E/C.18/2024/CRP.20

Distr.: General
04 March 2024

Original: English

Committee of Experts on International Cooperation in Tax Matters
Twenty-eighth session

New York, 19-22 March 2024
Item 3(f) of the provisional agenda
Taxation of extractive industries

Energy transition in extractive industries

Summary

This paper is presented to the UN Tax Committee at its Twenty-eighth Session **for discussion as a first read** and seeks the Committee's suggestions and guidance with the view to revising it for approval at the Twenty-ninth Session.

This paper delves into the complex intersection of tax policy and practice with the evolving landscape of energy transition, with a particular emphasis on energy production. Various approaches to energy transition and the role of tax policies are examined, particularly regarding the disparity in investments and energy production options between developed and developing countries.

The analysis examines the gap in investments and energy production options between developed and developing nations. It proposes necessary tax policies to bolster investments in clean energy in developing countries, where the challenge lies in balancing the imperative for increased energy access with the necessity for clean energy production. Special attention is given to the electrification domain, encompassing electricity production and the relevant tax implications associated with transitioning toward a cleaner energy landscape.

Furthermore, the paper explores the pivotal role of tax administrations at both national and subnational levels. It highlights outcomes using country examples, most of which are elaborated in the appendices.

While considerable effort has been invested in drafting this paper, the Subcommittee acknowledges the need to include more country cases. The Committee and other participants are invited to provide updated country information. The Committee's input is also solicited regarding the paper's structure, particularly the idea of compiling most country cases in an appendix rather than the main text.

Contents

Introduction

Scope of chapter and transition possibilities in energy supply

1. The UN Secretary-General has said, "Climate change is here. It is terrifying and it is just the beginning. The era of global warming has ended; the era of global boiling has arrived. For the entire planet, it is a disaster".[1] It is recognized that the growing commitment of public and private sector stakeholders worldwide to reach net zero emissions targets "is both an encouraging sign that the reality of the world's climate crisis is now being understood while also being a sharp reminder that actions, not just words will be needed if the rise in global temperatures is to be limited to 1.5-degree Celsius target this century."[2]

2. Climate change is now recognized as one of the most critical policy challenges faced by the world. It imposes significant economic and social costs on developed but especially also on developing countries, through increased frequency and intensity of natural disasters, loss in biodiversity and arable land, changes in agricultural practices and increases in transportation costs, to mention only a few. These then result in a range of second and third order effects, not least of which are increased human migration within and beyond borders, pressures on rapid urbanization and increased costs of infrastructure.[3] Climate change thus affects macroeconomic and financial stability through other transmission mechanisms, including fiscal positions, asset prices, trade flows, and real interest and exchange rates.

3. The central goal of the 2015 Paris Agreement is to limit the rise in global warming this century to 1.5°- 2°C above pre-industrial levels. This will require climate policy packages that include tax measures that drive transformative changes in the production and consumption of energy. Such measures can include policies around current direct and indirect taxes, introduction of carbon taxes and/or other environmental taxes, reduction of tax incentives for use of or incentives for exploration of fossil fuels and removal of subsidies on fossil fuel. They can also include measures to support the adoption of renewable energy, demand reduction or differentiation and climate-friendly technology solutions. The role of energy transition, and its relationship to other policy measures to achieve climate goals, is discussed in outline at 2. below.

4. This paper focuses on the tax policy and practice issues in energy transition, specifically on the production of energy. The purpose of this chapter is to consider the specific tax issues in the transition of energy supply. Tax issues arising from and aimed at modifying consumption behaviours, and in creating an enabling environment for adoption of climate friendly technology on the consumption side are covered in the UN Handbook on Carbon Taxation for Developing Countries and related papers. This paper also covers the tax issues inherent in energy transition in the extractive sector.

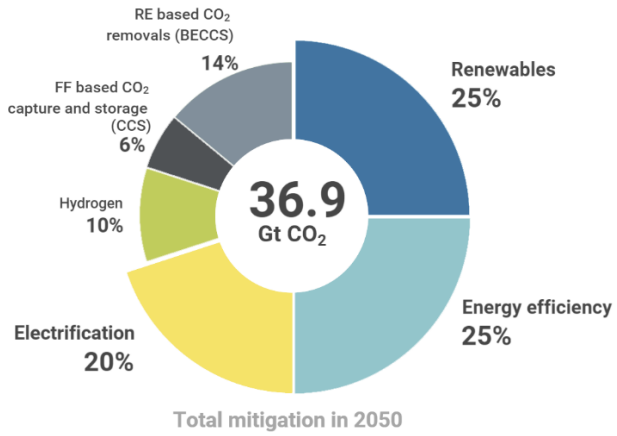
[1] The UN Secretary-General's opening remarks at press conference on climate on 27 July 2023; https://www.un.org/sg/en/content/sg/speeches/2023-07-27/secretary-generals-opening-remarks-press-conference-climate#:~:text=just%20the%20beginning.-,The%20era%20of%20global%20warming%20has%20ended%3B%20the%20era%20of,and%20climate%20inaction%20is%20unacceptable

[2] Henderson, J. (2021), The Energy Transition: Key challenges for incumbent and new players in the global energy system. OIES Paper: ET:01

[3] Infrastructure is expected to bear the brunt of anticipated climate change adaptation costs, typically estimated to be between 60 and 80 percent of total climate change adaptation spending globally. See further McKinsey, June 2020, *Will infrastructure bend or break under climate stress.*

Approaches to transition and transition requirements

5. The International Renewable Energy Agency (IRENA) considers that energy transition depends on a transformation of the global energy sector from fossil-based to zero-carbon sources by 2050. This can be achieved by the very ambitious goal of reducing energy-related CO2 emissions to limit the rise in global temperature to within 1.5° of pre-industrial levels. IRENA's 1.5°C pathway offers a roadmap for accelerating the global energy transition in line with the goals of the Paris Agreement. This strategy outlines six approaches:



6. Electrification of major forms of energy consumption (for example transportation) and energy efficiency are key drivers of change in this approach. However, while relevant, it is not the only driver; transportation of goods by road or aviation may need to rely more on biofuels and hydrogen. A range of energy sources are thus necessary in the transition. As these are more related to energy consumption, tax policies to support achieving these are mainly covered in the UN Environmental Taxation Handbook and related papers. This paper focuses on the tax issues required to achieve the transition to renewables, hydrogen, CCS and sustainable biomass. Decarbonisation of the energy sector to move towards renewables is thus the largest part of the production side of the equation.

7. This paper will address issues in creating an enabling tax policy and administrative framework that support a just and inclusive energy production transition. The primary focus will be on supporting the move of energy production to renewables, followed by the encouragement of hydrogen production. Electrification will be addressed to the extent of the production of electricity and tax issues relevant to the transition to a clean energy future, including the mothballing or decommissioning of current fossil-fuel based power plants. Carbon capture and storage (both fossil fuel and RE based) are addressed to some extent as they can be an important factor in the transition of current fossil fuel extraction, using decommissioned fields and facilities.

8. However, the above represents potential choices based on current technology and financial viability; policymakers should be open to rapid technological innovation and policy choices need remain "technologically neutral" and avoid picking winners or losers to the extent possible. It is also important to ensure, in view of the needs for access and increases in demand for development needs, that energy supply needs to be secure and affordable for consumers and businesses.[4] Technological neutrality means that energy transition must not artificially promote certain technological choices above others.

[4] The European Commission has stated the need to ensure that the European energy market is fully integrated, interconnected and digitalised, while respecting technological neutrality". https://eur-

9. Tax policy needs will vary from country to country based on a range of factors, including stage of development, geography and resource endowments. A broader view could also be taken of resource endowments, expanding the traditional definitions of extractable one-time resources such as minerals and hydrocarbons to include the potential for solar, hydropower, wave and wind power. Tax policy approaches for transition needs in renewables could then be calibrated to resource endowments.

10. Tax policy interventions could also be designed to encourage biofuels, liquid hydrogen and other renewable liquid fuels. Similar approaches and interventions could be designed for carbon capture and storage, which often are tied up closely with current extractive sector capacity utilization, such as the use of exhausted hydrocarbon reservoirs for such purposes. The goals of reducing carbon emissions and transition of energy. The phasing out of any subsidies needs to take into account the timeline to develop relevant technical solutions. consumption in extractive activities can also be covered in the same set of policy interventions.

11. Finally, guidance on tax issues to support a managed phase down/out of fossil fuels in energy production, based on a good understanding of transition risks, and to deliver equitable outcomes in such phase down/outs to manage employment and regional impacts will be necessary. Tax measures should thus seek to ensure that any new fossil fuel infrastructure is transition ready, enabling repurposing for low-carbon re-use and intermediate transitions, for example the use of natural gas instead of coal for power generation are not disadvantaged.

Role of tax policies

12. Policy plays an important role in the transition to a climate neutral and circular economy (see Sec. 3.7.); such a transition requires the full mobilisation of industry. Tax policy and administrative processes can act as a differentiator in encouraging transition, and to manage risks faced by emerging and developing economies that are vulnerable to challenges arising from the low-carbon transition. Tax measures that could help accelerate the transition and the scaling up required will need to be carefully considered. However, tax policies need to be coordinated with other policy measures; see Section 2, particularly 2.5, below.

13. In considering such interventions, current good practices seen in a range of developing and developed countries have been examined and appropriate recommendations are drawn. It will also be necessary to consider approaches to monitor the transition appropriately and develop holistic monitoring frameworks for energy transition. See Section 4 below; approaches to direct and indirect tax measures are set out at Sections 5 and 6 below, while administration measures to monitor and manage these are at Section 10.

14. While much of the discussion on tax policy is about positive incentives to support energy transition, the use of the tax policy to disincentivise fossil fuel use can also play a role in promoting energy transition. For example, the use of carbon taxes and excise taxes to capture the full negative externalities of fossil fuel use, extension of such instruments to capture greenhouse gas emissions in shipping and aviation, and enhanced relief for decommissioning fossil fuel installations can improve the competitive position of renewables. Windfall taxes on the extractive sector have been implemented in some countries as a policy instrument to recover for the state any excessive rents earned. Such taxes can have an indirect impact on energy transition, by increasing the market incentive for installing non-fossil fuel-based energy generation capacity and use, although energy security concerns also need to be considered. On the other hand, some in the private sector argue that windfall taxes may negatively impact capital

lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

available to energy firms to the of invest in pursuit of net zero objectives (i.e. energy efficiency, renewables, hydrogen, biofuels, etc.). However, such assertion in not supported by empirical evidence.

Interaction with carbon taxation/pricing and fossil fuel subsidies

15. Policy instruments that impose a price on carbon produced in energy generation will impact the pace of energy transition. Carbon pricing mechanisms, such as carbon taxes or cap-and-trade systems, are used to put a price on carbon emissions. They thus either impose an explicit or implicit price on carbon, which increases the attractiveness of alternative means of energy generation. Such measures can include explicit carbon taxes, carbon pricing through regulation and a related emissions trading scheme (ETS). These policies can encourage businesses to reduce their carbon footprint by making fossil fuels more expensive.

16. While such measures are undoubtedly part of the policy mix in promoting energy transition, the focus of this chapter is to consider only the impact of conventional direct and indirect tax measures that will influence transition in energy generation. Accordingly, carbon taxation and pricing issues, as well as other regulatory measures are only referenced as part of the policy mix at Section 2; no analysis is undertaken of these measures. The UN Carbon Taxation Handbook covers Carbon Taxes in detail.

17. Many developing countries provide direct or indirect subsidies in respect of fossil fuels, primarily to address equity concerns; further, some developed countries also subsidize fossil fuels, through both implicit and explicit means.[5] [6] These subsidies can make fossil fuels artificially cheaper, which can hinder the transition to cleaner energy sources. For example subsidised diesel, intended for the operation of agricultural irrigation pumps, may be used for small scale electricity generation and distribution in rural areas in developing countries; this is counterproductive for transition to environmentally desirable generation. As this is an issue of expenditure policy, this paper will not go further into this topic; policymakers should, however, consider the impact of any subsidies, including implicit subsidies, that may be in place with respect to fossil fuels. Such subsidies should, wherever possible, be removed to ensure that renewables do not face unfair competition from subsidized fossil fuel inputs.

18. It should however be noted that while progress towards using cleaner technologies may be hindered by expenditure policies, some technologies may not have progressed enough to deploy at scale. In such cases, removal of subsidies may not substantially impact the outcome.

The role of subnational tax policy

19. Regional and local governments play a key role in managing the environmental and energy transition, which involves systemic transformations of unprecedented depth and breadth. Regions and cities often have jurisdiction over crucial sectors for climate action, including local permitting, low emission zones, property taxation, and local taxes and fees. This is of particular importance in large federal states in both developed and developing countries, where subnational tiers of government often have specified or de facto powers of taxation over certain activities. Further, such subnational governments, especially city and local authorities, often have extensive powers over regulatory measures, such as traffic restriction schemes or mandates regarding use of energy from renewable sources. They can also be important change agents in areas from waste to energy.

20. Tax policy and administrative measures at the local level to support energy transition and the use of tax measures to address disparities between different regions should be carefully considered. Urban authorities may have different attitudes and willingness to support energy transitions, partly from

[5] IMF Fossil Fuel Subsidies Data: 2023 Update, WP/23/169, August 2023, p.18.
[6] OECD, IISD https://fossilfuelsubsidytracker.org/country/

concerns about potential negative consequences for tax revenues and mitigating measures should be considered. On the other hand, some urban locations may be inclined to pursue stronger policies, including tax policies, than the central government. Countries should thus consider the role of subnational tax policies and their application, in the light of their Paris agreement obligations, and seek to find a balance between policy goals at local level and national requirements.

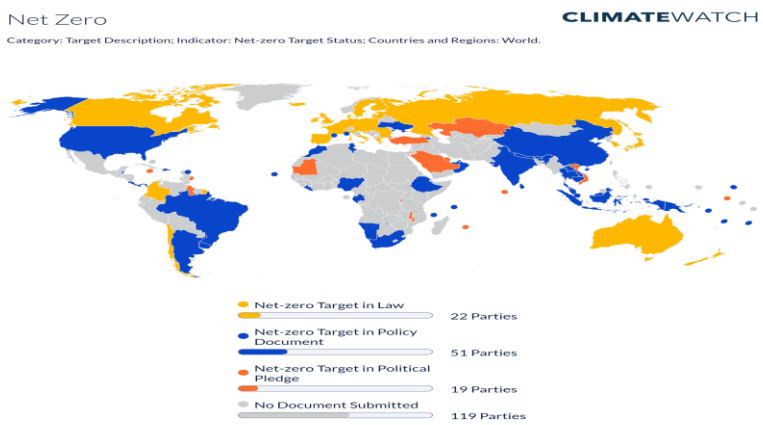
Transition challenges for developed and developing countries

The role of energy transition in broader climate goals

21. The UN Climate Change Conference in Glasgow, UK produced a number of milestone pledges from both state and non-state actor groups on subjects ranging from methane and deforestation to electric vehicles and coal finance.[7] Many countries updated their Nationally Determined Contribution (NDC)[8] pledges to become net zero by 2050, such that some experts estimated the post-COP global warming trajectory to be consistent with 2^0 C and Paris Agreement goals.[9] However, it has also been pointed out that without sufficient financial support and domestic frameworks to help implement long-term and conditional NDC targets, the world would be on a 3^0 C warming trajectory by the end of the century.

22. Pledges made by a sample group of countries, covering both developed and developing countries, at COPP26 are available at Appendix 4. There is a significant disparity in country commitments and actions taken across developed and developing countries. Further, countries were to submit updated or enhanced climate action plans i.e., NDCs to the United Nations Framework Convention on Climate Change (UNFCCC).[10] However, not all have updated and submitted the NDCs. Moreover, many countries have not adhered to their original commitments. Map 1 shows the net-zero target status of countries and regions and Map 2 shows NDC enhancements around the globe.

Map 1



Source: Climate Watch

[7] Bowman, Megan. (2022), Turning Promises into Action: 'Legal Readiness for Climate Finance' and implementing of the Paris Agreement. Publishes in *Carbon & Climate Law Review* 16(1) 2022: pp41-55. Availabe https://cclr.lexxion.eu/article/CCLR/2022/1/7

[8] These NDCs outline each country's commitments and targets to reduce greenhouse gas emissions and combat climate change.

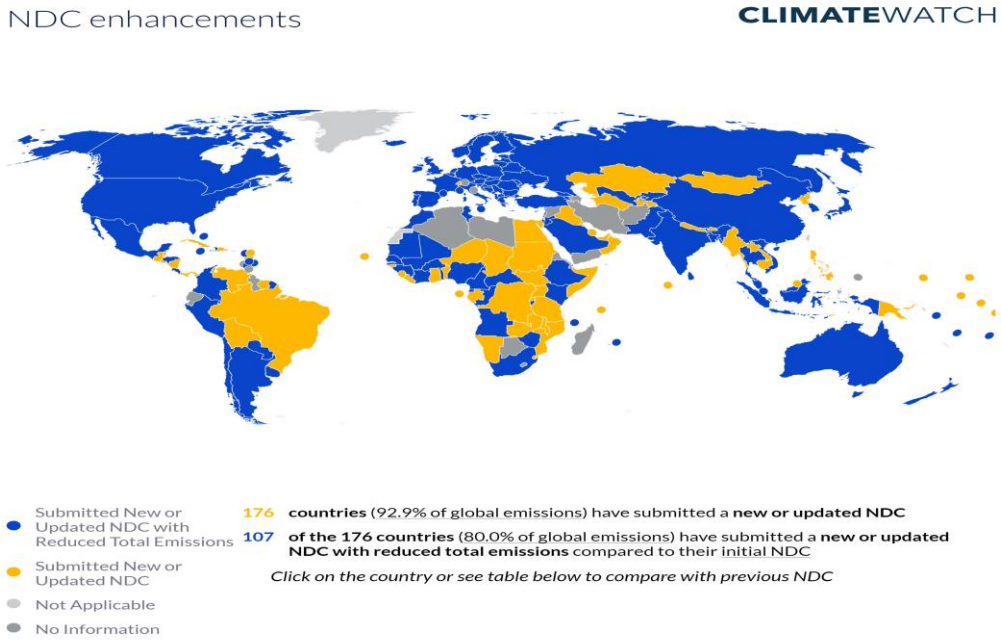
[9] Ibid

[10] NDC Registry. Available at https://unfccc.int/NDCREG

23. Decarbonization is central to global climate goals, which include moving from carbon-emitting to carbon-free sources of energy and removal of potential carbon in the atmosphere through either post-burning of hydrocarbons or direct air capture of carbon. There are associated issues to be considered, For example, the role of technology in energy transition, capital markets specifically for investors and above all the long term or sustainable effect of this global move. The above shows that while countries are bending the curve of global GHG emissions downward, there is a need for stronger implementation of decarbonization to meet the goals of the Paris Agreement.

24. Energy transition is a key part of decarbonization; however, the pathways to achieve this will vary based on different contexts. Many of the challenges are common to both developed and developing countries, while others are very specific to developing countries; the impact of such challenges will vary. A coordinated, comprehensive strategy involving a wide range of stakeholders is difficult in both developing and developed countries.

Map 2



Source: Climate Watch

25. While there are shared challenges between developed and developing countries, the latter need to consider more the balance between sustainable human development and economic growth. Developing countries are still catching up from much lower levels of economic welfare, and face conditions that are strong influencers in the approach to clean energy i.e., low grid capacity and inefficiency, lower rates of urbanization, and youth demographics.[11]

Pace of energy transitions – balancing progress across regions and countries

26. Previous energy transitions were largely driven by economic and technological advantages and not policy. Further, the scale of the targeted transition is significant and has much wider spillover

[11] Oluleke and others, Affordable clean energy transition in developing countries: Pathways and technologies. Volume 25, Issue 5, 20 May 2022, 104178. Available at: https://www.sciencedirect.com/science/article/pii/S2589004222004485#:~:text=Volume%2025%2C%20Issue,2022%2C%20104178

effects. Priority needs, especially in developing nations, will inform transition goals. Developing nations often face challenges in establishing robust policy and regulatory frameworks and face capacity challenges in implementing such policies. Developed nations may also need to update their policies to incentivise renewable energy adoption and ensure a smooth transition.

27. Not all regions will decarbonize at the same pace. Systemic change will be facilitated not only by macro policy and micro financial actions, but also through a critical mass of national legal and regulatory frameworks. Developing countries are expected to face disproportionate exposure; they will need to invest more as a share of GDP to get to net zero and a larger share of their economies in terms of jobs, GDP and capital stock will be exposed. Further, there is a policy position taken by many advocates that the energy transition must be just; this paper, however, has focused on purely tax technical issues.

28. A summary of the challenges for both developed and developing countries in energy transition is set out below (in order of priority for each group), again to understand the economic context within which tax policy can be designed. Prioritization of actions to be taken should be based on the specific economic circumstances of the country concerned and the interaction with other policy instruments (see 2.5).

Issue	Developed Countries	Developing Countries
Capital Investment: total annual investments in the energy sector are projected to grow by between 2 and 4 per cent per annum- to reach between $ 2 trillion and $3.2 trillion in 2040. Comparing estimates for 2023 with data for 2021, annual clean energy investment has risen much faster than investment in fossil fuels over this period (24% vs 15%).[12] Clean energy investments have been boosted through a combination of improved economic conditions and enhanced policy support through instruments like the US Inflation Reduction Act and new initiatives in Europe, Japan and China.	**Capital and policy capacity:** Offering incentives to accelerate the transition to a clean energy economy can help attract investment. For resource rich countries, enhanced tax relief for decommissioning existing assets can accelerate this process. Developed economies have fiscal headroom, capital markets, and regulatory capacity to better implement targeted investment promotion policies. Investment by the industry in clean fuels, such as bioenergy, hydrogen and CCUS, is picking up in response to more supportive policies but remains well short of where it needs to be in climate-driven scenarios.[13]	**Capital needs:** Developing countries cannot fund their energy transitions without significant international investment. The Global South only received 20% of the world's clean energy investments in 2022. Policy reforms will need to be accompanied by improved access to finance and measures to encourage such investment. Significant investment in renewable energy will be needed; without this, many developing countries will have to rely on traditional forms of energy to derive their economies and ensure the security of supply.
Regulatory and policy framework: According to UNCTAD, two-thirds of countries have enacted policies and laws specifically dedicated	**Entrenched market players and regulatory frameworks:** Developed countries often have complex regulatory frameworks and vested interests in the fossil	**Limitations in regulatory and policy formulation capacity:** Developing countries face challenges in formulating and adopting policies and strategies specific to renewable energy.[15] Further,

[12] World Energy Investment 2023
[13] World Energy Investment 2023
[15] UNCTAD, World Investment Report 2023. Available at https://unctad.org/publication/investment-policies-energy-transition-incentives-and-disincentives

to renewable energy, and only one-half of least developed countries and a third of small island developing states have done so.[14] There is also a need to encourage the enactment of policies for phased retirement of fossil fuel infrastructure.	fuel industry. Implementing new policies and regulations to support clean energy can face opposition and political challenges.	existing policy frameworks aimed at promoting investment in the energy transition can be inadequate. Many developing countries use generic tax incentives- applicable to investment in any industry- that do not address the specificities of the energy investment projects
Infrastructure: Transitioning to renewable energy sources requires significant investment in upgrading or replacing existing infrastructure, which can be expensive and time-consuming.	**Legacy Infrastructure:** Developed countries often have extensive energy infrastructure built around fossil fuels. Transition requires a shift away from the existing infrastructure to some extent and often building new infrastructure, such as car charging networks.	**Infrastructure deficiencies and capacity:** Many countries lack a robust energy infrastructure, especially a flexible nation-electricity grid. Building the necessary energy infrastructure in developing countries often requires significant foreign investment and expertise. While there is an opportunity to leapfrog older, polluting technologies and adopt cleaner, more efficient options the transition can be challenging without proper support.
Dependence on fossil fuels: While the total demand for fossil fuels is projected to peak by 2030 in all scenarios, a sharp decline in coal demand is expected to grow further in the next few years and then remain a core part of the world's energy mix for decades to come. Coal (without Carbon Capture, Utilization and Storage- CCUS) is expected to be phased out gradually.	**Diversifying production and consumption patterns:** Several developed countries are currently dependent on fossil fuels. While these countries have acquired enough reserves to finance the shift, the move is complex and disrupts current distribution economics.	**Dependence on fossil fuels both as a source of energy and for revenue:** Many developing countries are heavily dependent on fossil fuels for their energy needs. This makes it difficult for them to switch to renewable energy, as they may need to import these technologies or build new infrastructure. Phasing out current electricity generation capacity will also be a challenge. For countries dependent on resource revenue, this is a much more significant challenge.
Energy poverty and resource limitations: Balancing the need for immediate energy access with transitioning to cleaner sources can be a significant challenge.	**Distribution and access:** Energy poverty may only affect developed countries temporarily as a result of geopolitics. There may also be regional or local differences that reduce access to clean energy for sections of a population.	**Limited resources and greater energy poverty:** Many developing countries lack access to reliable energy sources and unreliable power networks. There is also often a predominance of traditional unprocessed biomass such as fuelwood, animal waste, and charcoal in the energy mix. Developing countries may have limited financial, technological, and human resources for large-scale renewable energy projects.

[14] https://unctad.org/news/investing-energy-transition-countries-need-more-balanced-policies

Economic transition: The International Labour Organization (ILO) estimates that transition to net zero brings substantial new opportunities for employment but raises new challenges. Ensuring a just and equitable economic transition for affected workers and communities is a major challenge to both developed and developed countries.	**Changes in skills needed:** Transitioning away from fossil fuels may impact industries and jobs that are closely tied to the fossil fuel sector, especially between regions. 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.	**Planning needed for transition in economy:** Developing countries often need to build the technical and institutional capacity to plan, implement, and manage the transition. Large countries dependent on significant fossil fuel inputs, such as coal-fired power may not be able to follow the path of other countries that have achieved middle income status through rapid industrialisation. Development of new skills will have to be considered.
Technological change and innovation: Patenting rates suggest that more technological innovation has taken place in the field of clean energy technologies than in traditional energy fields such as fossil fuels and nuclear. [16] Additionally, innovations in digitization and energy storage are also opening up new frontiers. New technology such as smart grids, the Internet of things, big data and artificial intelligence, are being applied in the energy industry. A major barrier to adoption relates to the high cost of renewable energy technologies. Renewable energy sources like wind and solar are intermittent, making grid integration and energy storage crucial.	**Ensuring a level playing field:** In view of the enhanced interest in low carbon technologies a key challenge will be the need to balance the adoption of new technology with the risk of potentially "locking out" other, pioneering solutions. For example electrification is key to reducing emissions, which will require both switching end-use demand to electricity (for example, EVs and heat pumps, and green hydrogen for hard-to-abate sectors like heavy transport and industry),[17] but there could be a risk that electricity grids become a bottleneck by favouring specific generation sources.	**Balancing transition needs with building domestic capacity and industry:** Building the necessary energy infrastructure in developing countries often requires significant foreign investment and expertise. While there is an opportunity to leapfrog older, polluting technologies and adopt cleaner, more efficient options the transition can be challenging. The need to import the necessary technologies and skills have to be balanced against the desire to develop domestic industrial and technical capacity in this new and promising field. The bulk of renewable energy patents are filed in China, the United States, the European Union, Japan and Korea. Renewable energy manufacturing follows a similar pattern. Most developing countries are clean technology consumers, rather than innovators or manufacturers.
Energy security: Fundamental changes are taking place in the global energy system which will affect almost all countries and will have wide-ranging	**Geopolitics and security constraints:** One of the biggest threats to energy security in developed countries is	**Capacity and economic constraints:** In developing countries, economic crises and capacity challenges are the major risks to energy security. These can be increased by domestic political

[16] EPO, UNEP and ICTSD (2010), *Patents and Clean energy: bridging the gap between evidence and policy*, European Patents Office, UN Environment Programme and International Centre for Trade and Sustainable Development, p 30.

[17] https://www.mckinsey.com/industries/oil-and-gas/our-insights/global-energy-perspective-2023-transition-bottlenecks-and-unlocks?stcr=4B156C369A3D4BBC98136C75EAD34416&cid=other-eml-alt-mip-mck&hlkid=d2a8bb23017d4c9282d7d2edee03517e&hctky=14361623&hdpid=e2ffb469-1dba-4a0f-a27b-fa6ba3823856

geopolitical consequences. The ongoing transition to renewables involves a transformation of the world's energy systems. Transitioning countries must ensure that clean energy sources are as reliable and secure as fossil fuels are, especially in times of crisis.	geopolitics.[18] Issues of energy access can be entangled with national security concerns.	instability and terrorism. Political instability can make it difficult to plan and implement long-term energy policies. Weak institutions can make it difficult to develop and implement effective energy policies.

29. While energy transition is a global objective, the challenges vary significantly between developed and developing countries. Developed countries face issues related to existing infrastructure and vested interests. Developing countries must contend with limited resources and the need to balance development and sustainability. The focus of this paper is on the needs of developing countries; the analysis and possible tax policy options to support solutions for such countries. For example, a significant difference between developed and developing countries is the financing of energy transition. Tax measures to encourage or facilitate such financing are accordingly given more significance in the analysis.

Transition impacts for resource-rich developing countries

30. A further critical issue concerns developing countries that derive a significant part of national revenue from fossil fuel extractive activities. Given the changing landscape, it could be beneficial for such countries will need to plan for reductions in revenue, find new ways to generate revenues and approaches to maintain growth in a low-carbon economy and meet import and debt servicing needs. Potential declines in revenue, increased price volatility and devaluation of fossil fuel endowments will require such countries to consider whether it is worthwhile to recover such assets at a quicker pace while they retain economic value or balance the revenue from extraction with potential environmental harm. Tax policy choices and tax rules should be designed in line with the approach taken.

31. As some developing countries rely on foreign direct investment in their resource sectors, the transition may impact the willingness of foreign investors to engage in other sectors of the economy. Some resource-rich countries have taken on debt secured by future resource revenues. If energy transition leads to reduced resource income, repaying this debt can become problematic. Transitioning countries may face challenges accessing financing for new economic activities, as lenders consider risks of lending without the security of resource revenue.

32. The energy transition thus has significant implications for resource-dependent developing countries. As the world reduces its reliance on fossil fuels, these countries may experience a decline in revenue from their resource exports. Where resource extraction requires significant energy, the higher costs on input such as electricity and fuel that are required to power operations will also reduce revenue from the sector. This can lead to fiscal challenges, making it difficult to fund essential public services, infrastructure, and development projects. Managing the transition effectively requires careful planning, diversification of economies, investment in clean energy and infrastructure, and international cooperation. Transition impacts are context-specific, depending on factors such as the country's level of development, governance, and the nature of its resources.

[18] IRENA (2019), A New World: The Geopolitics of the Energy Transformation. Available at https://www.irena.org/-/media/files/irena/agency/publication/2019/jan/global_commission_geopolitics_new_world_2019.pdf

33. Transitioning away from extraction of non-renewable resources these activities can have positive environmental impacts, but it may also require significant investment in environmental remediation and conservation. Resource extraction also often necessitates significant infrastructure development. As the sector contracts, the country may be left with "stranded assets" or underutilized infrastructure. Governments must plan for repurposing, for example transformation to facilities powered by clean energy or decommissioning these facilities. The appropriate solution will depend on the extractive facility in question; an oil field might be decommissioned but a mine or processing facility powered by fossil fuels could be converted to a facility powered by clean energy. This would require significant capital investment and likely Government support to incentivise it as an option rather than closure.

34. The broader move to a low carbon economy can also create new opportunities and challenges for other developing countries with endowments in natural resources that are necessary for the low-carbon transition. For example the[19] demand for electric vehicles and home storage solutions is considered to increase the demand for materials like lithium and raise important policy challenges for such countries. Tax policy measures should be designed to support the broader policy choices made. Energy transition also presents investment opportunities in renewable energy, energy efficiency, and related industries. These opportunities may also, over time, broaden or change the meaning of a resource endowment, as abundant sunshine or windy coastlines become more valuable. This would especially be the case if these areas with clean energy potential are located near markets, i.e. an industrial zone or a site of natural resources extraction (For example a bauxite mine). Developing countries can attract foreign investment and diversify their economies by tapping into these sectors.

35. To manage these transition impacts effectively, resource-endowed developing countries need a clear and well-planned transition strategy[20]. These countries must diversify their economies to reduce their dependence on a single resource. This typically involves diversifying the economy, improving governance, investing in education and workforce development, and creating a supportive business environment to attract investment in non-resource sectors. This can be challenging and often requires significant investments in infrastructure, education, and technology. International support and cooperation will also play a significant role in helping these countries manage the transition effectively.

Transition impacts for other developing countries

36. Energy production and consumption is the leading driver of climate change, yet one third of the global population does not yet have steady access to energy.[21] The UN Sustainable Development Goal 7 (hereafter, SDG 7) requires “Ensure access to affordable, reliable, sustainable and modern energy for all”. The UN Secretary-General, speaking at the 2030 High-Level Dialogue on Energy Ministerial Forum in 2021 stressed the urgency to bring electricity to the 759 million people worldwide who lack access and the need to remove reliance on harmful, polluting fuels to cook, light or heat homes. Energy availability is also a precondition to achieve many of the other SDGs, for example SDG 8 (sustained, inclusive and sustainable economic growth) or SDG 12 (sustainable consumption and production patterns). Improving energy access is thus a key concern of developing countries.

37. 50% of the world’s people live in Bangladesh, Brazil, Nigeria, Pakistan, Indonesia, China and India, where average GDP per capita is one-tenth to one-third that of industrialized countries. These countries’ overriding priority will be economic growth for the foreseeable future, and this will take a lot of energy.

[20] For more guidance on how developing countries with fossil fuel resources can manage the energy transition see the OECD Development Centre’s Equitable Framework and Finance for Extractive-based Countries in Transition (EFFECT) here: https://www.oecd-ilibrary.org/development/equitable-framework-and-finance-for-extractive-based-countries-in-transition-effect_7871c0ad-en

[21] See https://www.un.org/sites/un2.un.org/files/2021/11/report_of_hlde_by_secretariat_n.pdf See https://www.un.org/sites/un2.un.org/files/2021/11/report_of_hlde_by_secretariat_n.pdf

The challenge will be in finding ways to meet their energy needs without significantly increasing their carbon footprint. Transitioning from fossil fuels to production of clean energy is part of the solution.

38. Tax policy and practice can be a key enabler in supporting this goal and help developing countries reduce reliance on imports of fossil fuel and pursue a decarbonization strategy. Good tax policy can help reduce or eliminate emissions in electric grids, support small and utility grade generation and in other areas of production to meet energy demand, in particular household fuel use and electrification of transportation needs. It should also be recognized that the extractive sector is itself a major consumer of energy.[22]

Alignment of energy transition policy instruments and the role of tax policy

39. Government policy and regulation is the most important driver in the current energy transition. Policymakers have two broad groups of instruments, set out below, at their disposal to influence the transition. Alignment and a consistent approach between these two sets of instruments is crucial.

a. Financial measures

- Imposing a price on carbon and use of an ETS (see 1.4, not discussed further)
- Favourable pricing for energy produced from renewable sources.[23]
- Capital grants and financial incentives/subsidies for renewables and/or policies aiming at decreasing investment costs of renewables.
- Tax measures to promote energy transition, including incentives for renewables and energy conservation, use of climate friendly solutions in transportation and power generation, etc.

40. Financial measures are mainly used to mitigate the costs of transition, such as the use of price/market mechanisms, for example “feebates” that help manage price predictability, smoothen the transition to an electricity supply infrastructure based on multiple sources. Cash subsidies and fix price terms are often used to “de-risk” investments. Carbon pricing is designed to capture the external costs of greenhouse gas emissions in financial decisions and/or encourage emission reductions. These market measures help manage energy price impacts and acceptability of changes. Tax measures are the core focus of this paper and discussed in detail in the following Sections.

41. Carbon prices apply to all energy producers equally, encouraging low-emission production. They have the advantage of being technology-neutral, meaning that policymakers do not have to select the technologies to be favoured. Carbon pricing is thus an important tool to directly price the environmental externality of CO2 emissions and still utilise the information advantage of the market to find the most cost-effective solutions. However, carbon pricing may not be feasible for all developing countries; they may have to use other policy measures, including favourable pricing in electricity markets for energy from renewables as well as tax measures to achieve desired outcomes.

42. The use of auctions can create and leverage competition among energy suppliers, thereby favouring the most efficient solutions/firms and reducing societal costs while fostering innovation. However, to tap the full potential of auctions, they should preferably be used in well-developed markets, otherwise they might even be harmful because compliance leads to disproportionate costs for firms and could result in corner cutting, in the absence of protective design features.

[22] It is estimated that material extraction and processing contribute to 71% of greenhouse gas (GHG) emissions including fossil fuel use for energy supply.

[23] For example feed-in schemes that guarantee fixed prices (tariffs) or premia on the current market price for each kWh of renewably-sourced electricity supplied. These provide renewable energy suppliers with a predictable price above the market value, and thus incentivize investment in renewables; the disadvantage is that policymakers have to pick technologies which qualify, discriminating against other technologies and constraining market forces.

b. Regulatory measures and market factors

43.

- Energy efficiency codes and mandates.
- Mandating closure of fossil fuel-based energy plants.
- Control measures such as permitting only energy efficient vehicles in specified urban zones.
- Other tools.[24]

44. Regulatory controls targeting the use of carbon producing fuels with associated levies can impose a cost on carbon emissions in energy generation. Other regulatory or "command and control" type measures, such as a mandate to stop the sale of cars with internal combustion engines[25] or restrictions on movement in certain parts of a city[26] also have a similar impact by placing a direct or indirect cost on the use of fossil fuel-based transportation. Mandates regarding the proportion of renewable generation for utilities disincentivises fossil fuel-based electricity generation.

45. Market and infrastructure factors that enable more cost-effective distribution of renewable or lower carbon energy can also be a contributing factor to the energy transition. A smart grid infrastructure that enables diverse players in the clean energy market, or storage technologies that allow better matching of demand and supply can facilitate the transition.

46. The specific nature of the interaction between the two groups of policy instruments will vary from one country to another, depending on the local energy landscape, political priorities, and economic considerations. One size does not fit all. Transition timescales must recognize the current energy production mix, resource endowment, need for energy security and/or a diversity of sources to mitigate risks from disruption, and consider issues of energy access.

47. Tax policies can have a significant impact on the effectiveness of energy transition efforts but should be considered in conjunction with other policy measures taken. It is important, however, to recognise the interactions between tax and other policy measures, and to ensure that policy measures in one area do not hinder or counteract measures taken in another. This paper will hereafter focus on tax policy and tax administration measures to support the energy transition. A summary of the features of alternative mitigation approaches is set out at Appendix 3 to consider alongside tax policy measures.

Diversification of energy portfolio by energy industry

Overview of energy industry

48. Firms are diversifying their energy portfolios by integrating renewable energy sources and low-carbon technologies. In this respect, some companies are transitioning from being solely providers of fossil fuels to offering comprehensive energy services and solutions. This diversification is driven by both environmental considerations and long-term business sustainability. Key initiatives include:

[24] Daszkiewicz, Karolina (2022), Policy and Regulation of Energy Transitions. Accessible at https://link.springer.com/chapter/10.1007/978-3-030-39066-2_9
https://link.springer.com/chapter/10.1007/978-3-030-39066-2_9

[25] For example California Air Resources Board requires all new cars, SUVs and pickup trucks sold in the state to generate zero tailpipe emissions by 2035 https://ww2.arb.ca.gov/rulemaking/2022/advanced-clean-cars-ii

[26] For example London ULEZ scheme https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/ways-to-meet-the-standard; China's "green numberplate" scheme, which allows zero/low emission vehicles enhanced access, and restricts access for cars with higher emissions https://english.www.gov.cn/news/photos/2017/12/29/content_281475994442830.htm

Investments in renewable energy

49. Energy transition implies a significant shift towards sustainability and the adoption of renewable energy sources. Although the extent of investment and commitment to renewable energy varies, the increasing trend of investment in renewable energy (solar, wind, hydropower and, to a lesser extent, geothermal) reflects the re-evaluation that companies are doing on their business models to adapt themselves to the new energy landscape and the growing importance of sustainable alternatives.

50. Main projects relate to the building and operating of solar and wind farms at an international level to produce clean energy, which allows them to generate revenue from renewable sources. Some extractive companies have acquired or invested in renewable energy companies to gain expertise and expand their presence in the renewable energy sector. They have also formed partnerships and collaborations with renewable energy companies and other stakeholders with the aim to accelerate the development and deployment of renewable energy technologies and share knowledge and best practices.

Transitioning to natural gas

51. Natural gas has been labelled as a "green" or "sustainable" source of energy by the European Union (EU) due to its relatively lower carbon emissions compared to other fossil fuels. When used for power generation or heating, natural gas produces fewer greenhouse gas emissions and air pollutants, contributing to improved air quality and reduced environmental impact[27]. Some extractives firms are increasing their focus on natural gas production and distribution as a transitional fuel towards a low-carbon future. A consideration for governments in considering tax policy measures to support the transition will be whether they will consider a shift to natural gas as an intermediate fuel in electricity generation or will push for full adoption of renewables. This will depend to some extent on the current profile of electricity generation assets in the country; it may be worthwhile to adapt coal or HFO burning stations to use natural gas as feedstock for the balance of useful life of the asset.

Renewable or green hydrogen

52. Green hydrogen is a relatively new type of clean energy with potential to drive the energy transition. It is seen as the clean energy for the future and is produced by electrolysis using renewable energy.[28]It has been touted as an alternative to assist countries in reaching net zero emissions. Green hydrogen therefore has a significant role in the energy transition discourse particularly as a potential source of energy to power hard -to-abate industries). However, green hydrogen is still in the early phases of development, and concerns have been raised about its economic viability due to its high production costs as well as technical and logistical hurdles. In the interim, the production of blue hydrogen from natural gas with CCUS, or grey hydrogen without CCUS, can encourage development of the transportation infrastructure that will benefit the distribution of green hydrogen in the future.

53. To promote the development of green hydrogen, governments have implemented and suggested a variety of tax schemes. Many incorporate tax breaks either upstream to reduce production costs, or downstream to make green hydrogen competitive. For example, the United States under the Inflation Reduction Act of 2022, provides a tax credit for green hydrogen for ten years after it has been installed. Use of hydrogen as aviation fuel, and possibly also in shipping, offer important opportunities for energy transition.

[27] EU taxonomy: Complementary Climate Delegated Act to accelerate decarbonization of 2 February 2022. https://finance.ec.europa.eu/publications/eu-taxonomy-complementary-climate-delegated-act-accelerate-decarbonisation_en

[28] International Energy Agency, “The Future of Hydrogen: Seizing today’s opportunities”, June 2019 – www.iea.org/reports

54. Many energy firms are incorporating renewable hydrogen into their decarbonization strategies, utilizing their expertise in large-scale energy production and distribution to invest in renewable hydrogen production facilities. Such investment is made, for the time being, in pilot projects and demonstration plants to showcase the viability and scalability of renewable hydrogen technologies. These projects help in gaining practical experience, validating the economic feasibility, and building confidence in Renewable hydrogen as a sustainable energy solution. These facilities typically use renewable energy sources, such as solar or wind, to power the electrolysis process, which splits water into hydrogen and oxygen. This enables the production of renewable hydrogen without carbon emissions.

Re-emergence of nuclear energy as a zero-carbon energy source

55. Nuclear energy has, in recent years, received more positive interest, partly due to the energy security issues above, relative reliability and reduced emissions profile. However, according to IRENA, around two-thirds of today's nuclear power plants in advanced economies are more than 30 years old and will be shut down in the foreseeable future unless their lifetimes are extended. Some countries are building new nuclear power plants, notably China, India, Russia, and UAE while other governments are planning to phase out nuclear power i.e., Germany, Switzerland, Spain and South Korea. Nuclear energy also typically requires significantly greater investment and has security and safety concerns. The sector should nevertheless be included in any consideration of tax measures for energy transition.

Biofuels and alternative fuels

56. Many oil companies are exploring biofuels as a means to reduce carbon emissions. This involves producing biofuels from sustainable feedstocks like algae, agricultural residues, and waste materials. For example renewable natural gas (RNG) is a pipeline-quality gas that is fully interchangeable with conventional natural gas. RNG is essentially biogas (the gaseous product of the decomposition of organic matter) that has been processed to purity standards. Biogas is produced from various biomass sources such as livestock operations, wastewater treatment and urban waste landfills, through a biochemical process, such as anaerobic digestion, or through thermochemical means, such as gasification. Other research and development efforts are focused on alternative fuels such as hydrogen and synthetic fuels derived from renewable sources.

57. Many biofuels are largely compatible with current vehicle with internal combustion engines (ICE) and can be blended with current fossil fuels. For example RNG can be used as a transportation fuel in the form of compressed natural gas (CNG) or liquefied natural gas (LNG). Given that vehicles have extended useful lives in many developing countries due to lower labour costs of maintenance and repair, the use of these alternative fuels, especially "waste to energy" fuels could provide important energy transition opportunities in developing countries.

Circular economy and sustainability initiatives

58. The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products, to extend the life cycle of durable goods. In practice, it implies reducing waste to a minimum. When a product reaches the end of its life, its materials are kept within the economy wherever possible thanks to recycling. These can be productively used again and again, thereby creating further value. This is a departure from the

traditional, linear economic model, which is based on a take-make-consume-throw away pattern. This model relies on large quantities of cheap, easily accessible materials and energy.[29]

59. Energy firms are embracing the principles of the circular economy by focusing on waste reduction, recycling, and resource optimization. They are actively seeking ways to repurpose by-products and waste materials generated during their operations. While efforts to expand the circular economy and sustainability are being adopted by businesses and individuals much more broadly, and tax measures relevant to this also are more general in nature, tax measures for the circular economy can have more impact in the energy sector.

Reforestation

60. Reforestation can also play a role in mitigating emissions associated with the operations of extractive companies. By investing in reforestation projects, they can offset a portion of their carbon footprint and contribute to global efforts to combat climate change as trees absorb carbon dioxide from the atmosphere through the process of photosynthesis. Therefore, reforesting areas can help sequester significant amounts of carbon and offset emissions by increasing the overall carbon storage capacity of the ecosystem. Reforestation provides additional benefits beyond emission mitigation enhancing biodiversity by providing habitats for plant and animal species. They also support local communities by improving water quality, preventing soil erosion, and offering opportunities for sustainable livelihoods. Reforestation can be an important part of decommissioning of mining facilities in particular, and tax policy can include measure to encourage remediation of extraction sites through afforestation.

Tax regimes for energy transition – the comparative landscape

61. Tax rules aimed at fostering energy transition in a range of developed and developing countries were examined while developing this paper. Globally, wide-ranging incentives, mainly through exemptions and credits, are deployed to support renewable energy production to reduce carbon emissions, encourage technological innovation, and support the repurposing of fossil fuel assets to produce energy, store energy, or provide ancillary services. Other tax policy measures include reduced rates, accelerated depreciation, extended loss carry-forwards and targeted deductions. Indirect tax measures often include exemptions or reductions of customs duty and, less commonly, VAT concessions. Administrative measures include relaxation in withholding tax regimes and suspension of collection of certain taxes for set periods, thus providing for cashflow benefits to the investor.

62. A key step in the energy transition is to disincentivise, with a view to ultimately phasing out fossil fuel-based power generation. The comparative research shows that many countries have chosen to address this through non-tax approaches, such as an emission trading scheme or a carbon emission tax. Other non-tax policy mechanisms to encourage renewable energy development include tradable green certificates and feed-in tariffs. As mentioned at 1.4 above, non-tax measures such as carbon pricing and removal of fossil fuel subsidies are outside the brief for this paper, and carbon taxation is covered extensively in the Carbon Taxation Handbook. Some countries have offered measures to support fossil fuel exit strategies by repurposing fossil fuel production assets, thereby avoiding stranded assets.

63. Another key area for tax policy to support has been in research and development measures to support innovation. Key measures include incentives for developing alternative energy technologies and for

[29] https://www.europarl.europa.eu/topics/en/article/20151201STO05603/circular-economy-definition-importance-and-benefits#:~:text=What%20is%20the%20circular%20economy,cycle%20of%20products%20is%20extended.

innovation in transmission, distribution and storage technologies. Measures that support decarbonisation of the extractives sector by advancing technological advancements in reducing flaring, venting, and methane emissions across the upstream oil and gas and mining sectors also fall within this category.

64. It should be noted that while United States has made very significant investments, most other countries do not have the resources or fiscal space to provide this level of investment and are considering more targeted responses.

65. A summary of tax policy measures and conditions observed in a selected range of developed and developing countries, and considered desirable is set out below. The full detail of measures seen are at

Appendix 2. The Inflation Reduction Act of 2022[30] USA provides a good example of use of tax policy to encourage energy transition.[31]

Type of measure	Description	Examples
Incentives for production of renewable energy	Tax policies can provide incentives for renewable energy adoption by offering tax credits, deductions, or exemptions, including exemptions on indirect taxes, for investments in renewable energy projects. They can also include exemptions or tax holidays in respect of income from such projects.	Many countries, for example Brazil, Namibia, Tanzania, Morocco, Sri Lanka, Ghana, Rwanda, Nigeria, etc. offer Customs duty and, less commonly, VAT exemptions on importation of equipment for renewable energy technologies. Many of these countries, also offer tax holidays. Argentina offers various tax incentives for the use of renewable energy sources and preferred VAT refunds. The USA under the Inflation Reduction Act of 2022 provides Production tax credits (Sec. 45) and investment tax credits for wind, solar, geothermal, hydropower, etc. (Sec. 48), and a zero-emission nuclear power production credit (Sec. 45U). In the US, these credits are tradable. The Canadian Budget 2023 Clean Technology Investment Tax Credit provides a 30% investment credit for clean technologies including renewable generation, storage, low-carbon heat equipment and zero-emissions industrial vehicles.
Measures to support investment in critical minerals	Tax policies can incentivise investment in minerals and metals that are required to build the clean technologies of the future for example (green steal,	The US IRA provides an advance production tax credit for eligible minerals (Sec 45X). The Canadian Budget 2023 created a Clean Technology Manufacturing Tax Credit of a one-time 30% investment cost credit for new

[30] https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf

[31] Concerns have been expressed that the provision of direct tax incentives could lead to tensions with the standards implemented by a number of countries for a global minimum tax, the so called “Pillar 2” top up tax. It is not necessarily the case, however, that an incentive measure is automatically rendered ineffective as a result of a global minimum tax. The specific design of the measure, for example the IRA credits, can build in provisions so that companies that do not benefit from a reductio in tax can monetise them.

	low carbon aluminium, copper, lithium etc)	machinery and equipment used to extract, process, or recycle key critical minerals.
Research and development measures	Tax policies can support energy transition by offering research and development measures. Often provided through credits, these incentivize companies to invest in innovative technologies and processes that can help advance the transition to cleaner energy sources. Care needs to be taken, however, that these measures are not abused.	Australia offers a tax credit for eligible R&D activities, Brazil offers super deductions of 160% to 200%, with an additional 20% deduction for IP development for registered patents, and special depreciation for R&D assets. Argentina offers relaxation on VAT withholding. France offers a tax credit of 30% of eligible R&D expenses; the Innovative New Company status allows companies conducting R&D projects in France to receive tax benefits and pay lower social security contributions, while a reduced CIT rate of 10% applies to revenues derived from patents. Germany provides an R&D tax credit that offers companies a legal entitlement to R&D funding, currently up to EUR1 million per year. China offers a 150% deduction of qualifying R&D expenses.
Tax measures to support repurposing and decommissioning	Tax policies can be designed to encourage the repurposing of facilities for energy transition goals. They can also be used to accelerate decommissioning of fossil fuel-based energy generation facilities.	The UK government will introduce legislation to establish the tax treatment of payments into decommissioning funds relating to repurposing oil and gas assets for use in CCUS projects. Also, the current rules for ringfenced CIT and the Supplementary Charge provides for some relief for decommissioning costs in relation to assets used for the ring fence trade, even when assets are another purpose outside the ring fence. This ensures that use of assets for CCUS will not decrease the value of RFCT and SC relief available.
Tax measures to support manufacturing of components and inputs relevant for energy transition	Some countries, mindful of the need to maintain a hold on this strategically important sector, have measures to support manufacture capital equipment essential for the transition, such as solar and wind components, batteries and critical minerals. In some cases, these incentives require recipients to meet local-content thresholds, which could run contrary to global trade rules under GATT.[32]	Ghana offers incentives in the form of tax holidays, locational incentives and investment guarantees. In the USA, the Inflation Reduction Act of 2022, provides a credit for manufacturing energy property including EV components, fuel cells, electric grids, etc. (Sec. 48C) and a manufacturing credit for solar and wind components, batteries and critical minerals (Sec. 45X).
Grid modernization, distribution and infrastructure improvements	Tax policies can support the modernization of energy infrastructure, including the electrical grid. Investments in grid infrastructure are critical for accommodating the increased use of renewable	Chile has a plan to close all coal-fired power plants by 2040 and repurpose them to store renewable energy in thermal batteries and delivering the stored energy back to the grid using the former coal plant's existing power blocks and grid connections. The USA's the Inflation Reduction Act of 2022, Sec. 30C

[32] GATT Art. III (2) – National Treatment or under the SCM Agreement.

	energy sources. Tax incentives for grid improvements can facilitate the integration of renewable energy and enhance energy efficiency. Tax measures can also support the extension of distribution of electricity for transportation (for example through a charging network) and measures to reduce carbon emissions.	provides tax measures for charging stations. The Canadian Budget 2023 created a Clean Electricity Investment Tax Credit of 15% investment cost for clean electricity generation, storage & transmission.
Measures to support transition to electric vehicles, and for cooking fuels and motor fuels from renewable sources	Some countries have taken measures to incentivise the use of sustainable biomass energy sources such as biodiesel. Production side measures such as support for ethanol as fuel for transportation needs fall into this category. Many countries have sought to incentivise the use of electric or fuel-efficient vehicles, mainly through indirect tax measures such as customs duty or excise tax. While this is mainly a consumption side issue, it is relevant to consider this alongside the other measures to support transition.	USA Inflation Reduction Act of 2022 Sec. 30D & Sec. 25E, tax credits for EVs.; Sec. 45Z Clean fuel production credit; Sec. 179D Energy efficient commercial buildings deduction Sec. 45W Qualified commercial clean vehicles. Uzbekistan provides a VAT exemption of equipment necessary for production of electric cars and hybrid cars, their components and service provision for goods not produced in the country and an exemption from the disposal fee for electric cars and hybrid cars produced.
Measures to support financing of energy transition investments	Until recent technological improvements, many renewable energy investments were seen as risky, and there is a higher degree of risk perceived by financial institutions with regard to investments in developing countries. To mitigate these, some countries have introduced measures that help de-risk such investments; however the tax impact of such support may require separate mitigation. There are also examples of tax measures to incentivise investment.	Nigeria provides, in addition to tax exemption for renewable energy companies for the first three years, renewable for another two years, offers a zero-tax rate on repatriation of profits from such businesses. USA Inflation Reduction Act of 2022 provides for technology neutral clean electricity production and investment credits (Sec. 45Y and 48E). Uzbekistan provides an exemption from property tax for individuals when such property uses renewable energy sources in residential premises that are disconnected from the grid.
Measures to support fossil fuel based and renewable energy-based carbon capture	Carbon capture and storage is a process in which carbon dioxide emission, mainly from burning fossil fuels or biomass is separated, treated and transported to a long-term	USA Inflation Reduction Act of 2022 Sec. 45Q Credit for carbon oxide sequestration

and storage (CCS/BECCS)	storage location, typically in deep geological formations, or in the form of mineral carbonates. CCS retrofits for existing power plants is seen as a way to limit emissions from the electricity sector.[33]	
Regulatory and Fiscal Stability	Energy transition projects often require significant long-term investments. Stable tax policies that provide predictability and consistency in terms of taxation on energy production and consumption are important for attracting investment. Frequent changes in tax policies can create uncertainty and deter investment in clean energy. Some countries have taken steps to explicitly commit to policy stability in specific areas.	Argentina offers fiscal stability for national, import, and export taxes until 31 December 2029;

Direct tax measures

Principles for direct tax measures in energy transition

66. As can be seen from Section 4, tax policy measures are used widely to provide support to the energy transition. Developing countries face a particular challenge in utilising tax policy in this regard, as many have state owned energy providers that have fewer incentives to respond to tax policy. A pragmatic approach that prioritizes specific areas of tax policy work to support energy transition, that can be applied to meet the circumstances of each country could be highly beneficial.

67. Many developing countries face challenges due to energy shortages and lower capital availability. The twin needs of energy access and energy transition will require policy trade- offs within specific country contexts. This is particularly true in decommissioning existing power generation capacity in developing countries, where there is limited capital available to replace older, polluting fossil fuel-based plants.

68. Further, incentivisation of renewable energy and investments in technologies have important effects on markets as they can improve outcomes for other producers and for future consumers. Tax policy measures should be considered in the broader context of other energy transition policies and in the light of interaction of different policy measures (see 2.5). While incentivisation is important, it is also necessary to consider where tax measures in fossil fuel-based energy production can be tightened to provide fiscal headroom for countries and revenue for important development priorities.

[33] IPCC (2022). Shukla, P.R.; Skea, J.; Slade, R.; Al Khourdajie, A. (eds.). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. Page SPM-16.

Taxation of resource rights in renewables

69. The grant of a licence to build a hydro, solar or wind facility means that the specific geographic area and the natural resources located there have been allocated to a firm. Those rights have increasing value as capital costs in solar and wind energy, on a per MW of generating capacity cost basis, are on a downward trend. That value is further enhanced by developments in electricity markets; see further the energy transition paper covering demand side issues by the Environmental Tax Subcommittee.

70. While this is not an immediate issue for many countries, there is a case to be made to consider advantages from geography and climate. For example abundant sunshine or a long, windy coastline with potential for wind and wave power to be part of the natural resource endowment of countries. Inland hydropower potential, which can be harnessed for electricity generation, is already considered part of natural resources in some countries. The state should capture the economic rents from such resources, and design tax rules that will do so. Such a tax structure will need to consider taxing rights on the grant of the concession and/or taxation of ongoing rents. Further, the tax rules should also then specify taxation of the transfer, including indirect transfer of such rights. In view of the evolving and dynamic nature of this sector, there is some tension between making policy of providing tax incentives at present and considering taxation of resource rents in the future. This point may be academic for most jurisdictions but should be borne in mind.

71. A particular case in point is hydropower resources; this has been longstanding source of zero carbon electricity. In Norway generation of electricity from hydropower is the dominant source of energy for domestic use and consumption. Waterfalls and rivers harnessed for hydroelectric power are treated as natural resources under a special tax regime in the Tax Code. As power plants producing electricity from high potential water resources give rise to economic rents, income from hydroelectricity production have since 1996 been subject to a resource rent tax in addition to the ordinary CIT (22%). From 2021 the resource rent tax has been redesigned as a neutral "cash flow tax" allowing immediate deduction of investment costs in the special tax base and making the ordinary corporation tax also deductible in that base. Effectively the rate of the additional resource rent tax is 45%, but to take account of the deduction of the corporation tax technically the tax rate is 57.7 %. (57,7 % x (1-0,22) = 45 %). The effective tax rate for income from production of hydroelectric power is thus 67% (22% + 45%).

72. A related issue is the auction of permits on renewables and resales/indirect transfers of such permits. It is essential to have a clear set of rules on an auction of permits for wind/solar installations. In traditional extractives contracts, companies take the commodity price risk and ask for tax stability. In renewables, companies take the risk of general tax changes but want price stability. Auction bids for wind and solar involve bidding on long term pricing. Investors will find the auction terms more attractive if some or all of the fees can be spread over the life of the project, the grid connection is guaranteed by a certain time with the cost of that borne by the government party, and it is permitted to export any surplus capacity.

73. The Canadian province of Newfoundland & Labrador has proactively published a detailed tax regime that will be applicable to wind/hydrogen projects, including Crown Land Fees, Wind Electricity Tax, Water Use Fees and Water Royalties, with the last of these graduated according to profitability based on an R-factor. The idea of a special tax regime applicable to renewables is, at the time of writing, rather novel, although it has been prevalent in the petroleum sector for more than 50 years. Further details are available at the government website.[34]

74. Further, given that hydro, wave, wind and solar all relate to specific geographic areas, domestic tax rules should also consider imposition of source taxation on such income. This would be in accordance with the approach in Article 6 of the UN Model Convention, in line with the close economic connection

[34] https://www.gov.nl.ca/releases/2023/ecc/0223n05/

between the source of income and the State of source. While the Model addresses income from agriculture or forestry in Article 6, in view of the resource rights being intrinsically connected to the land there is a case to be made that income from such rights should be taxed in the source state. The Commentary to the UN Model, will provide final guidance on this point.

Renewable energy tax incentives

75. As seen above in Section 4, many governments provide project-related tax incentives, typically through exemptions from corporate income tax (CIT) or through accelerated deductions. Some countries also provide tax credits, which can be more flexible, especially if they are refundable; subject to domestic tax rules, a credit can be utilised to reduce tax liability of the company on its other income. However, the provision of credits, especially refundable credits, requires fiscal capacity which may not always be present in developing countries.

76. The selection of the particular mechanism, i.e. tax credits, exemptions or deductions, will depend, to some extent, on the mechanism used for other tax incentives by the jurisdiction. If an exemption is to be applied, however, it is worthwhile to require firms benefiting from the exemption to file annual accounts and tax returns, which show the potential revenue that the state is foregoing. This tax expenditure measurement is a good practice that will help improve the application of the incentive.

77. Tax incentives should also be designed in a manner that is consistent with government grants or other price-based incentives. For example Germany had a feed-in tariff policy offering all producers of renewable energy an above-market fixed price for a 20-year period; however, as production costs of photovoltaic systems decreased, this policy resulted in economic rents.[35] Assuming the same applies in another jurisdiction, a tax exemption should perhaps not be applied where sufficient financial subsidies or price incentives are available. See further 2.5 regarding the balance between tax policy and other measures.

78. There are additional fiscal measures that become important along the value chain of renewable energy production. Taxes imposed on the mining of critical minerals can be an impediment to the production of renewable energies, and trade wars around intermediate components or final products of wind turbines and solar panels have inhibited reduction in their cost. The development and deployment of other technologies within the fossil fuel value chain that would have the potential to bring emission levels of fossil fuel combustion close to those of renewables, such as CCUS, would also much depend on applicable fiscal incentives as well as the carbon price.

Tax measures to incentivise internal measures and new technologies for energy transition

79. Governments may provide tax incentives to encourage implementation of internal carbon pricing mechanisms. These incentives may take different forms, such as tax credits or deductions related to expenses incurred by companies on emissions reduction projects or investments in cleaner technologies, increased deductions for use of renewable energy or tax incentives to foster innovation in low-carbon technologies and practices. Support of research and development (R&D) activities can also address technological externalities. There are multiple examples of research and development related incentives on new technologies, processes, or practices that support energy transition.

80. A separate, but related matter, for hydrocarbons firms is the capture and utilization of associated methane in oil and gas production instead of flaring such gas. This is a not uncommon practice and has severe environmental impact, as methane adds at least 80- times more than CO2 to global warming but dissipates after 12-20 years. On the other hand, there is a business opportunity, in that captured methane can be sold or used for power generation. This is recognized by the industry which is reducing flaring

[35] Germany reformed the Renewable Energy Act from 2017.

in upstream operations, and many firms have committed to achieve zero routine flaring across global upstream assets by 2030 in line with the World Bank's Zero Routine Flaring Initiative. Tax policies can support this through specific measures and penalize flaring through the tax system. Any tax incentives granted should be based on actual capital invested – For example accelerated depreciation or deduction, rather than any exemption of income from sale of methane.

81. Renewable natural gas (RNG) is a pipeline-quality gas that is fully interchangeable with conventional natural gas. RNG is essentially biogas (the gaseous product of the decomposition of organic matter) that has been processed to purity standards. Like conventional natural gas, RNG can be used as a transportation fuel in the form of CNG or LNG. Biogas is produced from various biomass sources such as livestock operations, wastewater treatment and urban waste landfills, through a biochemical process, such as anaerobic digestion, or through thermochemical means, such as gasification. Tax measures can be introduced to encourage adoption of these technologies, for example in the hands of contractors that provide services to municipal bodies and subnational governments.

82. In the USA, the Inflation Reduction Act of 2022 has a new Clean Hydrogen Production Tax Credit of up to $3.00/kg. Projects can also elect to claim up to a 30% investment tax credit. The level of the credit provided is based on the carbon intensity of the hydrogen production. Projects must begin construction by 2033 and must meet certain job creation requirements.

Tax issues on repurposing of infrastructure

83. Repurposing of facilities offers an opportunity for extractives infrastructure to remain in the environment to be used or safeguarded for future use by another industry, for example, for CCUS. Repurposing thus reduces waste and offers time and cost efficiencies to new users. There are a number of facilities and types of infrastructure suitable for repurposing: depleted oil and gas reservoirs, wells, trunk pipelines, platforms, other (For example: subsea manifolds to well and fields data).

84. The tax treatment of assets utilized, for example in the extractive sector or for power generation, that are repurposed for qualified energy transition functions such as CCUS need to be considered. These assets would have already been depreciated for tax purposes, or may have been subject to a deduction, allowance, or other form of tax measure. Ordinary logic would require that these tax benefits are recaptured, and the asset revalued at open market value. However, the fossil fuel-based activity has actually been decommissioned and the asset remains in place. Given the incipient nature of the market and need for energy transition, this recapture could be deferred until the asset is finally abandoned, or permanently removed. In this respect, policymakers will have to consider the trade-offs in view of pursuing a smooth transition and additional investment into the low carbon emissions sector. The cost of improvements to repurpose the asset should be eligible for depreciation under ordinary tax rules and could be provided accelerated depreciation allows or full deduction to incentivise such re-use.

85. There are certain challenges to be overcome in re-using assets for CCUS projects. For example, hydrocarbon assets suitable for re-use are likely to be decommissioned before CCUS projects are viable; however, deferral of decommissioning may increase costs, uncertainty, and the risk of additional decommissioning costs. The factors that will require consideration in repurposing are issues such location, size, age and condition of the infrastructure, reservoir integrity and appropriateness (for oilfields), pressure, cost, etc. Decommissioning tax relief could also imply a relevant issue for consideration on the transfer of oil & gas (O&G) facilities, and as a result the assets may be decommissioned rather than sold for re-use.

86. Tax policy should also consider the risks of potential abuse of provisions to encourage the repurposing of assets. Thus, it may be prudent that any policies designed to support repurposing include compliance and reporting measures, and provisions for recapture of any tax benefits claimed if the

conditions for grant of benefits have not been met. Subject to that, policymakers should consider how to remove any tax obstacles in the way of repurposing/reusing O&G assets.

87. In particular, investors could be deterred if the existing assets are held within a special petroleum tax regime (‘ring fence’) and there is an exit charge or recapture of fiscal depreciation and/or decommissioning relief when the assets are moved outside the ring fence into the generally applicable tax regime. If this results in a change in the taxpayer’s trade or business, legislation could be introduced to prevent any impact on loss carry forwards or offsets that may otherwise result. Other non-tax considerations may also need to be addressed, such as whether to allow the date of decommissioning to be deferred if there is a possibility that the assets could be reused, which party is liable if the captured CO2 leaks, and what happens if not all partners in a joint venture want to participate in the re-use project.

Tax treatment applicable to decommissioning cost reliefs regarding repurposing should be a policymaking decision to facilitate energy transition on the switch from the fossil fuel industry to a lower carbon emission industry.

Tax treatment of Intellectual Property in new technology

88. Many extractive companies use cost contribution arrangements (CCAs, see Chapter 7, UN Practical Manual on Transfer Pricing, Third Edition) with regard to developing intellectual property (IP), including IP developed for energy transition. That means that new technology developed by one member of the cost-sharing group must be freely shared with other members, but non-members and third parties need to pay a royalty. Developing countries might want to encourage IP owners to consider making energy transition technologies available to other local investors at no, or low, cost.

89. A separate issue arises where new technologies are developed or tested in the course of an extractives project. A reasonable part of that IP ownership may be attributed to the local entity that is the taxpayer in the resource state. Where extractives contracts include local training as a contractual obligation for extractives firms, any IP development for energy transition should be accompanied by training of a skilled and knowledgeable local workforce that is capable of implementing the technology. Such allocation may be made actual contribution made by the local entity in the resource state.

90. Where royalties and licensing fees, along with fees for technical services to implement such IP are paid, payments may be subject to withholding tax under domestic law and treaties (see Articles 12/12A, UN Model Convention). Where IP has been developed by a third party and is being licensed by a taxpayer, it is necessary to ensure that any royalties due are consistent with what the licensor is charging other customers for the same IP rights and any technical services provided.

Ring fencing/consolidation issues in energy transition

91. An energy transition focused business may be a separate trade or business in some jurisdictions, where profits/losses may not be able to be consolidated with other activities of the same entity. This is particularly the case with extractive taxation activities that are often subject to a special tax regime that is ring-fenced from other activities. Again, given the nascent stage of the energy transition sector, there may be a case for a limited relaxation of ringfencing and group consolidation rules, to allow losses to be offset against other businesses in the same entity, or other entities under common ownership, subject to a minimum holding threshold in the latter case.

92. However, an incentive of the type above should be balanced against the need for revenue from the extractive sector. The pros and cons of such incentives should be examined; there are risks that a concession along the lines above can become subsidies that enable non-economic development of new green technologies. Developing countries, as well as other economies, should carefully consider how

risks/rewards are balanced between private sector enterprises and government in their tax policies also in processes of energy transition. This is especially the case where the country is reliant on revenues from extraction of natural resources through special tax regimes designed for such sectors. A limitation on the losses to be offset, perhaps set at a percentage of revenues earned from extractive activity, could be used as a mechanism. Another measure could be to use the amount of energy generated from renewables and the limit the loss offset to the potential carbon price that would have been due from conventional generation.

93. There are also some technical challenges in implementing such a measure; For example tax rates for the extractive activity and any renewable energy project might be different. In particular, development costs should not be allowed to be consolidated. Other rules, including a stated period of ownership of the entity in which energy transition activity occurs, may also be necessary to prevent abuse.

94. It may also be appropriate to look at the ring-fencing of incentives intended for the power generation and transmission sector, which are quite prevalent in developing countries. Many countries have already granted incentives of this kind, and it may be appropriate to consider if extensions or relaxations can be provided that will support energy efficiency and transition. For example technologies have been developed that recycle the water used in large scale conventional thermal power plants and use it for hydropower generation. Provision can be made for such innovation to take place while reducing and/or gradually eliminating the incentives for fossil fuel-based power generation. Tax measures can also be used to incentivise a transition from coal fired power to gas fired and the development of ancillary facilities.

Taxation of subcontractors and project implementers

95. It has been observed that some project specific agreements have removed taxation of contractors and subcontractors on renewables projects as an incentive to bring in the investor. This might not be considered a good practice as the services being performed are in the ordinary course of business of a contracting firm, and there is nothing unique about a construction firm that is building a solar plant as opposed to a conventional power plant. It could be valuable for countries to weigh avoiding the use of project specific tax concessions and provide for any incentives in tax legislation.

Tax issues around decommissioning of fossil fuel plants

96. Decommissioning and remediation activities come at the end of the life cycle of a project. The tax issues arising from the repurposing of extractive projects have been discussed above, and overall guidance on decommissioning of upstream activities in extractive projects is available in Chapter 14, UN Handbook on Selected Issues for Taxation of the Extractive Industries by Developing Countries Developing countries could take into consideration implementing measures and investing resources to retire or mothball their current fossil fuel-based power generation capacity, especially their coal-fired power plants, to meet their NDCs under the Paris Agreement. Presently, they collectively host 89 percent of the global coal power capacity that needs to be retired or repurposed before the end of its technical lifetime; this puts an estimated $1 trillion in capital costs at risk by 2040.

97. Closure of a fossil fuel power station, whether due to a carbon mandate or at the end of its useful life, is usually treated the same way as the closure of other businesses. There should be allowance for redundancy costs of staff, bearing in mind that tax treatment of statutory and ex gratia severance payments may differ, and deduction of demolition and restoration costs. There may be some challenges if the company involved has only one single plant as there will not be any income streams to offset such costs. There can also be issues around deductibility under general tax principles based on the characterisation of the costs as capital vs revenue costs. These costs may not be tax deductible without special provisions.

98. Where decommissioning of fossil fuel plants is considered appropriate, for example where there is sufficient capacity in the grid and progress can be made in decarbonisation through early shutdown of older, inefficient plants, some incentivisation of such closures could be made through tax policy. Such measures could be combined with closure mandates and could for example provide for increased deductions for plant closure costs.

Indirect tax measures

Principles for indirect tax measures in energy transition

99. As outlined at 1.2 above, electrification of key segments of energy demand is a critical part of the energy transition, and internalization of CO2 emissions externalities should be a key factor in electricity markets. As a first step, tax policy should aim to internalize externalities by market players. By internalizing the external costs of carbon emissions, policies such as carbon taxes or cap-and-trade schemes seek to reduce the economic appeal of generating electricity from fossil fuels. The specific area of carbon taxes is covered by the UN Handbook on Carbon Taxation for Developing Countries and is thus not discussed further here. However other indirect taxes may also play a role in internalizing the environmental costs in electricity markets and other energy use. Excise taxes, in particular, can play an important role; as a general principle, it is necessary to ensure that excise taxation approximately reflects the relative amount of carbon emitted from use of fossil fuel.

VAT/GST

100. As can be seen from the table at 4. above, the VAT measures typically used to support renewable energy generation are exemptions from VAT for capital equipment imported into the country, for example solar components such as panels, batteries, inverters, and regulators. In many European countries, there are exemptions for VAT registration for sales of power generated by decentralized energy production, for example from private solar panels, with excess capacity flowing through on the grid; however, this is mostly due to the operation of registration thresholds. Some countries also operate a general VAT waiver for the output of renewable energy plants. Other measures seen include administrative relaxations, such as the requirement to withhold VAT, and relaxation of refund rules in the case of renewable energy generation.

101. There is a policy view that VAT should not be used at all for differentiation, i.e. to impact or influence behaviour. However, in practice, VAT is often used to differentiate and steer behaviour, as can be seen in Section 4 above. The choice of whether or not to use VAT incentives is for the individual country to decide; however, it would be advisable to restrict VAT incentives to administrative relaxations, such as early refunds of input VAT on capital goods, especially where the outputs have been zero rated. The general principle of VAT neutrality, exercised through the reduction of VAT output by the amount of VAT input, should be preserved. Countries might find it prudent to avoid exemptions from VAT, in order to maintain the VAT value chain[36].

102. Apart from these general incentive measures, a range of technical issues have appeared in the course of implementing VAT rules. One of these is whether, in the electrification of transportation, the delivery of electricity to transport is considered a service or a good for VAT purposes. For reference purposes, the EU treats energy supplies such as electricity, gas, heat or cooling energy as tangible

[36] While there has been a conventional view of best practice as a single, unified VAT rate, with a zero rate for exports, about half of the 170 countries in the world that have a VAT have multiple rates. See F. Annacondia, *International - Overview of General Turnover Taxes and Tax Rates*, International VAT Monitor, Journals IBFD, cited in OECD (2020), Consumption Tax Trends 2020: VAT/GST and Excise Rates, Trends and Policy Issues, OECD Publishing, Paris, https://doi.org/10.1787/152def2d-en.

property[37] and thus a supply of goods.[38] A second technical issue arises on the VAT treatment of repurposed assets in the extractive sector, where VAT on the capital assets has presumably been recovered during the original life of the asset; when the assets are transferred into a new entity for use in say CCS, a question arises whether the normal VAT treatment for second-hand capital goods is still applicable. A related issue is whether the transfer of a licence, for example for specific geographic area, is exempt under generally applicable going concern rules.

103. To outline the above issue, as extractives companies dispose their oil & gas assets in support of the energy transition, they need to consider the VAT implications of any sale of contract interests. In most jurisdictions, the transfer of a going concern (TOGC) is not subject to VAT. In the EU, the conditions for TOGC treatment are:

- In order to be a transfer of a totality of assets, or part thereof, the assets transferred must together constitute an undertaking capable of carrying on an independent economic activity. This is to be distinguished from a mere transfer of assets.
- The nature of the transaction must be ascertained from an overall assessment of the factual circumstances, which includes the intentions of the transferee, as determined by objective evidence, and the nature of the economic activity sought to be continued.
- The transferee must intend to operate the business, or the part of the undertaking, transferred and not to simply liquidate the activity concerned immediately and sell the stock, if any.
- The nature of the transaction must be such as to allow the transferee to continue the independent economic activity previously carried on by the seller.

104. It is not uncommon for TOGC treatment to be mandatory, to protect the government from a claim for input tax by the purchaser where the seller might not have paid over output tax. Other countries have similar rules for TOGC treatment.[39]

105. While it is beyond the brief of this paper to consider these issues in detail, it would be appropriate for countries considering tax measures to encourage energy transition to address the VAT impact of potential investment transactions through regulations or other administrative guidance. Such guidance should enable the normal working of the VAT rules of the country, and provide clarity for investors, rather than seek to provide a concession. However, if it is the intention to provide a concession through administrative means, this should be clearly stated for investors and operators.

Excises and environment related levies

106. It is generally accepted that excises are the tax instrument best suited to modify and influence behaviour. For this reason, excise has been the policy instrument of choice worldwide for health taxes, i.e. to reduce consumption of harmful goods such as tobacco, alcohol and sugar sweetened beverages. Many, if not most, countries worldwide have excise duties applicable to fossil fuel products, primarily petroleum motor spirit (PMS), diesel (AGO), aviation kerosene (ATK), etc. Some countries apply lower excise rates to, or fully exempt, household kerosene (HHK) and liquified petroleum gas (LPG), largely

[37] Art. 14 and 15 of EU VAT Directive;

[38] A "supply of goods" means the transfer of the right to dispose of tangible property as owner. See also EU Court Decision of 20 April 2023 (Case C-282/22).

[39] In the UK, the conditions for TOGC treatment are:

1. The assets must be sold as part of a 'business' as a 'going concern'
2. The purchaser intends to use the assets to carry on the same kind of business as the seller
3. Where the seller is a taxable person, the purchaser must be a taxable person already or become one as the result of the transfer
4. Where only part of a business is sold it must be capable of separate operation
5. There must not be a series of immediately consecutive transfers

used for household cooking. There are also examples of lower rates applied to CNG and LPG intended for transportation purposes, on the basis that they are less polluting or have lower carbon emissions. There are also examples of lower excise rates for less harmful products, such as unleaded PMS.

107. The use of excise taxes to capture the full negative externalities of fossil fuel use may be advantageous for improving the competitive position of renewables. Countries may wish to consider whether the current use of excises fully capture the full cost of the carbon emitted and identify any gaps. For example a current exemption for HHK for equity goals can perhaps be better met by targeted subventions for the poor paid out of revenue from applying excise to HHK. The principle of taxation relative to level of harm/risk can also be applied; For example while petroleum excises are quite common, it is unusual to see an excise being levied on the use of coal, much less such an excise being calibrated to the type of coal being used. Such a structured excise system, delivered through smaller reforms, can act as a proxy carbon tax until a more comprehensive system can be implemented.[40]

108. Many countries, especially developing countries, impose an excise tax or a similar levy on the first purchase or registration of new automobiles. Some countries, for example Thailand, have a graduated structure that provide for a lower rate for low or zero emission vehicles. While this is a consumption side issue, it is relevant to mention it under the discussion of excise taxes.

109. Countries may also wish to consider extension of such instruments to capture greenhouse gas emissions in shipping and aviation. While some countries have in place a travel tax on air passenger travel, this is rarely calibrated to consider the level of carbon emissions. The broadening of the excise base should generate near term revenue for countries that will give them part of the fiscal headroom to enable other tax concessions to encourage energy transition. Further, a structured excise system, which considers the relative risk of products being consumed, will increase demand for sustainable energy. Similarly, excises or other use taxes based on electricity consumption can be varied based on the feedstock, so power from fossil fuels attract higher taxes, increasing the attractiveness of renewable energy generation.

Customs duties

110. As seen in Section 4, many developing countries apply zero or preferential tariffs for goods being imported for renewable energy production. At the present time, where many developing countries do not have significant manufacturing capacity in this area, this is an efficient approach. Countries should however consider the full range of capital goods needed for energy transition, and perhaps extend the scope of such relaxations to equipment beyond what is needed for solar or wind energy. Robust administrative and control processes by Customs authorities should be applied to ensure that these relaxations are not abused, for example through the importation of "dual use" goods for other purposes.

Transition challenges for the current extractives industry!

Decarbonization of the extractive sector

111. The low-carbon transition presents a range of opportunities for extractive industry producers to participate in diversification away from fossil fuels. Transition to green forms of energy and other low-carbon sectors can create employment, help build new value chains that are sustainably integrated into the global economy and support local value addition in developing countries. While these are important business opportunities for the sector, this subsection covers decarbonisation of industry itself.

[40] While this may improve the competitive position of renewables, measures should be balanced with a consideration of whether replacement is actually viable. The introduction of structured excises or phasing out of subsidies needs to consider the technology timeline.

112. Some companies have acknowledged the importance of reducing greenhouse gas emissions associated with their operations to mitigate climate change and committed to support a sustainable net-zero emissions objective through a complex transformative business process that keeps providing affordable and reliable energy with lower emissions. Extractives firms can thus be partners in decarbonization, broaden the tax base and support reductions in air pollution and public healthcare costs.

113. Companies, including national oil companies which are owned by the State, can set specific emission reduction targets aligned with the NDCs (see 2.1) of the countries in which they operate. They can commit to transparency by disclosing their internal carbon pricing methodologies and progress in emission reduction. Some firms publish sustainability reports with reliable and comparable information. Some firms also publish tax contribution reports showing the amount of environmental-related taxes paid. Carbon pricing policies support these targets by internalizing the cost of emissions and encouraging investment in cleaner technologies and practices.

114. Some firms are adjusting their strategies and investments based on the costs associated with carbon emissions and have implemented internal carbon pricing mechanisms. This involves assigning a monetary value to carbon emissions within their operations. By incorporating the cost of carbon into business operations or investment decisions, companies can incentivize emission reductions and prioritize low-carbon projects. This helps them take informed decisions about capital investments on projects with emissions associated, assess regulatory risks posed by existing and potential Government carbon pricing regimes or identify low-carbon innovative products or services.

Development of new technologies

115. Companies from different sectors and, specifically the renewable sector, have already made significant investments and future commitments to clean energy projects. Extractives firms are undergoing a transformative process to adapt to the changing energy landscape and actively implementing various strategies to reduce their emissions and minimize their environmental impact. A summary of technologies available follows which can again be used to shape tax policy measures to support energy transition.

116. Manufacturing companies are investing in CCUS technologies to capture and store carbon dioxide emissions to reduce greenhouse gas emissions from their operations. This involves preventing emission from entering the atmosphere by capturing them from industrial processes and storing them underground or utilizing them for enhanced oil recovery or other purposes. Extractives firms are also investing in technologies and practices that improve energy efficiency across their operations. This includes optimizing refining processes, minimizing energy waste, and adopting energy-efficient equipment and technologies.

117. It may be beneficial for countries to evaluate, over time, implementing tax policies that encourage these practices, while disincentivising capital investment that does not allow progress towards decarbonisation.

Repurposing and decommissioning

118. Repurposing and decommissioning of oil and gas infrastructure are relevant processes in the transition towards a more sustainable and renewable energy. Repurposing involves transforming existing oil and gas assets and facilities (for example rigs, refineries, pipelines, etc.), for alternative purposes that align with clean energy objectives, which minimizes waste and environmental impact. For example, a repurposing initiative could involve transforming oil and gas facilities into sites for renewable energy storage.

119. Decommissioning refers to the safe and environmentally responsible removal of oil and gas installations that are no longer in use. This process involves the dismantling and removal of platforms, wells, pipelines, and other infrastructure, as well as the restoration of the affected areas to their natural or pre-existing conditions. Decommissioning activities adhere to stringent regulations and standards to ensure the protection of marine ecosystems, human health, and safety. It involves the proper disposal or recycling of materials, plugging and abandoning wells, and implementing monitoring programs to assess and mitigate any potential long-term environmental impacts. Both repurposing and decommissioning play crucial roles in the energy transition by facilitating the shift from fossil fuels to cleaner alternatives.

120. The collaboration between governments, businesses, and stakeholders is crucial in driving this transition to achieve a sustainable energy landscape. Countries might want to contemplate developing tax policies to address decommissioning of existing facilities that are past useful life and build in approaches that incentivise repurposing.

Tax policy design for an enabling environment for the energy transition

Principles of tax policy design to promote energy transition

121. The implementation of energy transition policies can have economic implications. Tax policies should be designed to balance the economic impact on affected industries and regions. This may involve providing support and retraining programs for communities heavily dependent on fossil fuels. There is also an ongoing debate about revenue allocation; some advocates contend that revenue generated from, for example carbon taxes should be invested in clean energy infrastructure or returned to citizens to address any regressive impacts. As a matter of general policy design, such hypothecation or earmarking of taxes should be undertaken with care, as they can result in perverse incentives and/or decentralization of tax policy. For example some advocates have suggested that a Ministry of Environment should be responsible for these environment related tax measures and budget expenditures; this divides fiscal policymaking and can lead to sub-optimal policy choices.

122. Policymakers should also bear in mind that fossil fuels still play a very relevant place in energy supply and will continue to be required for the foreseeable future. Building a carbon free energy infrastructure will be a lengthy process and the financing gap (see below) in both developed and developing countries is unlikely to be met soon. The intermittent nature of renewable energies (the sun does not always shine; the wind does not always blow), requires fossil fuels in the interim and such fuels will continue to be part of the overall energy mix. Tax policies should try to be technologically neutral keeping a balance between promoting the renewable energy sector and encouraging the fossil fuels sector to decarbonize without favouring a specific sector to the detriment of another.

123. Tax policies could be considered in light of the wider framework of other climate and industrial policies and should be consistent with other pro-climate policy interventions (see 2.5). Tax policies could be useful to encourage investment in a transition to cleaner technologies. In general, tax policies should:

- Be technologically neutral and should not distinguish different generation technologies and encourage solutions.
- Focus on taxing the problem: emissions, not energy.
- Recognise that despite the growth of wind and solar technologies, these solutions are not enough to meet growing demand.
- Recognise that measures like subsidies, mandates, portfolio standards, low-interest financing, accelerated depreciation, guaranteed prices, etc. implicitly require the selection and promotion of certain technologies, and sometimes market participants, over others.

- Recognise that levelling of the playing field will send the right market signals to all actors, unleashing a new wave of innovation, not only in renewables but in all clean technologies.
- Address the need for ensuring tax neutrality for financing energy transition measures, which might appear to present more risk to financing institutions.

Financing the transition and appropriate tax measures

124. Energy transition in low- and middle-income countries (LICs and MICs) will entail an unprecedented expansion and transformation of power sector infrastructure. This transformation will require a massive
scaling up of renewable energy and energy efficiency to meet rapidly growing demand, followed by a phasing down of coal-fired power generation. The World Bank's analysis shows that that the pace of deployment of renewables-based electricity must accelerate considerably, including installation of solar and wind generation capacity, in combination with measures to improve energy efficiency and demand-side management to reduce capital requirements of transition.[41] To finance a just transition that is consistent with both the SDG 7 goal of ensuring universal access to affordable, reliable, sustainable, and modern energy by 2030 and the 2015 Paris Agreement on Climate Change, developing countries will have to mobilize far more capital than they do today. [42]

125. It is widely agreed that climate finance flow is far behind the level needed to meet the target set in the Paris Agreement to reach net-zero emission and circularity objectives, which are often estimated to be around 1% to 1.5% of GDP annually. Current financial flows offer an unbalanced picture. In 2017-18, climate finance reached as much as $775 billion on average per year[43]; but investments in fossil fuels amounted to $977 billion in the same period, and subsidies amounted to $472 billion in 2018 alone.

126. There are wider policy questions in meeting the critical long-term climate finance goal for parties to the Paris Agreement by re-orienting both public and private finance. Developing countries must mobilise finance for the implementation of NDCs pursuant to the Paris Agreement in the context of sustainable development.[44] Such financing includes for example developed countries' obligation to fund climate action by developing countries as provided for in Article 9 of the Paris Agreement. However, the focus of this paper is on tax issues that will facilitate such financing, which will primarily be private sector financing.

127. Developing nations often struggle to secure adequate funding for renewable energy projects due to limited resources and financial constraints. Tax measures to encourage such investment, and where appropriate, measures to reduce risks for investment in renewables (for example flexible tariff structures for small scale generation) will be needed. In addition, transition needs may require reorientation of investment flows away from fossil fuel and model approaches can be considered in this regard.

[41] Demand management can mean measures such as electricity tariff structures to encourage high energy consumption during off-peak hours; tax measures can help energy efficiency such as lower taxes for energy saving devices. These issues have not been discussed in detail as they are demand side matters covered by the Environmental Tax Subcommittee.

[42] Legal foundations for climate finance include, for example UNFCCC Paris Agreement (2016), UNFCCC Glasgow Climate Pact (2021); the Kyoto Protocol, which laid the groundwork for the Adaptation Fund and the UN Sustainable Development Goals.

[43] UNFCCC Standing Committee on Finance. Fourth (2020) Biennial Assessment and Overview of Climate Finance Flows. Available at https://unfccc.int/sites/default/files/resource/54307_1%20-%20UNFCCC%20BA%202020%20-%20Report%20-%20V4.pdf

[44] Bowman, Megan, Turning Promises into Action: 'Legal Readiness for Climate Finance' and implementing the Paris Agreement (April 14, 2022). Published in Carbon and Climate Law Review 16 (1) 2022: pp41-55, https://cclr.lexxion.eu/article/CCLR/2022/1/7, Available at SSRN: https://ssrn.com/abstract=4083998 or http://dx.doi.org/10.2139/ssrn.4083998

Guidance on tax issues that help developing countries close the financing gap will thus be needed. This should include mechanisms to de-risk green projects and innovation in raising finance.

128. There is also a need to structure transitions in a manner that can attract private funding. The extent to which banks and other financial institutions will be prepared to take the dual risk of financing new technologies while responding to investor and societal pressure to withdraw from funding hydrocarbons, will be a key determinant of the progress of energy transition. Measures that will support financing by the private sector will be those that help de-risk financial investments in energy transition, especially in developing countries and measures that support an enabling environment for "crowding in" financial investments for energy transition projects.

129. An example that countries could consider are the US IRA tax credits that are transferable and refundable (at a discounted rate) between unrelated entities. To explain this briefly, the US IRA 2022 enables qualifying tax-exempt taxpayers to claim refundable energy tax credits (as cash payments), while other taxpayers can transfer energy tax credits to third parties for cash. These credit monetization rules are considered to be gamechangers for the renewable energy industry, because they create ways for taxpayers to get the benefit of the energy tax credits even if the taxpayer has little or no tax liability. The so-called Transfer Election creates a new financing tool for businesses that have little or no federal tax liability by allowing them to transfer or sell credits to an unrelated third party. The intent of the new election is to allow project developers to reach a broader range of potential financing sources including firms or investors with little or no experience in the renewable energy industry, and tax-exempt foundations and bodies. Taxpayers electing to transfer energy credits or who plan to elect direct payment refundable credits must register through an online tool set up for this purpose.[45]

130. Many developing countries will not have the budget resources to provide refundable credits. However, the approach of allowing an unrelated party with tax capacity to utilise a tax credit or deduction, for actual investments made is worth consideration. Such measures would of course require strong anti-abuse provisions and monitoring. Measures could be provided to allow limited group relief for an investment credit or accelerated deduction for members of a corporate group, that may have taxable profits in another part of a group. Similarly, a bank or other financial institution could benefit from indirect reliefs based on the investments it made that meet set criteria.

131. Structuring requirements for private financing can mean enhancements to credit assessments and explicit or implicit guarantees provided by public bodies. The financiers in receipt of such measures will thus benefit from a contribution from the state or its agents (for example a power authority acting in its name). In an ordinary tax analysis, such a valuable measure could be considered a taxable benefit to the financing party or parties. Tax rules can be designed to provide a deferral on taxation of that benefit until the maturity of the project. Tax rules should also address whether that deferral would be extended to subsequent owners of the asset financing, for example if a financing transaction subject to such benefits is subsequently securitised and sold as for example CLOs (collateralised loan obligations) or a similar instrument in global capital markets.

Use of tax incentives in policy design

132. Project-related tax incentives or government grants can complement price-based incentives. They can make capital investments in renewable energies more attractive and help overcome financing impediments. On the other hand, current incentive measures for fossil fuel-based power generation can be gradually withdrawn. In some jurisdictions, the use of natural gas, as a lower carbon generating feedstock for power generation, can be incentivised but with a limited time horizon so reduction of carbon emissions can take place sooner, but such benefits are not permanent.

[45] See https://www.irs.gov/pub/irs-pdf/p5884.pdf

133. Tax incentives in the form of (reduced) consumption taxes or tax credits per Kwh of renewable electricity entered into the grid provide similar incentives to feed-in schemes. For context, feed-in schemes (FIT) allow the public sector purchaser to set the price higher for renewably-sourced electricity than the wholesale market price for electricity; FITs bear the risk of generating windfall profits for energy firms when their production costs fall. A tax credit scheme can therefore provide more visibility for the state and guard against this risk.

134. Apart from incentives for firms to invest in renewable energy sources, measures to promote the reduction of emissions from industry, and in particular the fossil fuel sector, should be considered. Such measures should be transparent and predictable and internalize externalities at the lowest cost for governments and market participants. As mentioned above, they should be technology solution neutral and focus on providing a level playing field.

135. The nature and tenor of incentives should be considered in the context of other policy choices made in energy transition. Care needs to be taken that tax incentives do not duplicate benefits provided through other policy instruments (see 2.5). Overall, incentives should be limited to the lifetime of the project, in the case of project-based incentives, and should be geared towards actual investments made rather than blanket exemptions of income. While exemptions in customs duties for imported capital goods are common, care needs to be taken to ensure that these are not abused. Further, it is important to avoid blanket VAT exemptions to maintain the VAT value chain. See further Section 6.

Tax measures to support investment in new technology

136. Support of R&D activities and measures to introduce new technologies through incentives and deductions can help overcome the technology gap faced by developing countries. For example power-to-gas is a key area of interest for decarbonisation and increasing flexibility in energy systems, as it has the potential both to absorb renewable electricity at times of excess supply and to provide backup energy at times of excess demand. Tax incentives that support such measures, without endorsing a specific technology solution, can be an important contributor to energy transition.

137. Technologies around managing the electricity grid, and balancing supply and demand are going to be critical, including reusing some of the infrastructure already in place, for example reusing natural gas infrastructure. Tax policies in new technology implementation should be aimed at finding the balance between encouraging existing producers to decarbonize while encouraging investments in zero-carbon technologies. Again, in many developing countries, the limited reach of current grid capacity can be a strength, in that a modern, more flexible system can be built from the outset. For some developing countries, however, an inefficient grid infrastructure can lead to stranded assets.

138. It has been stated that energy transition is a matter of national security in an era of global energy security and energy related geopolitical considerations. The concern is that developed countries will see significant competition in the area of technology, and most developed countries will develop their technology domestically for security reasons and fail to transfer this to developing countries. Developing countries face wider concerns of energy access vs energy transition and the need to achieve industrialisation. Also, many developing countries do not have economies of scale to focus on purely domestic development of technology, except in the case of the largest countries. Most developing nations will therefore need to look at models of cross border cooperation to develop appropriate technologies for energy transition in an affordable way. Tax measures taken should therefore take these factors into account; ownership of technology and facilitation of joint ownership should be clarified in any tax concessions granted.

139. Finance is also required for innovation, manufacturing, and building consumer infrastructure. Tax measures can help support raising finance for innovation.

Interaction with windfall taxes

140. Prices of fossil fuel products have been extremely volatile in periods characterized by economic instability and security challenges. These range from the oil crises of the 1970s, to more recently, the mismatch between energy demand and supply during the economic recovery from COVID-19, Russia's invasion of Ukraine, etc. Such volatility has resulted in windfall profits for some extractives firms, which in turn has led to some countries imposing windfall taxes to capture a part of the economic rents above ordinary returns for the state. Recent developments show that windfall gains can also accrue in the renewable energy sector when power purchase arrangements remain static a time of dynamic technological change.

141. The imposition of windfall taxes on fossil fuel firms to gain revenue should be balanced with the need to maintain an enabling environment for energy transition. The typical rationale for such taxes is to recover revenue from fossil fuel firms when temporary windfall gains accrue, mitigate high energy prices, redistribute revenue from the energy sector and encourage the switch to renewable energy. However, business contends that these taxes do not apply to other taxpayers which may also have excessive profits, can provide a competitive advantage to firms in associated sectors not subject to the tax and can result in double taxation of regular profits. They also contribute to investor uncertainty due to increasing perceptions of risk.

142. There are also some general good practice design principles to be followed in windfall taxes, i.e. they should be limited in time and tied to the specific circumstances in which a windfall arises and should apply to a clear measure of excess profit, rather than gross revenue. Temporary taxes on "windfall profits tend to increase investor risk, may be more distortionary (especially if poorly designed or timed), and do not provide revenue benefits above those of a permanent tax on economic rents. Investors prefer a stable, predictable tax regime over the risk of future temporary taxes when prices rise".[46]

143. Countries can also consider application of incentives for switching from a fossil fuel activity to low carbon emission activities in the design of such windfall taxes. Under this approach, windfall profits of fossil fuel firms invested in fulfilment of their net-zero commitments or otherwise invested in energy transition projects would not be subject to the windfall tax. Such a measure would of course be subject to compliance and verification rules, and measures to ensure that the same investment would not be eligible for any other specific tax incentive in this regard.

Interaction between tax rules and associated policies

Mining of critical minerals

144. There are additional fiscal measures that become important along the value chain of renewable energy production. Taxes imposed on the mining of critical minerals can impede the production of renewable energies, and trade wars around intermediate components or final products of wind turbines and solar panels have inhibited reduction in their cost. Global institutions like the IMF, the World Bank, the International Energy Agency (IEA), as well as the US government, the EU, and Japan have all examined the need to ensure new supply chains for net zero.

145. There has been some deeper analysis of the physical challenges to the energy transition. The wind and solar industries have "the free benefit" of respectively wind or the sun; however, physical inputs

[46]See IMF "Taxing Windfall Profits in the Energy Sector" https://www.imf.org/en/Publications/IMF-Notes/Issues/2022/08/30/Taxing-Windfall-Profits-in-the-Energy-Sector-522617

that go into harnessing wind and solar power are not costless. S&P Global's study"[47] focused on copper and explained that the thrust of the energy transition is toward electrification, and copper is "the metal of electrification." The study took the two types of the year 2050 targets advanced by the US administration and the EU and assessed what realising those targets would require for specific applications. This analysis concludes that copper demands would have to double by the mid-2030s to achieve the 2050 goals.

146. A move by nations to control critical mineral stockpiles and control supply chains has resulted in national tax policies that illustrate the complex connections between tax measures and geopolitical alignments. The United States passed the Inflation Reduction Act of 2022, with massive incentives and subsidies for electric vehicles with batteries containing critical minerals extracted or processed in the US or in any country with which the United States has a free trade agreement.[48] It excluded vehicles with batteries containing critical minerals extracted, processed, or recycled in countries that have no trade agreement with the United States.[49]

147. An increase in similar tax policies is likely to continue, including the REPowerEU plan in Europe amongst other similar initiatives elsewhere. This will accelerate the demand for critical minerals and accompanying value chains that are building blocks for renewable energy, which requires turbines, electric vehicles, and solar panels, amongst others. Developing countries, especially those that have significant recoverable reserves of the minerals in demand, for example lithium, copper, rare earths, cobalt, nickel, etc. need to develop tax and trade policies that protect their longer-term interests.

Introduction of Carbon Border Adjustments by major trading partners

148. The potential impact of carbon border adjustment mechanisms (CBAMs) implemented by jurisdictions that import large quantities of goods from developing countries should be considered. While the current CBAM arrangements by the EU apply to a limited range of goods and services[50], the expansion of the scope of CBAM cannot be ruled out. These can potentially threaten or limit market access for the affected industries of developing countries that have energy intensive industrial sectors.

149. On the other hand, the application of CBAM to electricity can actually promote the renewable energy sector, especially in North Africa, which has abundant sunshine. Similarly, CBAMs can be a spur for transition away from a fossil fuel-based energy sector in developing countries that have trade with the EU. The CBAM arrangements thus present both threats and opportunities for many developing countries.

150. Developing countries thus could evaluate considering how diversification of energy production can help manage these risks. This analysis should consider access to affordable capital for investment, balance investments in fossil fuel-based production during transition and limit the impact on stranded assets, especially in power generation.

Deep sea mining

[47] S&P Global. 2020. "The Future of Copper: Will the Looming Supply Gap Short-Circuit the Energy Transition?" New York

[48] Section 13401(e)(1) of the Inflation Reduction Act of 2022, amending Section 30D of the US Internal Revenue Code.

[49] Section 30D(d)(7) of the US Internal Revenue Code, as amended by the Inflation Reduction Act.

[50] The EU CBAM will initially apply to imports of certain goods and selected precursors whose production is carbon intensive and at most significant risk of carbon leakage: cement, iron and steel, aluminium, fertilisers, electricity and hydrogen.

151. Deep sea mining is the new frontier for mining with the potential of providing critical minerals, such as nickel, copper, cobalt, and manganese, required for the development of low-carbon technologies. According to the International Energy Agency from 2017-2022 there was a 70% rise in the demand for cobalt and a 40% rise in demand for nickel.[51] . Due to the rising demand for critical minerals, there is a "green" rush to the bottom of the sea by both mining companies, that want to maximise their profits, and countries, that want to secure their geopolitical positions.

152. While exploration of the deep sea has been underway and approximately 30 contracts have been issued by the International Seabed Authority (ISA), the body responsible for regulating the deep sea under the Law of the Sea Convention, no exploitation of the deep sea has begun.[52] This is in part due to the environmental concerns that mining in the deep sea will cause irreparable damage that does not justify the financial or decarbonisation benefits.. The ISA is in the process of negotiating regulations to facilitate commercial extraction of minerals including the tax or royalty component.

154. Three areas of the regulations are likely to have implications for the mining of critical minerals.

(1) A key component of the draft ISA regulation is determining the royalty regime through which the mining companies would pay a fee to the ISA and how the royalty can be equitably shared amongst member states. In determining the royalty, the value of the deep seabed is considered, but with the increased demand and rush of critical minerals, the royalty value for these minerals must be considered vis-à-vis the damage.
(2) The United Nations Convention on the Law of the Sea (UNCLOS) requires companies seeking a contract to mine from the ISA must be sponsored by a country that is a member state of the ISA (sponsoring state). The benefit to the sponsoring state is that it can, in theory, tax the mining company. However, the benefit to the state is determined by multiple factors including tax exemptions, the tax rate, and whether the companies are applying tax avoidance mechanisms, etc.
(3) Most of the companies involved in deep sea mining are sponsored by and located in developed countries. This means that it is likely that the majority of the profits, critical minerals, and control of critical mineral value chains will accrue to already wealthy individuals, high-value companies, and developed countries reinforcing current geopolitical positions. This will be contrary to the principle of equitable benefit-sharing and prioritising the needs of developing countries on which the UNCLOS was based.

Environmental, Social, and Governance standards (ESG) and taxation

155. As a response to climate change, countries are establishing tax policies designed to modify market behaviour resulting in decreased carbon emissions. The majority of these tax policies work by incentivising the uptake of climate-friendly technology and processes. As a result, many organisations are re-examining their processes and value chains in order to lower their carbon footprint and take advantage of the tax breaks and monetary incentives. Companies are examining their procurement processes as well as their logistics and distribution operations. For instance, the EUS's Fit for 55 package includes carbon content levies where tariffs charged are dependent on the type of fuel used. Companies that invest in low carbon technologies and systems also benefit from tax breaks and monetary incentives. These incentives are given at both a national and EU level to help businesses recoup some of the costs of decarbonising.

Energy transition, taxation and impact on human rights

[51] International Energy Agency, Critical Minerals Market Review 2023 (July 2023) – www.iea.org/reports
[52] International Union for Conservation of Nature, "Deep – Sea Mining", Issue Brief (May 2022) – www.IUCN.org/resources

156. The environmental and social impact of climate change and the energy transition is most significant on indigenous peoples and local communities; however, they are most likely to be left behind in the global energy transition agenda. An energy transition process should therefore consider protecting the livelihoods, culture, heritage, and human rights of local communities and indigenous peoples. Taxation can be a tool to promote indigenous peoples' and communities' rights and ensure that they are put at the forefront of the energy transition and share in the benefits.

Tax administration

Introduction

157. The bulk of measures taken to encourage energy transition will be in the nature of tax concessions and incentives. This also applies in a sector where both business practices and technology are new and subject to rapid change. The risk of abuse of concessions made is thus higher than other areas, especially when the regulators are new to subject. This section focuses on administration issues in tax policies for energy transition. The emphasis is on the practices and challenges faced in administering the sector and the anticipated transition from fossil fuels to renewable energy sources.

158. Tax measures directed at influencing investments in the sector should include reporting and compliance requirements. Such reporting requirements will encompass emissions or energy usage, the verification of costs for repurposing of infrastructure, actual investment made in R&D and technology development, etc. Tax administration measures are also advantageous to ensure the appropriateness (or implementation) of withholding tax systems on income derived from the use of intellectual property and the delivery of technical services. These are essential tools for monitoring and enforcing energy transition goals.

159. Tax administrators monitor a range of taxpayers, including those in the extractive sector, different extractive arrangements or for private power generation, in some cases, with different tax provisions and incentives in collaboration with the respective regulator. In the case of energy transition, tax administrations have a steep learning curve due to the dynamic nature of the sector. In the case of countries with a strong resource endowment, tax administrators also have to understand the interaction between the extractive sector and the renewable energy sector. This can be particularly challenging where the electricity sector has been going through corporatization or privatization, which result in a public sector utility that has taken on the characteristics of a taxpaying entity with different economic drivers than was formerly the case.

Key challenges

160. Interagency cooperation is often an issue. The number of regulators (for example a Ministry or department of environment, an energy regulator, the power grid company and the tax administration) and, at times, their failure or delays in sharing information can have an impact on revenue administration and collection. Coordination is very important concerning energy efficiency and transition milestones that have been the condition of the grant of incentives and concessions. A framework for interagency coordination can be developed to support this activity.

161. Tax administrations’ central challenge is protecting revenue from erosion as a result of abuses. Many tax administrations contend that even with incentives, taxpayer firms employ tax avoidance techniques that deprive developing countries of revenue. A principal problem in this regard is the imbalance in information and in negotiations; however, this is gradually changing.

162. Managing the expectations of the wider community is also a significant challenge. Tax authorities have to address the needs of taxpayers; in many countries, extractives and power firms are some of the largest taxpayers who have strong information advantages and technical expertise. On the other hand,

civil society actors and the broader community expect tax authorities to recover the maximum possible revenue without understanding the need to conform to tax legislation and what can be legally collected.

163. Emission volumes also need to be verified, whether because they are subject to some form of environmental taxation or because they need to be externally reported in relation to targets. This will require specialist expertise, possibly supported by independent external audit.

Organization and staffing for administering tax rules for energy transition

164. Most tax authorities have a specialized unit within the Large Taxpayer Division of the Domestic Tax Department that administers taxation of the extractive sector. The specialized unit must collaborate and coordinate with the other regulators. This coordination requires significant strengthening, particularly with respect to information on production volumes, cost and sales and information sharing. There is a strong case for locating officials responsible for administering the rules regarding energy transition in the same Division or office. The same office could also take responsibility for the power and utilities sector, assuming that these entities are privately owned or have been given corporate form and are subject to tax, while being owned by the state. Similarly, a petroleum taxation office (where appropriate) can take responsibility for application of special provisions, if any, for repurposing and decommissioning.

165. However, while the above may cover large energy firms, it should be recognized that there are other producers, including small and medium size companies that could be beneficiaries of these measures. Further, some developing countries have had success in creating small, localised grids for generating electricity in rural areas. The tax administration should consider how to communicate and manage expertise relating to specific types of incentives applicable to smaller companies. If, for example regional medium taxpayer offices (MTOs) are utilized, a specific MTO can be identified as the focal point for these measures.

166. While staff in such specialized units are generally more technically skilled, there are limitations. Given these limitations, and of the development of new technology in the energy sector, their skills should be regularly enhanced in key areas of business knowledge, transfer pricing, forensic auditing data analytics etc. It might be prudent for tax administrations to have structured staff development plans to address the challenges of the unavailability of requisite qualified staff and knowledge. They should also take measures to overcome the challenges of limited interfaces with other relevant systems and seek solutions to deal with the need for tools, logistics and access to technical sites. Contributions from development partners and capacity building institutions should be sought to address the gaps in tools and accelerate the acquisition of necessary professional knowledge and required skills.

Monitoring frameworks for energy transition.

167. Most Domestic Tax Departments are automated, and their systems are continuously being enhanced thereby accelerating the transformation of tax administration. This facilitates, to some extent, the administration of tax rules for complex sectors by enhancing compliance monitoring and management. However, in the case of tax rules regarding energy transition, there is often a gap in developing countries on reliable data and standards. for example a reliable carbon registry with an independent regulator to provide certification of achievement of decarbonization goals is often not available, or the agency established by the Ministry of the Environment or other body does not provide verifiable data. This can lead to abuse of any tax concessions granted.

168. There is accordingly a need to develop monitoring and reporting frameworks that are consistent with the tax rules that have been developed. These should ideally be developed by the sector regulator such as the Ministry of Environment or power regulator with input from tax administrators. The latter

can then work internally within the specialized units to develop monitoring tools and standards that will help ensure compliance with the tax rules designed to promote energy transition.

169. Many specialized units and other regulators responsible for the industry in developing countries do not have sophisticated automated systems nor adequate modern industry software capable of monitoring the sector and the benchmarking of related costs. On the other hand, taxpayers in the sector are likely to be heavily automated with ongoing digital transformation, again presenting an information and capacity challenge for tax administration. To mitigate these challenges, further investment in these areas is advisable; tax administrations in developing countries may wish to support acquiring the requisite infrastructure and tools to conduct verification and monitoring.

170. A further area of monitoring is to deter and prevent misuse and abuse of duty-free privileges. Customs authorities must ensure that the duty-free privileges granted to firms under tax concessions, for example for the importation of equipment for renewable energy facilities, are not abused while at the same time facilitating the clearance process for the sector. Sharing of information and connectivity between the systems and regulators as may be necessary are important factors in ensuring the integrity of these measures.

Appendix 1: Reference materials

1. International Renewable Energy Agency (IRENA) - Energy Transition in Developing Countries: https://www.irena.org/energytransition/Why/Developing-Countrieshttps://www.irena.org/energytransition/Why/Developing-Countrieshttps://www.irena.org/energytransition/Why/Developing-Countries.
2. World Bank - Energy Transition in Developing Countries: https://www.worldbank.org/en/topic/energy/publication/energy-transition-in-developing-countries
3. International Energy Agency (IEA) - Energy Transition Challenges for Developed Countries: https://www.iea.org/topics/energy-transition/challenges/developed-countries
4. United Nations Development Programme (UNDP) - Energy Transition in Developing Countries: https://www.undp.org/content/undp/en/home/topics/energy/energy-transition-in-developing-countries.html
5. World Bank - Energy Transition in Developing Countries: https://www.worldbank.org/en/topic/energy/publication/energy-transition-in-developing-countrieshttps://www.worldbank.org/en/topic/energy/publication/energy-transition-in-developing-countrieshttps://www.iea.org/topics/energy-transition/challenges/developed-countrieshttps://www.iea.org/topics/energy-transition/challenges/developed-countrieshttps://www.undp.org/content/undp/en/home/topics/energy/energy-transition-in-developing-countries.htmlhttps://www.undp.org/content/undp/en/home/topics/energy/energy-transition-in-developing-countries.htmlInternational Renewable Energy Agency (IRENA): IRENA provides reports and publications on various aspects of energy transition challenges, including those specific to developing nations. You can find their resources at: https://www.irena.org/publicationshttps://www.irena.org/publicationshttps://www.irena.org/publications
6. World Bank: The World Bank offers reports and articles on energy transition challenges faced by developing nations, along with strategies for overcoming them. You can explore their resources at: https://www.worldbank.org/en/topic/energy/publicationhttps://www.worldbank.org/en/topic/energy/publicationhttps://www.worldbank.org/en/topic/energy/publication
7. International Energy Agency (IEA): The IEA provides insights and analysis on energy transition challenges for both developing and developed nations. Their publications can be found at: https://www.iea.org/topics/energy-transitionshttps://www.iea.org/topics/energy-transitionshttps://www.iea.org/topics/energy-transitions
8. Climate Action Tracker: Climate Action Tracker is an independent scientific analysis that assesses countries' climate targets and tracks their progress. They provide regular updates on countries' NDCs and their alignment with the goals of the Paris Agreement. You can find more information on their website: https://climateactiontracker.org/https://climateactiontracker.org/https://climateactiontracker.org/
9. UNFCCC: The official website of the United Nations Framework Convention on Climate Change provides information on the NDCs submitted by countries. You can visit their website at: https://unfccc.int/https://unfccc.int/https://unfccc.int/
10. Intergovernmental Panel on Climate Change (IPCC) - https://www.ipcc.ch/https://www.ipcc.ch/https://www.ipcc.ch/
11. United Nations Framework Convention on Climate Change (UNFCCC) - https://unfccc.int/https://unfccc.int/https://unfccc.int/
12. Osofsky, Hari M. and Wiseman, Hannah Jacobs, Hybrid Energy Governance (February 13, 2013). University of Illinois Law Review, Forthcoming, FSU College of Law, Public Law Research Paper No. 608, Minnesota Legal Studies Research Paper No. 12-49, Available at SSRN: https://ssrn.com/abstract=2147860 or http://dx.doi.org/10.2139/ssrn.2147860https://ssrn.com/abstract=2147860 or http://dx.doi.org/10.2139/ssrn.2147860

13. https://thegiin.org/climate-finance/?gad=1&gclid=Cj0KCQjw_5unBhCMARIsACZyzS1PVMq9a3Mwe0m05mE2S3q9EQ0a4EwfIzll4b62FKrSCbzsJZxjzxkaAlaEEALw_wcB
14. https://ssrn.com/abstract=2147860https://ssrn.com/abstract=2147860http://dx.doi.org/10.2139/ssrn.2147860http://dx.doi.org/10.2139/ssrn.2147860https://ssrn.com/abstract=2147860http://dx.doi.org/10.2139/ssrn.2147860http://dx.doi.org/10.2139/ssrn.2147860https://thegiin.org/climate-finance/?gad=1&gclid=Cj0KCQjw_5unBhCMARIsACZyzS1PVMq9a3Mwe0m05mE2S3q9EQ0a4EwfIzll4b62FKrSCbzsJZxjzxkaAlaEEALw_wcBAlvarado M., IBFD 2023. "Windfall Profit Taxes Across Europe: Have they Proved to be Effective for Taxing Windfall Profits in the Energy Sector?" European Taxation, 2023 (Volume 63), No. 10.
15. Baunsgaard, T. y Vernon, N. 2022. "Taxing Windfall Profits in the Energy Sector" IMF Note 2022/00, International Monetary Fund, Washington, DC.
16. Annex II of the Communication from the commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. REPowerEU: Joint European Action for more affordable, secure and sustainable energy. COM (2022) 108 final. Strasbourg, 8 March 2022.
17. Lazzari, S. Congressional Research Service 2026 "The Crude Oil Windfall Profit Tax of the 1980s: Implications for Current Energy Policy".
18. Schalk Cloete, June 26, 2019. Time for tech-neutral incentives if renewables growth won't stop climate change? Energypost.eu.
19. North Sea Transition Authority. "Repurposing offshore oil and gas infrastructure can reduce waste and accelerate energy transition".
20. Department for Business, Energy & Industrial Strategy. July 2019. Consultation on "Re-use of oil and gas assets for carbon capture usage and storage projects".

Appendix 2: Inventory of energy transition measures in select countries

COUNTRY	Tax incentives for renewable energy generation	R&D incentives for innovation	Repurposing of fossil fuel energy production assets
Argentina	The Renewable Energies Promotional Regime offers various tax incentives for the use of renewable energy sources, including accelerated depreciation, extended loss carry-forwards, exemption from income tax on profit distributions reinvested in new infrastructure projects and VAT refunds.	- Fiscal stability for national, import, and export taxes until 31 December 2029; - Reduced income tax rate by 20% for large companies and availability of foreign tax credit; - No VAT withholding; and - 70% tax credit for certain social security contributions.	Restrictions to transmission and transformation capacity are limiting the development of many renewable energy projects. The government estimates that by 2035, 11,800 km of transmission lines need to be built.
Australia	The Renewable Energy Act 2000 aims to stimulate investment in renewables by requiring entities to purchase and surrender a certain number of Renewable Energy Certificates, in order to meet their obligation under the RET each year. This was replaced by large-scale generation certificates (LGCs) and small-scale technology certificates (STCs). LGCs and STCs, are the main Federal Government incentives for renewable energy investment in Australia.	Australian Renewable Energy Agency Act 2011 provides financial assistance for the R&D, and commercialization of renewable energy and related technologies. Offers a tax offset for companies conducting eligible R&D activities, tax credits and other fiscal incentives; initiatives that the private sector can engage with, grants, de-risking instruments such as loan guarantees etc.	ARENA, the CEFC and the Northern Australia Infrastructure Facility have invested in the 250 MW Kidston Pumped Hydro Project in Queensland, an innovative project that will repurpose an abandoned gold mine site as a storage reservoir. These projects complement other pumped hydro investments, including the Snowy 2.0 and Battery of the Nation projects.
Bolivia	Fiscal incentives have been provided on a case-by-case basis or with regional and time limited scope. For example, Law 3279 and Law 31525 of 2005 provided 5 years of VAT and import duty exemptions for renewable energy equipment in the Departments of Beni and	Regulatory framework seeks to develop promotion mechanisms, including preferential dispatch, financing mechanisms, and import tax exemptions for renewable energy equipment that cannot be locally manufactured.	

	Pando respectively. Decree 280 of 2009 provided import duty exemption for solar and small-scale wind power equipment from the EU Euro-Solar cooperation project.		
Brazil	Special Incentive Regime for the Development of Infrastructure - suspends the application of certain taxes on goods and services employed in the development of those projects. - Many components used in solar generation projects benefit from a zero rate of importation tax. - Discounts on the transmission system usage rate and distribution system usage rate of 50% are also available for solar, wind and biomass generation projects whose capacity is 300MW or lower.	Provides for super deductions, accelerated depreciation, and an exemption from excise tax. - Super deductions of 160% to 200%. An extra 20% deduction is available for IP development for registered patents. - Special depreciation/ amortization for R&D assets. - Certain deductions related to equipment, machinery, and tools acquired and dedicated exclusively for R&D activities. - 50% reduction in IPI (federal excise tax) on equipment, machinery, and tools dedicated to R&D.	Offshore wind power projects offer an alternative to the removal and final disposal of infrastructures, a potential solution to Brazilian offshore decommissioning.
Canada	Canada's new renewable energy investment tax credit is a refundable incentive that offers up a percentage of the cost of capital investment – will provide a 30% tax write-off for renewable technologies deployed through 2034.	The Energy Innovation Program is a federal program that aims to advance clean energy technologies. In 2022, Canada implemented an investment tax credit for CCUS, including direct air capture projects and equipment for transportation, storage and use.	Canada has explored repurposing oil and gas infrastructure for renewable energy, particularly in provinces heavily reliant on the fossil fuel industry.
Chile	The quota system requires power companies that have an installed capacity of more than 200 MW and that withdraw energy	R&D Tax Incentive Law 20,241 establishes a tax incentive for private investment in R&D. The tax incentive consists of a tax credit against first category	By 2040 Chile plans to close all coal-fired power plants and repurpose the retired coal power plants to serve the green

	from the electrical grid for trading with distribution companies and final consumers to certify that a certain percentage of their energy withdrawal comes from renewable energy sources. This percentage has increased every year until reaching 20% in 2025. Exemption from paying tolls for using the main electrical transmission is available to renewable energy projects.	income tax of 35% of the amount invested in R&D, capped annually at approximately USD 1 million. The remaining amount invested may be deducted, regardless of the company's line of business. If a company is in a tax loss situation or does not have enough tax against which to apply the R&D tax credit, the credit can be carried forward indefinitely to subsequent years.	economy by storing renewable energy in thermal batteries and delivering the stored energy back to the grid using the former coal plant's existing power blocks and grid connections.
China	- The government offers FiTs, providing a fixed price for renewable electricity generation. t. - National, regional and local subsidies reduce upfront costs for renewable projects, making them more financially viable. T - Tax incentives and exemptions include VAT waivers, income tax reductions, and preferential tax rates, lowering overall project costs. - Green Electricity Certificate scheme.	A resident enterprise may deduct 150% of qualifying R&D expenses actually incurred (i.e., an additional 50% deduction on top of the normal expense deduction) in computing its tax liability if the expenses do not result in the creation of an intangible asset. If intangible assets are developed, the qualifying R&D expenses that have been capitalized may be amortized based on 150% of the actual R&D costs.	Announced plans in 2016 to convert some coal plants to nuclear power stations.
Egypt	A reduced income tax rate of 30% applies to projects using new and renewable energy. Auctions for large-scale solar PV projects. FIT scheme to encourage investment in electricity generation from renewable energy resources, particularly wind and solar.	The current renewable energy context, where the NREA is the main developer of renewable energy projects in Egypt through funding from development partners, has constrained the development of R&D capacity to leverage local manufacturing potential.	With extensive energy infrastructure and renewable energy potential, and vast storage facilities, and its ability to leverage large-scale solar and wind projects can play a vital role in achieving low carbon hydrogen production.

Finland	In Finland, the current national policy is to tax energy production based on the carbon intensity of the fuel used, leaving renewable energy sources outside this tax. These carbon-based tax incentives for renewable energy production promote technologies with higher maturity and lower subsidy needs.	R&D expenses may be deducted at the time they are incurred. Taxpayers also have discretion to depreciate the R&D expenditure over two or more years (but no more than 10 years). Grants energy aid to climate and environmentally friendly investment projects that promote energy savings and the production/use of renewable energy. The purpose is to promote the implementation of new energy technology and its introduction to the market.	Finland is replacing fossil-based chemicals with renewable raw materials such as wood to produce goods, services, and energy.
France	The main support schemes that have been implemented for the promotion of renewable energies are the feed-in tariff (FIT) and feed-in premium (FIP). This price, set by the minister of economy, is higher than the market price. Under the FIP scheme, producers selling electricity from renewable sources on the market at market prices receive compensation based on an agreement.	- The R&D tax credit, which is equal to 30% of eligible R&D expenses. - The Innovative New Company status, which allows companies conducting R&D projects in France to receive tax benefits and pay lower social security contributions for highly qualified jobs, such as engineers and researchers. - A reduced CIT rate of 10% instead of the standard CIT rate applicable to revenues derived from patents.	Potential to repurpose existing gas infrastructure for hydrogen transmission. However, investment costs are still significant, and complex regulatory frameworks and technical limitations pose a challenge to repurposing gas pipelines.
Germany	In 2000, Germany introduced a FIT policy offering all producers of renewable energy an above-market fixed price for a twenty-years period. 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	The R&D incentives regime in Germany is predominantly based on two pillars: (1) nonrefundable cash grants, provided through various programs via a competitive application process and (2) an R&D tax credit that offers companies a legal entitlement to R&D funding, currently up to EUR1 million per year (per	Germany has been decommissioning coal plants and investing in converting to renewable energy storage sites by 2038. Germany has been repurposing former coal mines and other industrial sites for renewable energy projects. While not specifically related to

	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.	company group, max funding amount p.a. fixed until 1 July 2025).	oil and gas, it reflects a broader trend in repurposing old industrial infrastructure for clean energy.
Ghana	Incentives for renewable energy manufacturing and assembling firms including substantial tax reduction; exemption of materials, components, equipment and machinery that cannot be obtained locally for manufacturing or assembling, from import duty and VAT up to the year 2025. Other incentives in the form of tax holidays, locational incentives and investment guarantees are scattered throughout the legislations affecting the renewable energy industry, tax statutes as well as other sector specific laws.	The Renewable Energy fund was set up to provide financial support for activities to promote, develop and utilize renewable energy is not operational due to low cashflow into the fund. This has negatively affected some provisions in the Renewable Energy Act, 2011 (Act 832), such as the off-grid electrification for remote communities, and research and development.	Ghana is working to transition its energy use by using natural gas resources more efficiently and contributing to a cleaner energy mix
India	Renewable Energy Certificates (RECs) is a market-based instrument to promote renewable sources of energy, and the development of the market in electricity. Certificates are issued to eligible companies generating electricity from renewable sources which can be traded on specific regulatory exchanges.	A 100% deduction is available on revenue and capital expenditures paid out or expended on scientific research related to the business. This deduction is available even for companies that opt for the concessional tax rate of 22% or 15%.	India plans to repurpose fossil fuel thermal power plants for long-duration energy storage technology that can be deployed in the near term.
Indonesia	Indonesia launched the country's first carbon emissions credit trading system. Trading will be voluntary in its initial stage, and the system will aim to adopt international standards to	The R&D super deduction is available to companies that conduct qualifying R&D activities in Indonesia. The super tax deduction includes a deduction of up to 300% of the total expenditure	The 660-megawatt coal-fired power plant Cirebon-1 in Indonesia will likely be retired almost 7 years earlier than scheduled.

	make the credits available to foreign buyers. The government also plans to launch its twice-delayed carbon tax in 2025. Indonesia, however, the government ultimately decided that its carbon market would be open to foreign buyers.	incurred for certain R&D activities.	
Italy	For qualifying energy and natural gas intensive enterprises. Specifically, the tax credit is increased as follows: - The 20% tax credit computed on expenses incurred for energy purchased and consumed in the second quarter of 2022 is raised to 25%. The 15% tax credit on expenses incurred for the purchase of natural gas consumed in the second quarter of 2022 is raised to 20%.	Enterprises are eligible to benefit from the R&D tax credit, regardless of their legal status, size, or economic sector, and the incentive is available to both enterprises resident in Italy and to Italian PEs of nonresidents. The tax credit is computed on 10% of eligible innovation expenditure in the field of "green transition" up to a total tax credit of EUR 1.5 million;	Eni has developed a dual use wave turbine that can convert decommissioned oil platforms into renewable energy islands. The first Inertial Sea Wave Energy Converter trial unit has been installed at the Ravenna site, Italy's largest gas and oil offshore facility.
Morocco	Exemptions were introduced to promote the establishment of local industries of renewables components: - Corporate tax for the first five years, and then a rate of 8.75% for the following 20 years. - VAT on imports and domestic sales. Investment grants of up to 10% of the acquisition cost of new capital goods.	The Industrial and Investment Development Fund grants financial assistance for tangible and intangible investments, up to 30% of the total investment amount.	No tax provisions are available. Morocco was a net importer of fossil fuels.
Netherlands	The main support schemes that have been implemented are the *Stimulering Duurzame Energie* (SDE++) and the Energy Investment	The Netherlands has several incentives to lower R&D costs and investments for a company. This includes the R&D tax credit, which reduces wage tax on	The Netherlands has shown interest in repurposing oil and gas infrastructure for renewable energy, including offshore

	Allowance (EIA). The SDE++ subsidy can be used for using CO2 reducing technologies. Wind and solar have benefitted well from these schemes and are currently also supporting CCUS projects. The Energy Investment Allowance (EIA) provides for a tax reduction up to 11% to stimulate investments in energy-efficient technologies.	qualifying wage costs and other costs and expenses; an R&D deduction that allows for a fixed additional deduction for companies. Furthermore, qualifying profits can be taxed in the innovation box. Effectively, these profits would be taxed at a rate of 9%.	wind projects. Netherlands presents an illustrative case of coal phase-out through mechanisms of "industrial upgrade and regional renewal.
Norway	Norway and Sweden have collaborated to develop a green electricity certificates scheme resulting in a common market for trading the certificates. The scheme is a funding system for renewable energy production. Power plants that are part of the scheme will receive a green energy certificate for every MWh of renewable energy produced, which counts towards their electricity certificate quota. The certificates can be sold on the free market. Green certificates are issued to produce renewable energy for 15 years.	Energy technology and innovation will play an important role in Norway's energy transition, to leverage the existing strengths of its energy sector in new areas, such as CCS and hydrogen. Innovation in Norway's energy sector is spearheaded by Enova, an entity owned by the Ministry of Climate and Environment. It supports new energy and climate technology in industry and transport, and the introduction of new technologies. The Norwegian government also offers several R&D-related support measures for the development of low-carbon hydrogen.	Norway is leading in CCS expertise. The technology can notably play a role in decarbonising the industry sector (such as upstream oil and gas production, cement, and waste incineration) and also facilitate the production of low-carbon hydrogen, along with offering vast CO2 storage capacity for other countries. Norway is exploring ways to repurpose offshore oil platforms for wind energy installations.
South Africa	Businesses can deduct 125% of the costs of qualifying investments in the first year of the project with no threshold on generation capacity. This incentive is only available for investments brought into use for the first time between 1 March 2023 and 28 February 2025.	The R&D super deduction is 150% of qualifying operating expenditure incurred directly for the purposes of R&D relating to scientific or technological activities. Capital costs that relate to pilot plants or prototypes for the purpose of R&D also will qualify.	The first option would be to retrofit coal-fired power plants with carbon capture, utilisation and storage technologies. Another option is to use low-carbon fuels, such as sustainable biomass, or ammonia produced from renewable hydrogen

			or fossil fuels in combination with CCUS.
Spain	A temporary CIT incentive (extended to 2024) regarding the freedom of amortization regime for investments in renewable energy self-consumption facilities or fossil energy substitution. The amount of investment that can benefit from the freedom of amortization is limited to EUR 500,000 per investment and is subject to the maintenance of workforce conditions.	In general: A 25% tax credit for expenses incurred from R&D activities. If the expenses are higher than the average R&D expenses incurred by the company during the previous two years, the tax credit is 42% for the excess amount. An additional tax credit of 17% can apply regarding staff expenses allocated exclusively for carrying out R&D activities. An 8% tax credit can be availed of for investments made in tangible fixed assets (excluding buildings) and intangible assets that are exclusively assigned to R&D activities. A 12% tax credit for technological innovation activities.	
Sweden	The main incentive for building renewable energy production capacity in Sweden has been provided in the form of the Electricity Certificate system. The market for ECs and the EC system started in Sweden in 2003 and in 2012 has been extended to Norway. Currently, the market and the system will operate until 2045 although Norway has decided to leave the system in 2035. Tax reductions may be granted to produce renewable energy under certain conditions subject to application.	Various grants and other incentives are awarded by government agencies, such as the Swedish Research Council and the Swedish Agency for Innovation Systems. 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.	

United Kingdom	The Feed-in Tariff scheme was introduced to promote the uptake of renewable and low-carbon electricity generation. For larger scale regeneration, the FiT scheme has been replaced by the Contracts of Difference scheme This scheme is designed to act as an incentive for investment in renewable energy as it provides project developers who incur significant upfront costs and are involved in long-term projects with direct protection from variable wholesale prices, while protecting consumers from paying higher costs when electricity prices are high. UK renewable generators that meet specific requirements may apply for CfD by way of a "sealed bid" process.	The UK offers volume-based super deductions and credits for qualifying revenue expenditure as defined in the Department for Business, Energy and Industrial Strategy guidelines that vary depending on the size of the taxpayer. Capital expenditure is excluded from the volume-based incentives, but a full deduction for capital costs incurred for carrying out R&D or providing facilities for carrying out R&D may be claimed in the year the expenditure is incurred, rather than being depreciated for tax purposes in accordance with the normal rules. An incentive is also available that provides a reduced effective rate of corporation tax of 10% on certain profits derived from qualifying patents and other similar intellectual property	The United Kingdom has phased out most of its coal-fired power stations. Additionally, the UK has been repurposing old oil and gas decommissioned infrastructure in the North Sea for renewable energy projects.
United States	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. In the United States, the promotion of combined heat and power 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. The Inflation	The US offers a nonrefundable research tax credit that can be applied to reduce income taxes. The research tax credit is a credit computed on an increment of qualified research spending exceeding a base amount. A nonrefundable tax credit is available under Internal Revenue Code (IRC) Section 41 for certain qualified research expenses incurred in the US that exceed one of two computed base amounts. This tax credit may be used by a business to reduce its federal tax liability.	The U.S. has seen various initiatives to repurpose old oil and gas infrastructure. In Illinois, at least nine coal-burning plants are on track to become solar farms and battery storage facilities in the next three years. In Massachusetts and New Jersey, two retired coal plants along the coast are being repurposed to connect offshore wind turbines to the regional electrical grids. 11 coal plants will close over the next three years and

	Reduction Act, enacted in 2022, provides a 30 per cent investment tax credit for CHP projects that begin construction before January 1, 2025.		be converted to solar farms or battery storage.

Cooking fuel transition in Ghana and Indonesia

COUNTRY	Cooking fuels
Ghana	- Promote the establishment of dedicated woodlots for wood fuel production; - Promote the production and use of improved cookstoves; - Support development of biofuels as a transportation fuel as well as job creation initiative by creating appropriate financial and tax incentives; - Promote the exploitation and use of mini hydro, solar and wind energy resources.
Indonesia	Indonesia's Conversion Programme from Kerosene to LPG provided every household with a stove "starter pack", and a 3 kg cylinder of LPG to try to discourage use of kerosene in cooking which is more polluting. The programme resulted in a five-fold increase in LPG use, and a 92% decrease in kerosene between 2007 and 2015. While prices for both kerosene and LPG have remained the same, subsidies for LPG are lower than for kerosene, providing the same amount of cooking energy at lower cost for the government, as well as less pollution and GHG emissions.

Other policies to support energy transition

COUNTRY	Tax policy measures	Reform of fossil fuel subsidies	Decommission high carbon emitting energy production
Morocco	The fiscal regime for E&P activities in Morocco grants a corporate tax holiday for a period of ten years. All the expenditures relating to royalty, bonuses, rental, training,	Energy subsidies on gasoline and fuel oil and diesel were eliminated in 2014 and 2015. Subsidies on liquefied petroleum gas (butane gas) are	Law No 21-90 and Decree No 2-93-786 do not contain specific decommissioning obligations. Under Article 70 of Law No 11-

	exploration and production activities are tax deductible. It is proposed that Morocco should first introduce a carbon tax to achieve a short-term impact on GHG emissions. In the longer term, an emission trading mechanism (ETS) could be introduced to ensure a more sustainable impact on emissions.	maintained to avoid a disproportionate burden on the poor. Morocco still has substantial implicit "brown" subsidies stemming from vat exemptions. Tax reforms include pricing carbon, removes the remaining explicit subsidies on gas butane, and eliminates tax exemptions on fossil fuels.	03, the Ministry of Energy can require an operator to remediate the environment. In practice, decommissioning obligations are imposed on the signatories of petroleum agreements (and consecutive holders of exploration permits or concessions).
India	India is seeking to establish a domestic carbon market, which is to be implemented in three phases: increasing demand for voluntary carbon credits; enhancing supply of voluntary carbon credits; introducing a mandatory system for certain sectors, modelled on the EU's cap-and-trade system.		
Argentina	Range of federal and provincial incentives for mining projects including in respect of fiscal stability, income tax, VAT, fuel taxes, royalties, and import duties: - Fiscal stability for 30 years; - 100% income tax deduction for - certain pre-trading expenses; - VAT refund after 12 months or - accelerated depreciation; - Tax revaluation of mining assets; - Deduction of up to 5% of extraction and operational expenses; - 3% cap on royalties paid to the - provincial government; and - Exemption from import duties/taxes on imports of capital goods. **Mining industry**		

	A range of federal and provincial tax incentives are available for mining projects including in respect of income tax, VAT, import duties, fuel taxes, royalties, and fiscal stability. Qualifying activities include prospecting, exploration, preparation, development, and mining of minerals included in the Mining Code, together with trituration, milling, separation, conversion into pellets, synthesization, primary elaboration, briquetting, calcination, fusing, refining, sawing, shaping, polishing and shining (provided these processes are performed by the same economic unit and carried out within 200 kilometers of the mining premises). The following activities are excluded: liquid and gas hydrocarbons, industrial manufacturing of cement through calcination, industrial production of ceramics and sand, and round and split stone for use in construction. Special registration and compliance with all applicable tax and social security regulations are required. The benefits available include the following: • General: – Fiscal stability for 30 years; • Income tax: – 100% tax deduction for prospecting, exploration, preparation, research, and test expenses; – Optional depreciation regime for investments in installations, constructions, and infrastructure: 60% deductible in the fiscal year of acquisition and the remaining 40% in two equal installments in the following two consecutive fiscal periods.		

	Investments in equipment and vehicles are depreciated on a straight-line basis over three years from the date of commencement of business. Taxpayers must choose between the accelerated depreciation and the VAT refund; – Tax revaluation of mining assets; and – An additional deduction of up to 5% of extraction and operational expenses. • VAT: Any credit accumulated after 12 months can be reimbursed; • Royalties: A 3% cap on the rate of royalties paid to the provincial government; and • An exemption from import duties and other import taxes on imports of capital goods. From oil & gas to energy companies The Argentine market is not strange to the shift of oil and gas companies towards the power industry. Different long-standing Argentine oil and gas companies like Tecpetrol, Pan American Energy (PAE) and YPF have been investing in renewable generation projects in the past years. A good example of this trend is a recent asset swap between TotalEnergies and the Pampa Energía (one of largest integrated energy companies in Argentina). In this deal, Marval advised TotalEnergies in the purchase of a 100MW wind farm called Mario Cebreiro from Greenwind, a subsidiary SPV of Pampa Energía. The wind farm was paid through an assignment to Pampa Energía of TotalEnergies' percentage interests in the hydrocarbon		

	concession called Rincón de Aranda, located in the Province of Neuquén, Argentina (Vaca Muerta basin). It is likely that this trend will continue, and Argentine oil and gas companies will probably continue their shift towards integrated energy companies. Critical minerals: lithium and copper prospects In addition to investing in renewable projects, as part of their energy transition policies, Argentine oil and gas companies have also been looking into lithium and copper projects. It is well-known that lithium batteries, as an option for rechargeable energy storage, have created a strong demand for lithium. Argentina holds over 20 per cent of the worlds reserves and has the world's largest lithium project pipeline.[15] The demand for copper is expected to steadily increase as the electrification of the economy progresses and it has been said that copper 'is the missing ingredient of the energy transition'.[16] Argentina also has extensive reserves of copper and if the projects underway come online as expected, the country could become one of the top 10 worldwide producers.[17] Among other transactions, between 2022 and 2023 the Marval mining department advised PAE (i) in its due diligence and acquisition of lithium mining properties in the Province of Salta held by		

	Trilogy Minerals Pty Limited; (ii) in its due diligence of a mining project in Catamarca held by Puna Group SA and the execution of a tenement purchase agreement and exploration agreement; (iii) in its due diligence of a mining project in Catamarca and Jujuy held by Integra Recursos Naturales SA and Integra Recursos Naturales Minerales SA and in the negotiation of the transaction documents; and (iv) in the public bidding of a mining project held by Jujuy Energía y Minería SE. During 2023 Marval mining department also advised Glencore International AG in its acquisition of Pan American Silver's shares in the copper integrated project Minera Agua Rica Alumbrera. As part of their decarbonisation efforts, we have seen different multinational automotive companies with local presence focus their attention on lithium and copper projects in Argentina. For example, Marval mining department advised Stellantis (Fiat Chrysler-Peugeot Citroën Group) in the acquisition of the 14.2 per cent of McEwen Copper Inc in the Los Azules Project.		
South Africa	South Africa is the first African country to adopt a carbon tax policy. 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.		
China	China has had a national market for emissions since February 2021. It is the world's largest carbon market by emissions; however currently the carbon price is too low to be effective, and only covered entities are allowed to make trades.		
Chile			In the case of mines with a monthly extraction capacity in excess of 5,000 tonnes, the establishment of financial assurance is required to cover: - Closure and post-closure costs for each facility on the operating site - Administrative costs of closure works - Post-closure monitoring costs Taxes applicable to closure works.

Appendix 3: Alternative Mitigation Approaches

	Carbon Tax	Emissions Trading Systems	Feebates[53]	Regulations
Potential for exploiting mitigation opportunities	Full, if applied comprehensively (in practice may contain exemptions)	Full, if applied comprehensively (in practice often limited to power/large industry)	Similar to regulations	Can exploit some key opportunities but not all (for example, reductions in vehicle use)
Use of price/market mechanism	Yes	Yes	Yes	No
Efficiency across mitigation responses induced by policy	People and firms choose most efficient way of reducing emissions	People and firms choose most efficient way of reducing emissions	People and firms choose most efficient approach only within one activity	No automatic mechanism
Energy price impacts and acceptability	Higher energy prices can be challenging politically	Higher energy prices can be challenging politically	Avoiding significant energy price increases may enhance acceptability	Avoiding significant energy price increases may enhance acceptability
Price predictability	Yes (if clearly specified trajectory)	No (unless includes price floors or similar mechanisms)	Yes (if clearly specified trajectory)	No (implicit prices vary with technology costs, energy prices, etc.)
Revenue generation	Yes (though exemptions may limit revenue base)	Maybe (if allowances auctioned, but revenue base may be limited)	No (recommended design is revenue neutral)	No
Administrative burden	Small (if builds on existing fuel or royalty tax systems)	New capacity needed to monitor CO_2/trading markets	New capacity needed (for example, to apply fees/rebates to power generators)	New capacity needed (for example, to monitor and enforce emission rate standards for power generators)

Source: IMF staff.
Note: CO2 = carbon dioxide.

[53] Feebates: They act as a negative price incentive to encourage a behavioral change from traditional or energy-intensive technology to a similar but less emission intensive option.

Appendix 4: Commitments made by countries at COP 26

Country	End Deforestation	Net zero target date	Quit coal	Cut methane emissions	Action(s)
* Algeria	No	No target set	No	No	No commitments and no target set[54]
Angola	Yes	2050	No	No	Angola's first NDC updated[55] Angola commits to reduce emissions by 14% (unconditional) by 2025.[56]
Australia	Yes	2050	No	No	Australia counts to reducing its greenhouse gas emissions 43% below 2005 levels by 2030.[57] Net zero target source: Climate Change (consequential Amendments) Bill 2022 (9/8/2022), Australia First NDC (Updated Submission) 10 (22/2021). Australia's long term Emissions Reduction Plan (10/16/2021).[58]
Austria	Yes	2040	No	No	Limited information however sectors covered include energy, industrial processes and products use, Agricultural waste, land use changed and forestry.[59]
Botswana	Yes	No target set	Yes	No	Limited information. 15% reduction in GHG emissions by 2030 compared to 2010.[60]
Brazil	Yes	2060	No	Yes	Commits to reduce emissions from 2005 levels by 37% in 2025, and 50% in 2030.[61]

[54] Climate Watch- In 2020, Algeria emitted 267.02 million tons of CO2 equivalent representing 0.57% of global emissions. See https://www.climatewatchdata.org/countries/DZA?end_year=2020&start_year=1990
[55] Angola NDC. See https://unfccc.int/sites/default/files/NDC/2022-06/NDC%20Angola.pdf
[56] See https://www.climatewatchdata.org/countries/AGO?end_year=2020&start_year=1990
[57] See https://www.climatewatchdata.org/countries/AUS?end_year=2020&start_year=1990
[58] Ibid
[59] See https://www.climatewatchdata.org/ndcs/country/AUT?document=revised_first_ndc
[60] See https://www.climatewatchdata.org/countries/BWA?end_year=2020&start_year=1990
[61] See https://www.climatewatchdata.org/countries/BRA?end_year=2020&start_year=1990

					Net zero target status: Political pledge (4/22/2021), in policy document (12/8/2020 and 10/28/2021) Addendum to Brazil's updated First NDC (10/28/2021). Leaders summit on Climate (4/22/2021). Brazil update first NDC (12/8/2020).
Burkina Faso	Yes	2050	No	Yes	Commits to reducing its emissions by 29.42% (19.6% unconditional, 9.8% conditional by 2030) compared to BAU.[62]
Burundi	No	2050	No	No	Commits to reduce GHG emissions by 1.58% (unconditional) and 11.40% (unconditional) by 2025 compared to BAU and by 3.04% (unconditional) and 12.61% (conditional) by 2030.[63]
Canada	Yes	2050	Yes	Yes	At least a 40-45% reduction in GHG emissions compared to 2005 levels. Canada Frist NDC (updated submission) 07/12/2021.[64] Long-term targets: Exploring approaches for Canada's transition to net zero (10/31/2022). Net Zero target source: Canadian Net Zero Emission Accountability Act (06/29/2021). Climate Ambition Summit 2020 (12/12/2020).
*China	Yes	2060	No	No	NDC: Aims to have CO2 emissions peak before 2030 and achieve carbon neutrality before 2060.[65] China will lower its C02 emissions per unit of GDP by over 65% from 2005 levels.

[62] See https://www.climatewatchdata.org/countries/BFA?end_year=2020&start_year=1990
[63] See https://www.climatewatchdata.org/countries/BDI?end_year=2020&start_year=1990
[64] See https://www.climatewatchdata.org/countries/CAN?end_year=2020&start_year=1990
[65] See https://www.climatewatchdata.org/countries/CHN?end_year=2020&start_year=1990

					China First NDC (update submission) 10/28/2021. China has a long-term strategy for Carbon neutrality before 2060. Mid- Century Long Term Low GHG Emission Development Strategy (10/28/2021). Climate Ambition Summit 2020 (12/12/2020).
*Germany	Yes	2045	Yes	Yes	At least 55% reduction in GHG emissions by 2030 compared to 1990. The information subject to revision in light of the enhanced targets.[66] Germany: Net-zero emissions by 2045 (per 2022 addendum). At the time, Under Directive (EU) 2018/410 the EU Emissions Trading System: EU will reduce its emissions from sectors covered by this legislation by 43% from 2005 levels by 2030; under Regulation (EU)2018/842, members to reduce emissions from sectors outside the EU ETS from 2005 levels by 2030. Amongst other percentages Germany at 38%. Target status: In Policy Document (11/2/22), In law (5/5/21) and in Political Pledge (5/14/2019 and 5/5/2021) Update to the long-term strategy for climate action of the Federal Republic of Germany (11/2/22). Amended Federal Climate Protection Act (5/5/2021); Merkel pledges to make Germany Carbon neutral by 2050 (5/14/2019).
*Japan	Yes	2050	No	Yes	Committed to reduce GHG emissions by 46% by 2030 compared to 2013 levels.

[66] See https://www.climatewatchdata.org/countries/DEU?end_year=2020&start_year=1990

					Japan First NDC (Updated submission) 11/21/2021 Quantified Long-term Emissions Goal: Carbon neutrality by 2050.[67] Amongst other commitments.
Kenya	Yes	No target set	No	No	The Country commits to reduce emissions by 32% by 2030. Kenya's First NDC (updated submission) 12/27/2020
*North Korea	No	No target set	No	No	Limited information[68]
Morocco	Yes	No target set	Yes	Yes	Commits to reduce GHG emissions by 18.3% (unconditional) and 45.5% (conditional) in 2030.[69]
*Napal	Yes	2045	Yes	Yes	Commits targets and measures in energy, industry, agriculture, forestry and land use, and waste sectors. Its second NDC (12/8/2020)
*Russia	Yes	2060	No	No	A target for limiting GHG emissions, which provides for a reduction in GHG emissions by 2030 to 70% relative to the 1990 level. Russia First NDC Quantified Long-Term Emissions Goal: 80% reduction from 1990 levels by 2050. The Document is Strategy of Socio-economic development of the Russian Federation with low GHG emissions until 2050 (10/29/2021).
Rwanda	Yes	2050	No	Yes	Limited information although the country commits to reducing its emissions by 16% (unconditional) and 38% (conditional) in 2030.

[67] See https://www.climatewatchdata.org/countries/JPN?end_year=2020&start_year=1990
[68] See https://www.climatewatchdata.org/countries/PRK?end_year=2020&start_year=1990
[69] See https://www.climatewatchdata.org/ndcs/country/MAR?document=revised_first_ndc

*South Africa	No	2050	No	No	Limited information however in 2025, its annual GHG emissions will be in a range from 398-510 Mt CO2- eq. [70]
*United Kingdom	Yes	2050	Yes	Yes	In its NDC, the UK commits to reducing economy-wide GHG emissions by at least 68% by 2030 compared to 1990 levels. The Country updated Adaptation Communication to the UNFCCC in October 2021, ahead of COP 26, in compliance with decision 9/CMA.1. he Adaptation Communication sets out the UK's domestic and international ambition and action on adaptation and resilience.[71]
*United States	Yes	2050	No	Yes	Limited information however the USA commits to reduce Net GHG emissions by 50-52% by 2030 compared to 2005 levels. USA first NDC (after rejoining the Paris Agreement) 4/21/2021[72]

(Source: Energy Transitions Working Group)

Notes:
* Countries starred

[70] See https://www.climatewatchdata.org/ndcs/country/ZAF?document=revised_first_ndc
[71] See https://www.climatewatchdata.org/ndcs/country/GBR?document=revised_first_ndc
[72] Available at https://unfccc.int/sites/default/files/NDC/2022-06/United%20States%20NDC%20April%2021%202021%20Final.pdf