidies offered by developed and developing regions, and by type of fuel (figure 11). On average, developing countries account for over three quarters of world subsidies on oil, gas and electricity for end-user consumption of fossil fuel origin. However, while subsidies on oil have decreased significantly in developing countries, they have increased steadily in developed countries, almost doubling in volume between 2010 and 2021. Conversely, coal subsidies have declined steadily over the past decade in developed regions, dropping from $18.5 billion in 2010 to $9.8 billion in 2021, but more than doubled in developing regions, increasing from $5.6 billion in 2010 to $13.3 billion in 2021. The data for 2022 is not yet complete, but there is a likelihood that subsidies on gas in developed countries saw a substantial increase to offset the rise in prices during that year.

Figure 11: Fossil fuel subsidies in developed and developing economies, by type and region 2010-2021 (Billions of dollars)

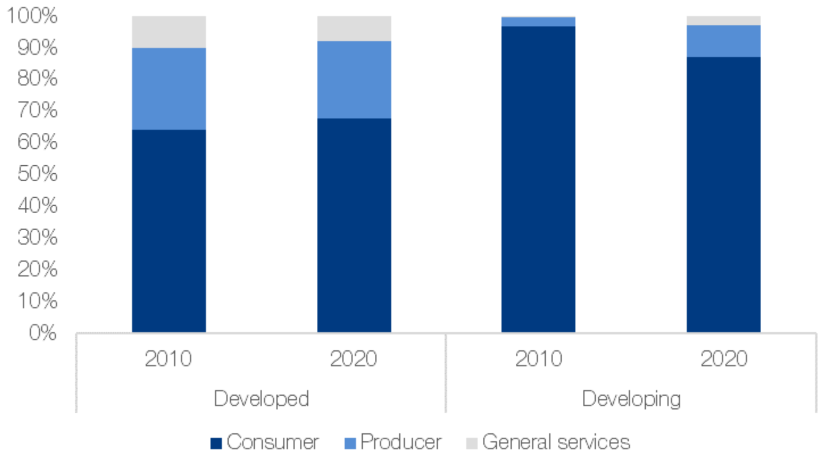


Source: UNCTAD, based on FossilFuelSubsidytracker.org

Data collected by the Fossil Fuel Subsidy Tracker initiative indicates that such subsidies also increasingly benefit producers rather than consumers. Although consumers remain the key beneficiaries of fossil fuels subsidies, their share in total subsidies has declined by 10 per cent between 2010 and 2020, while the share of producer subsidies has doubled in the same period (from 7 to 14 per cent). The record share of producer subsidies in 2020 may be due to the sudden and unexpected fall in demand for energy brought about by COVID-19 pandemic, which has spurred policymakers to consider financial assistance to fossil fuel companies in order to mitigate damage to the industry (Kotchen, 2021). The trend, however, started well before the pandemic, with alarming consequences on investment attractiveness.

Again, global trends obscure significant differences between countries at different levels of development. Notably, in developing countries, consumer subsidies have decreased from 97 to 87 per cent of the total between 2010 and 2020, while producer subsidies have increased from 3 to 10 per cent in the same period. Conversely, in developed countries, consumer subsidies have slightly increased their share of total fossil fuel subsidies from 2010 to 2020 (from 64 to 68 per cent), while producer subsidies have remained stable at around 25 per cent (figure 12).

Figure 12: Fossil fuel subsidies by beneficiary in developed and developing countries, 2010 and 2020
(Per cent)



Source: UNCTAD, based on FossilFuelSubsidytracker.org

Although there is universal agreement on the need to reduce or remove fossil fuel subsidies, it remains a complex policy issue, particularly in developing countries, which must overcome multiple competing interests and challenges:

- Dependence on fossil fuels: Many developing countries rely heavily on fossil fuels, both as a source of energy and as a revenue stream. Reducing or removing subsidies could result in a gap in energy supply as well as higher energy costs and a loss of export revenue, which may be difficult for governments to manage.
- Energy for all: Although studies show that fossil fuel subsidies are regressive by nature and benefit the wealthiest the most, subsidies can help make energy more affordable for low-income households.[9] Removing them could lead to an increase in energy poverty, which is a major concern for many developing countries.
- Short-term economic impacts: The International Labour Organization estimates that the transition to net zero brings substantial new opportunities for employment, but the new jobs may be in different locations or require different skill sets, thus calling for policies to minimize hardship and promote skills upgrading. Reducing or removing subsidies may also result in short-term economic impacts, such as job losses in the fossil fuel industry and higher energy costs for consumers and businesses. These impacts may be difficult for governments to manage and may lead to resistance to change.
- Political interests: The removal of subsidies may face opposition from large corporations, which may have significant political influence, as well as a vested interest in maintaining the status quo.

Nonetheless, according to the IEA, achieving net zero by 2050 will require the elimination of all fossil fuel subsidies in the coming years (IEA, 2021c). Hence, governments must navigate these challenges carefully and develop a well-thought-out plan for phasing out subsidies in a manner that minimizes negative impacts, is inclusive and supports the transition to a low-carbon economy in a just and cost-effective manner (WIR23).

[9] See, for instance, Moayed, Guggenheim and von Chamier (2021), or World Bank (2012).

4. Conclusion

UNCTAD's World Investment Report 2023 calls for urgent support to developing countries to enable them to attract significantly more investment for their transition to clean energy. UNCTAD's 8th WIF, which came to a close on 20 October, also called on public and private investors to play a pivotal role in reshaping the world economy and advancing the energy transition. Recognizing that policies and regulations have a key role to play in de-risking as well as incentivizing investment in the clean energy sector, the Forum generated insights and policy proposals for further discussions at COP28.

Investing in renewables and clean energy is hindered by a range of specific risks and challenges, leading to higher costs of capital, especially in emerging and developing countries. Factors such as the natural resources endowment, the quality of the regulatory environment, market size and maturity, and economic and political uncertainty determine the unique potential and risk profile of each country. While policymakers in all countries should ensure that the key policy determinants for the promotion of renewable and clean energy investment are addressed through a solid legal and regulatory framework, [10] the analysis in this Investment Policy Monitor has highlighted a number of additional policy lessons:

1. Developing countries and LDCs face specific challenges in the development and adoption of policies and strategies specific to renewable energy. When such policies exist, they typically lack a focus on the promotion of private investment. Similarly, in the case of clean energy technologies, efforts to develop comprehensive legal and regulatory frameworks have largely been limited to developed and large emerging economies.
2. The policy tools employed to promote renewable energy (summarized in table 2) are often not suited to country- and industry-specific situations. Developing countries and LDCs tend to rely more on generic promotion instruments, such as profit-based tax incentives, because of familiarity with those tools, their lower level of complexity and the fact that they do not require upfront expenditure of public funds. However, these instruments can be expensive in the long run (in terms of forgone government revenues), and their effectiveness in the promotion of renewable energy investment is often low because they do not directly tackle the key challenges for investors in the sector. Advanced economies tend to use more complex and targeted mechanisms to promote investment in the renewables and energy infrastructure sectors (e.g. feed-in tariffs and auctions). The choice of the investment promotion instruments employed needs to take into account country, location as well as technology-specific criteria, including factors such as market size, regulatory capacities, and infrastructure gaps, which are critical for selecting the appropriate promotion tools for derisking investments and fostering their deployment.
3. Despite reiterated commitments to discontinue inefficient fossil fuel subsidies, the global level of support has reached record levels, and increasingly benefits fossil fuel producers. These subsidies are detrimental to climate change mitigation in and by themselves, and they are also a factor holding back renewables investment in some countries. They affect the incentive for firms to invest in clean energy, and they weigh heavily on government resources to support energy transition investment. Reallocating resources currently devoted to supporting traditional fossil fuel technologies can facilitate the adoption of targeted policies and regulations for promoting clean energy.

To address the above challenges and promote a balanced approach that considers all three objectives of the energy transition – meeting climate goals, providing affordable energy for all and ensuring energy security – the World Investment Report 2023 puts forward a Global Action Compact for Investment in Sustainable Energy for All. The compact recognizes the need to find an equilibrium in investment and energy policymaking between many

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[10] See, in this regard: "Promoting Sustainable Investment in Renewable Energy for Global Economic Recovery", an Issues Paper jointly prepared by the Indonesian Presidency of the G20 and UNCTAD to facilitate the discussions at the 2nd G20 Trade, Investment and Industry Working Group Meeting, 6-7 July 2022, Solo, Indonesia.

alternative approaches and proposes six action packages covering national and international investment policymaking; global, regional and South–South partnerships and cooperation; financing mechanisms and tools, and sustainable finance markets.

Table 2 Investment promotion instruments for renewable energy investment: pros and cons

Policy instrument	Use by developed economies	Use by developing economies	Main Pros	Main Cons
Tax incentives	••	•••	• Can be tailored to meet specific policy goals. • Familiar to private companies, who know how they work and are used to them	• Foregone tax revenue • Can be difficult to administer and keep track of • Limited effectiveness if other factors such as regulatory uncertainty persist
Feed-in tariffs	•••	•	• Reduce risks by ensuring revenue stream to investors • Encourage deployment of not yet mature technologies by providing guaranteed payments • Can promote large and small renewable energy power plants, targeting both large companies and households	• Limits incentives for producers to compete on cost • Can lack flexibility to adapt to changes in technology • Can be a burden for public finance if the States supports the cost and can increase the electricity cost if consumers support the cost • Administrative burden in the long run • Limited control over the quantity of energy produced
Auctions	•••	••	• Cost-effective: help reveal the real price of renewable energy • Transparency: reduce the risk of corruption in selecting projects • Provide a predictable and stable contracted environment for investors • Allow control over the quantity of electricity produced	• Risk of undersubscription: Need a minimum number of bidders to be efficient • Participation by smaller companies limited by complex bidding process and qualification requirements • Risk of overbidding and delays that may prevent partial or full realization of the project • Complex to design and conduct
Subsidies or grants	••	••	• Address the high upfront cost of renewable energy projects • Easier to administer than feed-in tariffs	• Burden on public finances • Resources allocation: risk of inefficient use of funds and risk of political interference in resource allocation
Loans	•	•	• Can help address the financing issue.	• High cost and risk of default: can be a burden on public finances • Risk of political interference in resource allocation
Quota-based instruments and renewable energy certificates	••	•	• Set clear targets and send a clear message to investors • Create demand and financial incentives for renewable energy producers	• Market-like mechanism: fluctuating price of green certificates offers fewer guarantees to renewable energy producers • Administrative burden: resource-intensive regulation of the market for green certificates • Complexity of green certificates: challenging for smaller companies • Market: need a sufficient size and time to function properly

• Rare •• Occasional ••• Common

Source: UNCTAD.

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ACKNOWLEDGEMENTS

This Investment Policy Monitor was prepared by Mathilde Closset and Massimo Meloni under the general guidance of James Zhan. It also benefited from comments from Richard Bolwijn and contributions from Maxime Ladrière, Anastasia Leskova, Abraham Negash and Changbum Son.

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