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Taxation of the Extractive Industries

Energy transition in extractive industries

Summary

This paper is presented to the UN Tax Committee at its Thirtieth Session *for a final reading and the Committee's approval*.

This paper delves into the complex intersection of tax policy and practice in 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.

At the last session an earlier version of the paper was presented to the Committee for discussion and guidance. Some of the key issues raised were related to: (i) inadequate labour protections in some countries, during energy transition policy implementation, (ii) balancing the urgent need for energy access with the promotion of clean energy production, (iii) protective measures for vulnerable groups during clean energy policy implementation, as well as (iv) the need for a deeper analysis of the risks and costs associated with such measures as carbon capture and storage.

During technical meetings and the last Subcommittee meeting those comments were considered. The Subcommittee also benefited from input of its participants also participating in the work of the Subcommittee on Environmental Taxation. This draft is presented to the Committee for final review and approval.

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1. Introduction

1.1 Executive Summary

1. The energy transition poses both opportunities regarding new extractive energy transition markets and challenges, in that, extractives are highly energy intensive. However, achieving global decarbonisation commitments requires a paradigm shift in transforming the energy system towards sustainable sources. Accelerating cleaner and more efficient forms of energy access needs large investments in technologies and removing institutional, technological, social, and economic barriers such as the lack of funding and high capital costs. Meeting the energy needs of the future requires urgent financial and fiscal reforms to address these barriers and direct investment promotion policies to support the transition to renewables and other energy sources.

2. To this end while energy transition challenges are common to both developed and developing countries alike, the pathways towards achieving this will vary based on differing country contexts. A coordinated, comprehensive strategy involves a wide range of stakeholders and includes a policy mix calibrated towards country specific circumstances; that balance competing objectives including energy access, climate goals, resource availability and available fiscal space.

3. This paper focuses on the tax policy and practice issues in the transition of energy production and supply in the extractive industry. Tax issues arising from and aimed at modifying consumption behaviours and creating an enabling environment for adopting climate-friendly technology on the consumption side are covered in the UN Handbook on Carbon Taxation for Developing Countries and related papers. Similarly, the Subcommittee on Environmental Taxation paper focuses on tax policy and related measures on consumers, including businesses, governments as well as households rather than on the producers of energy products.

4. This paper further addresses issues in creating an enabling tax policy and administrative framework that supports a just and inclusive transition of energy production in the extractive sector. The primary focus will be on supporting the move of energy production to renewables and other clean energy sources, and encouraging hydrogen production. Electrification is discussed 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

5. This paper is organized, after this introduction Section along the following lines:

- Section 2 delves into the role, pace, and transition impacts for resource rich countries and provides a context for the role of tax policy in supporting the energy transition.
- Section 3 outlines tax policy examples implemented in different countries
- Sections 4 and 5 then follow with a review of direct and indirect tax measures.
- Section 6 considers transition issues and challenges for the extractive sector
- Section 7 presents a tax policy design framework for energy transition, drawing on the above.
- Section 8 looks at the interaction of tax policy with other, related policy issues.
- Section 9 examines tax administration design and capacity needs for energy transition.

6. The Appendices (1-4) contains the challenges for transition for both developed and developing countries, an overview of measures taken by a selection of countries to address energy transition, alternative mitigation measures and tax and market-based renewable energy generation policy mix respectively.

1.2 Climate change and the role of energy transition

7. Climate change is a critical global policy challenge. While it imposes significant economic and social costs on developed countries, developing countries are disproportionately affected, e.g. through increased frequency and intensity of natural disasters, loss in biodiversity and arable land, changes in agricultural practices and increases in transportation costs. These result in a range of second and third order effects like increased human migration within and beyond borders, pressures on rapid urbanization, and increased infrastructure costs.¹ 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.

8. The UN Climate Change Conference in Glasgow, UK produced several milestone pledges from both state and non-state actor groups on subjects ranging from methane and deforestation to electric vehicles and coal finance. Many countries updated their Nationally Determined Contribution (NDC) pledges to become net zero by 2050, experts estimate the post-COP global warming trajectory to be consistent with 20 C and Paris Agreement goals. 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 30C warming trajectory by the end of the century.

9. 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 change in the production and consumption of energy. Such measures can include policies around current direct and indirect taxes, the 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 in achieving climate goals, and its relationship to other policy measures, is discussed in outline at 2. below.

10. Decarbonization is central to global climate goals, which include moving from carbon-emitting to carbon-free sources of energy (i.e. energy transition) 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. Decarbonization through energy transition is thus part of the efforts to arrest climate change.

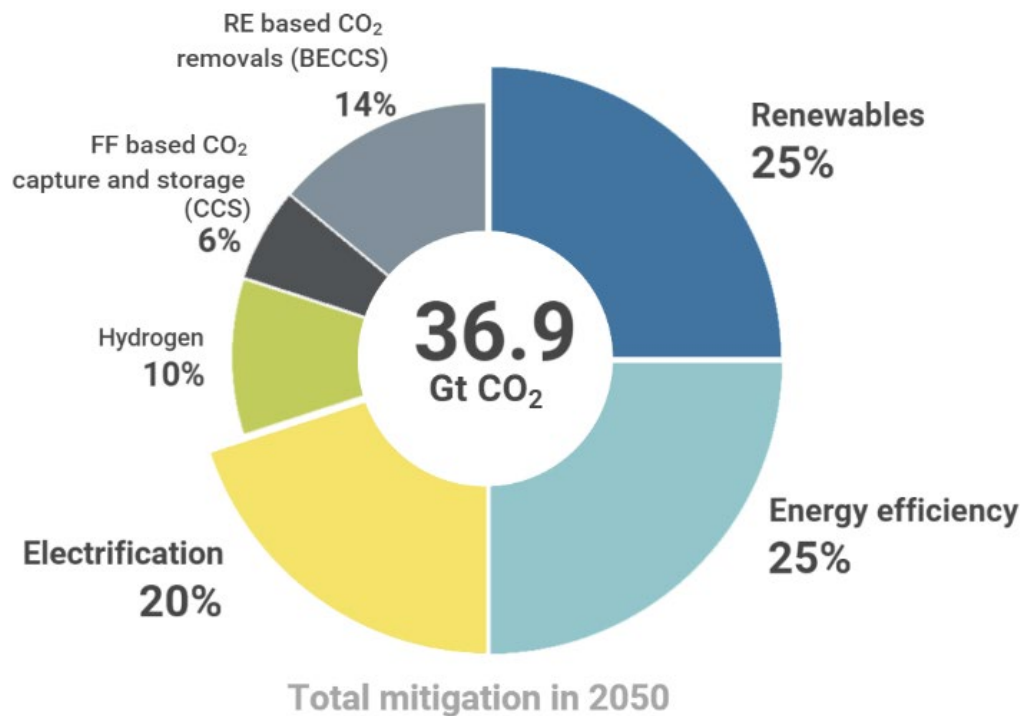
1.3 Approaches to transition and transition requirements

11. The International Renewable Energy Agency (IRENA)² 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

¹ 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*. Available at <https://www.mckinsey.com/capabilities/sustainability/our-insights/will-infrastructure-bend-or-break-under-climate-stress>

² See, <https://www.irena.org/>

for accelerating the global energy transition in line with the goals of the Paris Agreement. This strategy outlines six approaches:



12. 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, shipping or aviation may need to rely more on biofuels and hydrogen. Some forms of green energy are also not yet economically viable, especially in aviation; a range of energy sources are thus necessary for the transition. Decarbonising the electricity generation sector to move towards renewables is the largest part of the production side of the equation and is the principal focus of the paper. This paper thus mainly focuses on the tax issues required to achieve the transition to renewables, hydrogen, CCS and sustainable biomass. Other aspects of promoting the move to renewables, especially for household heating and industrial use, are also considered.

13. This paper further addresses issues that create an enabling tax policy and administrative framework that support a just and inclusive transition of energy production. 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.

14. However, the above represents potential choices based on current technology and financial viability. Policymakers should thus be open to rapid technological innovation and policy choices need to remain "technologically neutral" and avoid picking winners or losers. 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.³ Technological neutrality means that energy transition must not artificially promote specific technological choices above others.

1.4 Role of tax policies

15. Tax policy needs will vary from country to country based on a range of factors, including stage of development, geography and resource endowments⁴. Tax policy approaches for transition needs in renewables could then be calibrated to resource endowments.

16. Tax policy interventions could also be designed to encourage biofuels, liquid hydrogen and other renewable liquid fuels, especially for use in transportation and for household heating and cooking needs. Similar 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 consider the timeline to develop relevant technical solutions. consumption in extractive activities can also be covered in the same set of policy interventions.

17. 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, using natural gas instead of coal for power generation is not disadvantaged.

18. Policy thus plays an important role in the transition to a climate neutral and circular economy (see Sec. 3.7.), and 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.

19. 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.

20. The discussion covers both tax incentives to support energy transition and the use of the tax policy to disincentivise fossil fuel use. 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; this can indirectly impact energy transition, by increasing the market incentive for installing non-fossil fuel-based energy generation capacity (see 7.4).

³ The European Commission stressed the need to ensure that the European energy market is fully integrated, interconnected and digitalised, while respecting technological neutrality". https://eur-lex.europa.eu/resourcehtml?uri=cellar:b828d165-1c22-11ea-8c1f01aa75ed71a1.0002.02/DOC_1&format=PDF

⁴ 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.

1.5 Interaction with fossil fuel subsidies and carbon taxation/pricing

21. 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.

22. Policymakers should 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 clean energies do not face unfair competition from subsidised fossil fuel inputs. It should however be recognized that significant segments of the population in developing countries rely on fossil fuels, including subsidised fuels, and some form of compensation needs to be planned for vulnerable people through budget mechanisms.

23. 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, the removal of subsidies may not substantially impact the outcome.

24. 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.

25. While such measures are undoubtedly part of the policy mix in promoting energy transition, this paper focuses on only conventional direct and indirect tax measures that will influence the 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 in Section 2; no analysis is undertaken of these measures. The UN Carbon Taxation Handbook covers Carbon Taxes in detail.

1.6 The role of subnational tax policy

26. 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 the use of energy from renewable sources. They can also be important change agents in areas from waste to energy.

⁵ IMF Fossil Fuel Subsidies Data: 2023 Update, WP/23/169, August 2023, p.18.

⁶ OECD, IISD <https://fossilfuelsubsidytracker.org/country/>

27. 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 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 commitments and seek to find a balance between policy goals at the local level and national requirements.

28. An example of subnational variation is the UK. Although the country as a whole has a target to reach net zero by 2050, Scotland as a subnational jurisdiction has a target of net zero by 2045 because there are greater opportunities to adopt nature-based solutions. Indonesia, recognizing the need for regional variation, has introduced Regional Climate Budget Tagging (RCBT), covering multiple provinces, cities, and districts to track local government efforts in achieving national climate targets.

2. Transition challenges

2.1 The role of energy transition in broader climate goals

29. Decarbonisation of the energy supply is one of many tools available for countries to meet their climate commitments. While energy transition is a key part of decarbonization, the pathways to achieve this will vary based on different contexts. Many of the challenges are common to developed and developing countries, while others are very specific to developing countries; the impact of such challenges will vary.

30. While there are shared challenges between developed and developing countries, the latter needs to consider 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.⁷

31. A coordinated, comprehensive strategy involving a wide range of stakeholders is difficult in both developing and developed countries. However, developing countries have additional challenges in finding a balance between energy access targets, climate goals, resources available and available fiscal space. Developing countries also face additional challenges in securing adequate financing for the investments needed.

2.2 The pace of energy transitions – balancing progress across regions and countries

32. Earlier energy transitions were driven by economic and technological advantages and not policy. Further, the scale of the targeted transition is significant and has much wider spillover effects. Priority needs, especially in developing countries, will inform transition goals. Such countries often face challenges in establishing robust policy and regulatory frameworks; they also have capacity limitations in implementing such policies. This cannot be financed from public funds. The investments needed and/or have limitations in investable capital and financing ecosystems to raise funds from the private sector. Developed countries may also need to update their policies to incentivise renewable energy adoption and ensure a smooth transition.

⁷ 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.>

33. 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. The policy position taken by many advocates is that the energy transition must be just. As some evidence available shows, the transition so far has not been just.⁸ This paper, has focused on purely tax technical issues. It is necessary, however, to ensure effective energy policies that address consideration of access and a just transition (see 2.8 below) so that power outages and reduced energy supply for marginal groups in society are mitigated. Tax policy design should bear in mind the need to achieve SDG 7 (clean, affordable energy for all).

34. A summary of the challenges for developed and developing nations in the 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). A full description of the challenges is available in Appendix 1.

Issue	Developing Countries	Developed Countries
Capital Investment:	While capital needs for developing nations are significant, they should be seen in terms of upgrades with a focus on advanced technology and grid modernization.	In contrast, developed nations face a dual challenge, i.e., the need for substantial capital investment to expand access to energy, and transition to cleaner sources.
Regulatory and policy framework:	The regulatory frameworks for developed nations require frameworks that promote innovation, incentivize renewable energy investments and ensure grid reliability while integrating advanced technologies. The focus here is tax incentives, emissions regulations, and international cooperation.	Regulatory and policy formulation capacity may have gaps. Further, many countries need frameworks that focus on access to energy affordability and sustainability, while taking account of limited fiscal space.
Infrastructure:	Legacy Infrastructure. Developed nations have existing infrastructure to upgrade to intergrade renewal energy sources, improve energy efficiency, and modernize grid systems to handle decentralized energy production.	Infrastructure deficiencies and capacity coupled with the fact that developing countries have to prioritize building foundational energy infrastructure to provide access to electricity and clean energy to their populations
Dependence on fossil fuels:	Diversifying production and consumption patterns. While still dependent on fossil fuels, developed nations have integrated a variety of energy sources such as renewals, nuclear, and fossil fuels with carbon capture technologies, adopting smart grids and encouraging consumer participation	Dependence on fossil fuels as a source of energy is due to limited access to alternative energy sources, lower costs and infrastructural challenges. For some developing countries fossil fuels are a key source of revenue.

⁸ A. Creti and Z. Ftiti (2024), Energy, just transition, and sustainability: what's? Available at <https://doi.org/10.1016/j.eneco.2024.107872>

	in energy markets. This enhances energy security, reduces greenhouse gas emissions and ensures sustainable growth.	
Energy poverty and resource limitations:	Distribution and access to modern energy services in developed nations is relatively high and they enjoy reliable energy access and infrastructure. However, low-income populations often struggle with energy costs, but these can be mitigated through fiscal subsidies.	Factors like lack of investment, poor governance and overall economic constraints influence limited resources and greater energy poverty in developing nations
Economic transition:	While the shift in developed nations can lead to job creation in the energy sector, improved energy efficiency and reduced dependency on fossil fuels, this may disrupt traditional industries requiring workforce retention. Changes in skills will be inevitable as well.	Developing nations on the other hand have numerous challenges. It is essential to evaluate both the short-term and long-term effects of energy transitions on economic stability, growth and social equity thus planning will be crucial.
Technological change and innovation:	Ensure a level playing field for an inclusive and equitable transition, considering the socio-economic impacts on different populations.	In developing countries, technological challenges are more pronounced due to limited financial resources and inadequate infrastructure. They must balance transition needs with development needs by building domestic capacity and industry.
Energy security:	Geopolitics and security constraints	Capacity and economic constraints

35. Energy transition is a global objective; however, the challenges vary significantly between developed and developing nations. While developed nations face issues related to existing infrastructure and vested interests, developing nations must contend with limited resources and the need to balance development and sustainability. This paper focuses 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.

2.3 Transition impacts for resource-rich developing countries

36. An additional issue concerns developing countries that derive a significant part of national revenue from fossil fuel extraction. Transition impacts will be different for those countries that have an endowment of fossil fuel resources and those that have reserves of critical minerals necessary for the energy transition. Important trade-offs have to be considered by the former, while the latter have to consider whether to maximise current revenue from extraction or preserve these finite resources to develop processing and industrial capacity in the growth sector of the future.

37. As the world reduces its reliance on fossil fuels, countries with such endowments may experience a decline in revenue from their resource sales, making it difficult to fund spending and investment needs. Given the changing landscape, it could be beneficial for such countries to plan for reductions in revenue from fossil fuels and find new ways to generate revenues. They need to identify approaches to maintain growth in a low-carbon economy and continue to 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. On the other hand, from the perspective of demand for fossil-based energy, if prices drop due to increased supply that may reduce the incentives for transition. Accordingly, there is a need for such countries to track progress on energy transition goals and plan for alternatives. There is a particular concern for countries with coal reserves, where higher carbon intensity is leading to some pressure to abandon current mines or not commence new mines. Thus, tax policy choices and tax rules should be designed in line with the approach taken by each country.

38. Some developing countries still 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 the risks of lending without the security of resource revenue. Sources of finance may become restricted as some financial institutions withdraw lending from the fossil fuel sector. There may thus be a need to consider tax policy measures as part of the policy response.

39. Where resource extraction requires significant energy, the higher costs of inputs such as electricity and fuel that are required to power operations will also reduce revenue from the sector. 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. Again, tax policy can play a role in encouraging such a transition.

40. The broader move to a low carbon economy can also create new opportunities and challenges for developing countries with natural resources endowments in minerals that are necessary for low-carbon transition. For example, the⁹ demand for electric vehicles and home storage solutions is considered to increase the demand for materials like lithium. Tax policy measures should be designed to support the broader policy choices made.

41. 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.

42. Transitioning away from extracting non-renewable resources can have positive environmental impacts but may also require significant investment in environmental remediation and conservation. 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.

⁹ Global EV Outlook 2024. Available at <https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-vehicle-batteries>

43. To manage these transition impacts effectively, resource-endowed developing countries need a clear and well-planned transition strategy¹⁰. 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 infrastructure, education, and technology investments. International support and cooperation will also play an important role in helping these countries manage the transition effectively.

2.4 Transition impacts for other developing countries

44. Energy production and consumption is the leading driver of climate change, while one third of the global population lacks steady access to energy.¹¹ 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 has stressed¹² the need to bring electricity to the 759 million people worldwide who lack access and to remove reliance on harmful, polluting fuels to cook, light or heat homes. Energy availability is also a precondition for many other SDGs, e.g. 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.

45. 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. 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 at scale is part of the solution.

46. Many developing countries also point out that their average emissions per capita are still well below the averages in most developed countries. They feel that action on global climate change cannot constrain their goals of economic development. They also point out that policy measures that constrain fossil fuel use require greater investment capital, which they lack; further, adoption of such policies may at least temporarily reduce economic growth, resulting in less revenue to deal with climate impacts and fund investment in the energy transition.

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

47. Government policy and regulation are the most important drivers 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.

Financial measures	Regulatory measures and market factors
Imposing a price on carbon and use of an ETS (see 1.4, not discussed further)	Energy efficiency codes and mandates.

¹⁰ 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

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

¹² 2030 High-Level Dialogue on Energy Ministerial Forum, in 2021

Favourable pricing for energy produced from renewable sources. ¹³	Mandating closure of fossil fuel-based energy plants.
Capital grants and financial incentives/subsidies for renewables and/or policies aiming at decreasing investment costs of renewables.	Control measures such as permitting only energy efficient vehicles in specified urban zones.
Tax measures to promote energy transition, including incentives for renewables and energy conservation, use of climate friendly solutions in transportation and power generation, etc.	Standards, labels, and portfolio standards among others
Imposing a price on carbon and use of an ETS (see 1.4, not discussed further)	Other tools. ¹⁴ For instance, education and information dissemination, training and research, development and deployment programmes

48. It is worthwhile to note that other approaches to the classification of the policy types can be applied by sorting them from the angle of project size or purpose (electricity sector). Categorising policies per their exposure to market forces could be another approach.¹⁵ There is also an overall trade-off of all in balancing the measures considered above. Overall, the mix of the above measures can often increase – at least in the short run - the cost of energy consumed, and this has an impact on all of the challenges identified in the summary table at 2.2.

49. 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, and smoothen the transition to an electricity supply infrastructure based on multiple sources. Cash subsidies and fixed 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 the acceptability of changes.

50. Tax measures are the core focus of this paper and are discussed in detail in the following Sections.

51. 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; as such, 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.

52. 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.

¹³ 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.

¹⁴ Daszkiewicz, Karolina (2022), Policy and Regulation of Energy Transitions. Accessible at https://link.springer.com/chapter/10.1007/978-3-030-39066-2_9

¹⁵ IRENA, IEA and REN21 (2018) Renewable energy policies in a time of transition. Available at https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_IEA_REN21_Policies_2018.pdf

In other cases, auctions 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.

53. 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 engines¹⁶ or restrictions on movement in certain parts of a city¹⁷ 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 disincentivise fossil fuel-based electricity generation.

54. 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.

55. 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.

56. Countries worldwide utilise a range of tax incentives and other financial instruments such as feed-in-tariffs, and net metering to encourage the adoption of renewable energy technologies. Transitioning towards renewable energy technologies requires large upfront capital costs which is identified as one of the main barriers towards renewable energy adoption. Financial incentives can address this barrier by easing the burden of renewable energy technology acquisition costs, increasing access to capital and facilitating the development of renewable energy markets.

57. Research in 2024 on the balance between various policy instruments in South Africa, China, Germany, Denmark and India is summarised in Appendix 4. While this analysis may not be complete, it shows a methodology for comparing different policy instruments.

2.6 Energy industry overview and diversification of energy portfolio

58. This sub-section looks at the energy sector to consider the firms that would respond to the policy mix above Taking a broad view of the energy sector, encompassing the traditional extractive industries in fossil fuels including hydrocarbons and coal, and also midstream and downstream operations of such firms. The sector also includes electricity generators, transmission and distribution firms and providers of energy for transportation. It also includes other associated firms such as LNG transportation and regasification.

59. Many such firms are diversifying their energy portfolios by integrating renewable energy sources and low-carbon technologies. 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. While the extent of investment and

¹⁶ For example, the California Air Resources Board requires all new cars, SUVs and pickup trucks sold in the state to generate zero tailpipe emissions by 2035. See <https://ww2.arb.ca.gov/rulemaking/2022/advanced-clean-cars-i>.

¹⁷ For example, London ULEZ scheme. See <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

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.

60. Energy firms have built and operate solar and wind farms 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 with renewable energy companies and other stakeholders to accelerate the development and deployment of renewable energy technologies and share knowledge and best practices.

61. Nuclear energy has, in recent years, received 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. However, the latest fifth generation designs, such as molten salt reactors, operate at atmospheric pressure thereby greatly reducing these concerns. The sector should therefore be included in any consideration of tax measures for energy transition if the security, financing and safety challenges can be satisfactorily addressed.

2.7 Circular economy and sustainability initiatives

62. 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-throwaway pattern. This model relies on large quantities of cheap, easily accessible materials and energy.¹⁸

63. Some energy firms are embracing the principles of the circular economy by focusing on waste reduction, recycling, and resource optimization. Some extractives firms, as well as other industrial enterprises, are actively seeking ways to repurpose by-products and waste materials generated during their operations. Policy measures, including tax policy, can promote efforts to expand the circular economy and sustainability are being adopted by businesses and individuals. For example, in the Netherlands some non-energy companies are delivering excess energy to consumers (e.g. refineries in Rotterdam deliver excess heat to households via pipelines), while many countries in the former Soviet Union have utility firms that deliver domestic heating to households through combined heat and power (CHP) stations. Tax policy can play a role in encouraging non-energy businesses to be part of the energy transition, both in contributing to electrification and achieving lower carbon intensity in overall energy consumption.

64. 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

¹⁸ See <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.>

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 especially be included as a policy goal in considering decommissioning rules for mining operations.

2.8 Energy access vs energy transition

65. Many developing countries face significant challenges in balancing the urgent need for energy access with the necessity of promoting clean energy production as part of the energy transition. For instance, vulnerable population groups in some developing countries rely on traditional fuels for household heating and cooking needs. While this latter activity has significant carbon and other environmental pollution impacts, it has been difficult to find effective solutions for such challenges. Tax policy development should thus take these challenges into account in developing a comprehensive approach. Section 5 on indirect taxation below presents some options to be followed in considering carbon intensity in setting tax rates, thus providing price signals for consumers.

66. In considering access to electricity, such limitations may be due to gaps in distribution infrastructure or generation capacity. Tax policy can only have a significant impact on these areas if the private sector is involved in providing these services to the national grid, as a public sector monopoly is most likely to be an exempt entity. However, some countries are reorganizing public sector businesses under ordinary corporate law and subjecting them to taxation, even though the ownership is held by the state, in which case tax rules can have an impact. Another tax policy measure can be to provide tax advantages for mini-grids, especially those owned and managed by cooperatives of consumers. Similar concessions can be made for capital inputs to “waste to energy” or biogas/RE gas facilities built by cooperatives. There would need to be some minimal administrative processes in place (see Section 9) to prevent or deter abuse.

67. Where access is an economic issue, i.e. vulnerable groups cannot afford power and cooking fuel prices, it is preferable to provide direct financial subventions rather than provide subsidies or tax exemptions, especially to fossil fuels. The reason is that these cannot often be efficiently directed to the groups that lack access, are vulnerable to abuse and corruption and often are captured by people in the upper income brackets. There are, however, examples of a zero VAT rate being applied to a basic level of electricity units per household; these cannot be targeted to the poor, unless complex administrative processes of identifying geographic locations of consumption and/or means testing are undertaken.

68. While the Annex on country experiences is not complete, there are some good examples of measures taken in different countries to broaden access.

2.9 Role of tax policy in the policy mix

69. Tax policy and practice can be a key enabler and help countries reduce reliance on fossil fuels 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.¹⁹

70. Tax policy interventions can support the move to renewables or help the adoption of cleaner fuels such as natural gas in place of coal. However, tax policy interventions can be broader, e.g. reforestation

¹⁹ It is estimated that material extraction and processing contribute to 71% of greenhouse gas (GHG) emissions including fossil fuel use for energy supply.

can be an important part of the decommissioning of mining facilities in particular, and tax policy can include measures to encourage remediation of extraction sites through afforestation. On the one hand tax measures for the circular economy can have a positive impact on the energy sector, e.g. encouraging waste to energy plants, while on the other hand tax policy design can support the introduction of smart grids that can deal with a variety of electricity sources.

71. 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 in Appendix 3 to consider alongside tax policy measures. The following section provides an inventory of tax policy measures being applied by countries around the world.

3. Tax regimes for energy transition

72. 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 repurposing 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. This section provides a summary of various measures that have been implemented worldwide; a tax policy framework that countries can use is set out at Section 7 below.

73. While tax incentives have been widely used, it is worthwhile to note that there is now some doubt about their efficacy in achieving desired goals, especially where blanket exemptions are given. Further, given the implementation of minimum tax regimes, often in line with Pillar 2 of the OECD's GloBE arrangements in many countries, the benefit to taxpayers may be questionable going forward.²⁰

74. Administrative measures to support energy transition include relaxation of withholding tax regimes, e.g. deferral of collection of certain withholding taxes for set periods, thus providing cashflow benefits for the investor. Other administrative measures can include deferral of specific levies and similar hypothecated taxes applicable to energy firms.

75. 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. While non-tax measures such as carbon pricing and removal of fossil fuel subsidies are mentioned in this paper, they are outside the brief of this paper.

76. An alternative strategy can be the imposition of increasing carbon taxes or suitable proxies on higher carbon intensity fuels that are used as feedstock for power generation. A higher tax on coal can change the relative economic calculation for coal-based power, and drive firms towards cleaner fuels like natural gas or move to renewables. Carbon taxation is covered extensively in the Carbon Taxation Handbook.

²⁰ See separate report on tax incentives in the extractive sector and Pillar 2 also drafted by the Subcommittee.

77. Some countries have offered measures to support fossil fuel exit strategies by repurposing fossil fuel production assets, thereby avoiding stranded assets.

78. Another key area for tax policy to support is research and development measures to support innovation. Key measures include incentives for developing alternative energy technologies and for 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.

79. 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 is available at Appendix 2.

Tax Policy Measures in Selected Developed and Developing Countries

Type of measure	Description	Examples
Incentives for the production of renewable energy	Tax policies can provide incentives for renewable energy adoption by offering tax credits, deductions, or exemptions, including exemptions ²¹ 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 using renewable energy sources and preferred VAT refunds. The USA provides tradable Production tax credits (Sec. 45 Inflation Reduction Act of 2022 or IRA), and investment tax credits for wind, solar, geothermal, hydropower, etc. (Sec. 48), and a zero-emission nuclear power production credit (Sec. 45U, IRA). 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 steel, low carbon aluminium, copper, lithium etc)	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 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	Australia offers a tax credit for eligible R&D activities, and 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

²¹ Exemptions and tax holidays are under serious criticisms in most developing nations. Proper consultations and well-negotiated terms/policies will be needed.

	invest in innovative technologies and processes that can help advance the transition to cleaner energy sources. However, care needs to be taken that these measures are not abused.	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 200% 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 provide 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 the use of assets for CCUS will not decrease the value of RFCT and SC relief available.
Tax measures to support the manufacturing of components and inputs relevant to energy transition	Some countries, mindful of the need to maintain a hold on this strategically important sector, have measures to support the manufacturing of 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. ²²	Ghana offers incentives in the form of tax holidays, locational incentives and investment guarantees.
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 energy sources. Tax incentives for grid improvements can facilitate the integration of renewable energy and enhance energy efficiency. Tax	Chile has a plan to close all coal-fired power plants by 2040 and repurpose them to store renewable energy in thermal batteries and deliver the stored energy back to the grid using the former coal plant's existing power blocks and grid connections. The USA's Inflation Reduction Act of 2022, Sec. 30C 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.

²² GATT Art. III (2) – National Treatment or under the WTO Subsidies and Countervailing Measures Agreement.

	measures can also support the extension of the distribution of electricity for transportation (for example through a charging network) and measures to reduce carbon emissions.	
Measures to support the 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 the 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, and 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 and storage (CCS/BECCS)	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 storage location, typically in deep geological formations, or in the form of mineral carbonates. CCS retrofits for existing power plants are seen	USA Inflation Reduction Act of 2022 Sec. 45Q Credit for carbon oxide sequestration

	as a way to limit emissions from the electricity sector. ²³	
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;

4. Direct tax measures

4.1 Principles for direct tax measures in energy transition

80. As can be seen from Section 3, 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.

81. 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.

82. It has been recognized that large numbers of people in developing countries are reliant on fossil fuels for essential needs such as cooking and transportation. Tax policy to encourage energy transition should recognize the need to accommodate these needs; while a common goal is possible, differentiated approaches should be considered. Policy recommendations should aim for a gradual shift away from fossil fuel-based consumption with adequate measures taken to protect vulnerable sections of the population.

83. Further, incentivisation of renewable energy and investments in technologies have important effects on markets, as they can improve outcomes for other producers and future consumers. Tax policy measures should be considered in the broader context of other energy transition policies and in the light of the 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.

²³ 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.

4.2 Taxation of resource rights in renewables

84. 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. For more information, see the energy transition paper by the Environmental Tax Subcommittee covering demand side issues.

85. While this is not an immediate issue for many countries, there is a case to be made to consider the advantages of geography and climate. For example, abundant sunshine or a long, windy coastline with the 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 address 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. Given the evolving and dynamic nature of this sector, there is some tension between providing tax incentives for renewables 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.

86. A particular case in point is hydropower resources; this has been a longstanding source of zero carbon electricity. In Norway, the 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 has 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 %. ($57,7 \% \times (1-0,22) = 45 \%$). The effective tax rate for income from the production of hydroelectric power is thus 67% (22% + 45%).

87. 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, that grid evacuation (i.e. the capacity of the grid to take the power generated) 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.

88. 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 on the government website.²⁴

89. Further, given that hydro, wave, wind and solar all relate to specific geographic areas, it is important to consider the allocation of taxing rights to such income. The Commentary on the UN Model, especially the commentary on Articles 6 and 13, will provide final guidance on this point.

²⁴ <https://www.gov.nl.ca/releases/2023/ecc/0223n05/>

4.3 Renewable energy tax incentives

90. 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.

91. 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 forgone by the state. This tax expenditure measurement is a good practice that will help improve the application of the incentive.

92. 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 20 years; however, as production costs of photovoltaic systems decreased, this policy resulted in economic rents.²⁵ Assuming the same applies in another jurisdiction, a tax exemption should 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.

93. 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 reductions in their cost. The development and deployment of other technologies within the fossil fuel value chain can be impacted by applicable fiscal incentives as well as the carbon price. E.g. technologies such as CCUS could have the potential to bring emission levels of fossil fuel combustion close to those of renewables.

94. In developing countries, consideration can be given to tax measures to encourage energy transition in transportation by use of conversion kits (e.g. to convert two stroke engine vehicles to electric), agriculture (replace diesel powered irrigation pumps with solar DC pumps) and industry (e.g. solar heaters for use in the textile industry). Governments may provide tax incentives to encourage the 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 the 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.

95. 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 a 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 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 the sale of methane.

²⁵ Germany reformed the Renewable Energy Act from 2017.

96. 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 the adoption of these technologies, for example in the hands of contractors that provide services to municipal bodies and subnational governments.

97. 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.

4.4 Tax treatment of Intellectual Property in new technology

98. Many extractive companies use cost contribution arrangements (CCAs)²⁶ about 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.

99. A separate issue arises when 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 based on the actual contribution made by the local entity in the resource state.

100. 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.²⁷ 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.

4.5 Ring fencing/consolidation issues in energy transition

101. 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 ring fencing 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.

²⁶ See Chapter 7, UN Practical Manual on Transfer Pricing, Third Edition

²⁷ See Articles 12/12A, UN Model Convention or a future Article xx.

102. 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 the 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 approach could be to use the amount of energy generated from renewables to compute the environmental benefit using the carbon price/ton of CO₂ from conventional generation for the same amount of energy; the loss offset could then be limited to that amount in money terms.

103. 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. Development costs, in particular, 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. Further, to avoid abuse and unequal treatment to non-extractive companies, a further measure could be to allow offset only at the general company tax rate and not the higher rates applicable to extractive activities, if any.

104. 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. While limited fiscal headroom might limit the scope to provide such measures, the goal can be to gradually shift incentives away from fossil fuel-based generation and transmission towards renewables, e.g. in mini-grids.

4.6 Taxation of subcontractors and project implementers

105. 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. Countries should consider avoiding the use of project specific tax concessions and provide for any incentives in tax legislation.

4.7 Tax issues around decommissioning of fossil fuel plants

106. 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.

107. 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. Developing countries currently

host 89 percent of 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.

108. Closure commitments will influence the overall profile of power generation in a country, which can impact trade taxes (see 5.4). Accordingly, appropriate tax relief, where power generation is in the private sector (and thus likely to respond to tax measures) can facilitate the closure of such plants. However, this has to be balanced with the impact on the overall power supply and energy access as well as the remaining lifespans of the current plant. Measures taken should allow optimal use of fossil fuel plants, to ensure that decommissioning takes place when they start to become less efficient. Relief regimes could also be designed around the exchange of generation assets, linked to the emission of carbon, under which a generation firm can benefit from incentive measures as they replace fossil fuel-based plants with cleaner or renewable fuel plants.

109. 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.

110. 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 accelerated deductions for plant closure costs, without breaching rules on excessive deductions under Pillar 2 or similar rules adopted.

5. Indirect tax measures

5.1 Principles for indirect tax measures in energy transition

111. As outlined in 1.3 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. Policies such as carbon taxes or cap-and-trade schemes seek to reduce the economic appeal of generating electricity from fossil fuels by internalizing the external costs of carbon emissions.

112. The specific area of carbon taxes is covered by the [UN Handbook on Selected Issues for Taxation of the Extractives Industries by Developing Countries \(2021\)](#) and is 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, and can be a good proxy for a carbon tax. As a general principle, it is necessary to ensure that excise taxation accurately reflects the relative carbon intensity of fossil fuel used.

5.2 VAT/GST

113. The VAT measures (as seen in table 4 above) 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.

114. 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 already stated in section 4. The choice of whether or not to use VAT incentives is for the individual country to decide; however, if this is indeed the choice, it would be better to use a reduced rate rather than an exemption from VAT. It would be advisable to restrict VAT incentives to administrative relaxations, such as early refunds of input VAT on capital goods, especially where the power generated has been zero rated or exempted. The general principle of VAT neutrality, exercised through the reduction of VAT output by the amount of VAT input, should be preserved. Countries may find it prudent to avoid exemptions from VAT e.g. on the import of capital goods for energy transition to maintain the VAT value chain.

115. 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 property²⁸ and thus a supply of goods.²⁹ 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 a specific geographic area, is exempt under generally applicable going concern rules.

116. To outline the above issue, as extractive companies dispose of 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:

- 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 part of the undertaking transferred and not simply liquidate the activity concerned immediately and sell the stock, if any.
- The nature of the transaction must be such that it allows the transferee to continue the independent economic activity previously carried on by the seller.

117. It is not uncommon for TOGC treatment to be mandatory, to protect the government from the purchaser's claim for input tax where the seller might not have paid over output tax. Other countries have similar rules for TOGC treatment.³⁰

²⁸ Art. 14 and 15 of EU VAT Directive.

²⁹ 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).

³⁰ In the UK, the conditions for TOGC treatment are:

- (i) The assets must be sold as part of a 'business' as a 'going concern'
- (ii) The purchaser intends to use the assets to carry on the same kind of business as the seller

118. 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.

5.3 Excises and environment related levies

119. It is generally accepted that excises are the tax instrument best suited to modify and influence behaviour. 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 used for household cooking. There are also examples of lower rates applied to compressed natural gas (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.

120. 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 captures 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. This recognizes the carbon emission inherent in energy use, increasing the price of such use through taxes. This can be a challenging approach and should be done incrementally; it should be done with some consultation and temporary mechanisms for compensation to households and firms for increased input costs.

121. The principle of taxation relative to the 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 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.³¹ They can also generate revenue that can be used to create fiscal space for targeted energy transition measures; further, they improve the economic position of renewables as electricity prices in particular reflect at least a part of the carbon cost of generation.

122. Many countries, especially developing countries, impose an excise tax or a similar levy on the first purchase or registration of new automobiles. Some countries, such as Thailand, have a graduated structure that provides for a lower rate for low—or zero-emission vehicles and/or more fuel-efficient vehicles.

123. Countries may also wish to consider extending such instruments or a new levy 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.

(iii) Where the seller is a taxable person, the purchaser must be a taxable person already or become one as the result of the transfer

(iv) Where only part of a business is sold it must be capable of separate operation

(v) There must not be a series of immediately consecutive transfers

³¹ 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.

124. 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 attracts higher taxes, increasing the attractiveness of renewable energy generation.

5.4 Customs duties

125. As seen in Section 4, many developing countries apply zero or preferential tariffs for goods being imported for renewable energy production. At present, 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.

126. Some developing countries are, however, taking measures through Customs duties to incentivise domestic production of equipment for energy transition. E.g. South Africa has introduced an import duty on solar panels, to encourage local industries to capitalise on future growth sectors of the energy economy. There are similar examples in Germany, Indonesia and Jamaica. This may be an area for future consideration by developing countries, especially those with an endowment of critical minerals such as lithium, taking into account the size of the domestic market and the economies of scale needed in specific industries.

6. Transition issues and challenges for the current extractives industry

6.1 Decarbonization of the extractive sector

127. The low-carbon transition presents a range of opportunities for extractive industry producers to participate in diversification away from fossil fuels. Transitioning 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 the decarbonisation of the industry itself.

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

129. National oil companies, which are owned by the States can set specific emission reduction targets aligned with the Country’s NDCs. They can thus 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.

130. 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 to make 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.

6.2 Development of new technologies

131. Extractive 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. In particular, CCUS technologies enable extractives (and other manufacturing) firms to capture and store carbon dioxide emissions to reduce greenhouse gas emissions from their operations. This involves preventing emissions from entering the atmosphere by capturing them from industrial processes and storing them underground or utilizing them for enhanced oil recovery or other purposes. Extractive 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.

132. 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. Such incentives, especially in CCUS, would need to be coordinated with carbon tax measures, if any.

6.3 Transitioning to natural gas

133. 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 impact³². Some extractives firms are increasing their focus on natural gas production and distribution as a transitional fuel towards a low-carbon future.

134. 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 the 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. Sri Lanka is introducing an offshore natural gas extraction regime which has been built in consideration for later use of infrastructure for transporting "green" hydrogen (see below). Tax measures to encourage such innovation could also be considered.

6.4 Renewable or green hydrogen

135. Green hydrogen is a relatively new type of clean energy with the potential to drive the energy transition. It is seen as a key form of clean energy for the future and is produced by electrolysis using renewable energy (e.g. wind and solar)³³ and can be a way for countries to reach net zero. 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

³² 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

³³ International Energy Agency, "The Future of Hydrogen: Seizing today's opportunities", June 2019 – www.iea.org/reports

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 the development of transportation infrastructure that will later allow the distribution of green hydrogen.

136. Governments have implemented and suggested a variety of tax schemes to promote the development of green hydrogen. 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. The use of hydrogen as aviation fuel, and possibly also in shipping, offers important opportunities for energy transition.

137. 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 green hydrogen as a sustainable energy solution.

6.5 Repurposing and decommissioning

138. Repurposing and decommissioning of extractive industry infrastructure are relevant in transitioning towards more sustainable and renewable energy generation. Repurposing involves transforming existing assets and facilities (for example rigs, plants, mines, installation, 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.

139. Repurposing of facilities offers an opportunity for extractive 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, reduces emissions during environmentally hazardous dismantling operations and offers time and cost efficiencies to new users. There are several facilities and types of infrastructure suitable for repurposing: depleted oil and gas reservoirs, wells, trunk pipelines, platforms, and others (For example: subsea manifolds to wells and field data).

140. Decommissioning³⁴ refers to the safe and environmentally responsible removal of oil and gas installations that are no longer in use. This process involves dismantling and removing the platforms, wells, pipelines, and other infrastructure, as well as restoring the affected areas to their natural or pre-existing conditions. Decommissioning activities adhere to stringent regulations and standards to ensure marine ecosystems are protected for 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.

141. The tax treatment of assets utilized, for example in the extractive sector or for power generation, that is repurposed for qualified energy transition functions needs 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 been decommissioned, and the asset remains in place. Given the incipient nature of the market and the need for energy

³⁴ Refer Chapter 14, [UN Handbook on Selected Issues for Taxation of the Extractives Industries by Developing Countries \(2021\)](#)

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 allowances or full deduction to incentivise such re-use.

142. 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 as 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 be sold for re-use.

143. 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.

144. 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.

145. 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.

146. Collaboration between governments, businesses, and stakeholders is crucial in driving this transition to achieve a sustainable energy landscape. Countries may consider developing tax policies to address decommissioning of existing facilities that are past useful life and build in approaches that incentivise repurposing.

6.6 Biofuels and alternative fuels

147. A number of businesses are exploring biofuels as a means to reduce carbon emissions. Many biofuels are largely compatible with current vehicles with internal combustion engines (ICE) and can be blended with current fossil fuels. For example, RNG (see 4.3) 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. Tax policies, especially property tax in urban areas, and excise duties, can be tailored to create incentives for the production of RNG and other forms of waste to energy fuels.

148. Biofuels can play a particularly important role in decarbonising transport, as they can often be used in existing ICE engines with little to no modification. Biofuel demand in 2022 reached a record high of 170,000 million litres but will need to double to meet 2030 targets.³⁵ However, the majority of biofuel production currently uses conventional feedstocks, especially sugar cane, corn and soybeans. This puts pressure on food and feed prices; it is thus essential to have further technological development so biofuels can come principally from waste products and plant products that do not affect human food supplies or require large inputs of fertiliser and insecticides. Tax policy tailored to these goals can have a positive impact in attracting further investment into this area.

7. Tax policy design for an enabling environment for the energy transition

7.1 Principles of tax policy design to promote energy transition

149. The implementation of energy transition policies will have economic implications. Tax policies should be designed to balance the economic impact on affected population groups, industries and regions. This may involve providing support and retraining programs for communities heavily dependent on fossil fuels.

150. There is also an ongoing debate about revenue allocation; some advocates contend that there is a need for earmarking revenue generated from, for example, carbon taxes and investing the same 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.

151. 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.

152. 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.

³⁵ See <https://www.iea.org/energy-system/low-emission-fuels/biofuels>

- Address the need for ensuring tax neutrality for financing energy transition measures, which might appear to present more risk to financing institutions.
- Consider the need to implement SDG 7 (clean, affordable energy for all) in tax policy design to ensure a just transition that addresses the energy access needs of vulnerable groups.

7.2 Financing the transition and appropriate tax measures

153. 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 the pace of deployment of renewables-based electricity must accelerate considerably, including the 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.³⁶ 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.³⁷

154. 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 year³⁸; however, investments in fossil fuels amounted to \$977 billion in the same period, and subsidies amounted to \$472 billion in 2018 alone.

155. 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.³⁹ 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. While there is demand from many developing countries for support to be mobilised for developing countries in move away from fossil fuels. These wider issues of climate justice and public finance are outside the brief of this paper. However, there are valid measure through which developed countries could support developing countries in energy transition. In narrow tax policy terms, e.g., developed countries could help preserve the benefits provided by developing countries through tax policy to investors in renewables or financing of renewables. There could also be scope to reach agreement on tax and trade policy matters, perhaps on a bilateral or regional basis, on linked industries such as critical mineral value chains. See further paragraph 157.

³⁶ 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 demands ide matters covered by the Environmental Tax Subcommittee.

³⁷ 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.

³⁸ 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

³⁹ 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, available at <https://ccr.lexxion.eu/article/CCLR/2022/1/7>, SSRN: <https://ssrn.com/abstract=4083998> or <http://dx.doi.org/10.2139/ssrn.4083998>

156. 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. 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.

157. 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 on risks 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 the energy transition. Measures that help de-risk financial investments in energy transition, especially in developing countries, will support financing by the private sector. Further, tax measures that support an enabling environment for “crowding in” financial investments for energy transition projects can also play a key role. Mexico has had good experience with sustainable financing such as sovereign bonds linked to SDGs, targeted at special investors. Other countries, especially capital exporting nations, could support such measures by allowing the tax benefits accruing to such instruments, e.g. bonds that support SDG 7, to be preserved for taxpayers resident in their jurisdictions.

158. An example that countries could consider is 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 game changers 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.

159. 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 election⁴⁰ 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.⁴¹

160. 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. 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. Such measures would of course require strong anti-abuse provisions and monitoring.

161. 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

⁴⁰ The Treasury Department and IRS released in June 2023 the Proposed Regulations (REG-101610-23) providing guidance concerning the section 6418 election to transfer eligible credit, as well as temporary regulations (T.D. 9975) and concurrently released identical proposed regulations) setting forth mandatory information and registration requirements for making an election to transfer credits under section 6418

⁴¹ See <https://www.irs.gov/pub/irs-pdf/p5884.pdf>

extended to subsequent owners of the asset financing, for example, if a financing transaction subject to such benefits is subsequently securitised and sold as CLOs (collateralised loan obligations) or a similar instrument in global capital markets.

7.3 Use of tax incentives in policy design

162. 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.

163. 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 a higher price 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 risk⁴².

164. Apart from incentives for firms to invest in renewable energy sources, tax 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; they should 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. Also, as mentioned above, governments can implement complementary policies such as mandates and technology inputs. Where such measures include providing grants or direct subsidies for adopting cleaner technologies, or indirect subsidies through support to industries and research institutions, ordinary tax rules can impute a taxable benefit. Tax policy can be used to preserve the full value of such non-tax incentives.

165. 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 5.

166. 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.

167. 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-

⁴² Tax credits are more prevalent in developed nations. For instance, households in Germany that produce renewable energy at home can now sell any excess to the national grid. Germany also provides homeowners with tax incentives for energy-efficient renovations. Households can claim back 20% of renovation costs. See: <https://www.iea.org/policies/11633-tax-deductions-for-building-renovations>

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.

168. 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.

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

7.4 Interaction with windfall taxes

170. Prices of fossil fuel products have been extremely volatile in periods characterized by economic instability and security challenges. Such volatility has resulted in windfall profits for some extractives firms, which in turn has led to some countries imposing windfall taxes as a policy instrument to recover for the state any excessive rents earned from the production of fossil fuels. Recent developments show that windfall gains can also accrue in the renewable energy sector when power purchase arrangements remain static in a time of dynamic technological change. Such taxes can have an important role, 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 available to energy firms to invest in pursuit of net zero objectives (i.e. energy efficiency, renewables, hydrogen, biofuels, etc.). However, such assertions have not been seen to be supported by empirical evidence.

171. The imposition of windfall taxes should be balanced with the need to maintain an enabling environment for energy transition. The typical rationale for such taxes is to recover revenue when temporary windfall gains accrue, mitigate high energy prices, redistribute revenue from the energy sector and encourage the switch to renewable energy. However, the 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.

172. 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, maybe 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”.⁴³

173. Countries can also consider the application of incentives for switching from fossil fuel activity to low carbon emission activities in the design of such windfall taxes. Under this approach, windfall profits

⁴³See 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>

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 should 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 to prevent “double-dipping”.

8. Interaction between tax rules and associated policies

8.1 Mining of critical minerals

174. 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. While these are largely matters of trade policy, there are tax implications as illustrated below.

175. A move by countries 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.⁴⁴ It excluded vehicles with batteries containing critical minerals extracted, processed, or recycled in countries that have no trade agreement with the United States.⁴⁵ This measure can impact investment into a developing country that is a source of these critical minerals which is trying to develop its industrial sector and its trading relationships.

176. An increase in similar tax policies is likely to continue, e.g. 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.

177. In principle, a neutral tax policy designed to capture the profitability attached to the mineral is good practice. Good tax policy should be towards fair application of national tax policy to the resource; however, where a developing country is trying to develop a strategy to add value to critical minerals mined in the country, tariff measures and explicit direct tax benefits consistent with trade obligations should be considered.⁴⁶

8.2 Introduction of Carbon Border Adjustments by major trading partners

178. The potential impact of carbon border adjustment mechanisms (CBAMs) implemented by jurisdictions that import large quantities of goods from developing countries should be considered.

⁴⁴ Section 13401(e)(1) of the Inflation Reduction Act of 2022, amending Section 30D of the US Internal Revenue Code.

⁴⁵ Section 30D(d)(7) of the US Internal Revenue Code, as amended by the Inflation Reduction Act.

⁴⁶ Policy guidance on the implications of this interaction is available from the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF). See <https://www.igfmining.org/>

While the current CBAM arrangements by the EU⁴⁷ apply to a limited range of goods and services⁴⁸, 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. Many developing countries have expressed misgivings about the use of CBAM and have concerns about “green protectionism.” Consideration could be given to how the CBAM could be modified to help developing countries in the transition, perhaps through graduated trade taxes.

179. 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 the transition and limit the impact on stranded assets, especially in power generation. For countries with an extractive resources endowment, such analysis could consider introduction of carbon taxes, which could reduce or eliminate payments to the EU under the CBAM.

8.3 Deep Sea mining

180. 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.⁴⁹ Owing 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.

181. While exploration of the deep sea has been underway and approximately 30 contracts have been issued by the International Seabed Authority (ISA⁵⁰), no exploitation of the deep sea has begun.⁵¹ 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 negotiating regulations to facilitate commercial extraction of minerals including the potential fiscal take component for the state. The goal should be to have an equitable payment regime for extractions; countries could also consider taxability of indirect disposals of interest in a deep-sea mining concession.

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

- 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.
- The United Nations Convention on the Law of the Sea (UNCLOS) requires that 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

⁴⁷ The EU adopted a CBAM in October 2023 to put “a fair price on the carbon emitted during the production of carbon-intensive goods that are entering the EU and to encourage cleaner industrial production in non-EU Countries.” See, https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

⁴⁸ 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.

⁴⁹ International Energy Agency, Critical Minerals Market Review 2023 (July 2023) – www.iea.org/reports

⁵⁰ The body responsible for regulating the deep sea under the Law of the Sea Convention

⁵¹ International Union for Conservation of Nature, “Deep – Sea Mining”, Issue Brief (May 2022) – www.IUCN.org/resources

exemptions, the tax rate, and whether the companies are applying tax avoidance mechanisms, etc. This measure in UNCLOS could perhaps be examined by the UN Tax Committee to ensure consistency with tax measures established by the Committee. There is also a need to consider the balance of taxing rights for the source state and the sponsoring state, and ensure consistency with the general fiscal regime of the latter.

- 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.

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

183. 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 to lower their carbon footprint and take advantage of tax breaks and monetary incentives. Companies are examining their procurement processes as well as their logistics and distribution operations. For instance, the EU'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 decarbonisation.

8.5 Energy transition, taxation and impact on human rights

184. To understand this interplay, an understanding of tax and human rights is important as they are two critical aspects that profoundly influence the well-being and dignity of individuals and societies. The relationship between tax and human rights are multifaceted and interconnected. When taxation systems are fair, transparent, and effectively implemented, they can play a pivotal role in advancing human rights by ensuring adequate resources for social and economic development. However, the impact of taxation on human rights can be complex and diverse. If tax policies are regressive and discriminatory, they can exacerbate existing inequalities, leading to a disproportionate burden on marginalised and vulnerable populations. Moreover, the way tax revenues are utilised and allocated can significantly influence human rights outcomes.⁵²

185. Human rights issues thus need to be considered in transition goals alongside reducing greenhouse gas emissions and combating climate change. Tax policies aimed at facilitating this transition should recognise human rights considerations. Reforms should consider concerns that marginalised communities are not disproportionately affected by energy policies and that their rights are respected during the transition. It is important to guard against the risk that the urgency in energy transition exacerbates exploitation and human rights abuses. A potential remedy might be to condition the grant of tax benefits for energy transition on compliance with measures to protect worker rights and marginalised communities.

186. 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.

⁵² Atim, J. A, (2023), Compendium on Tax and Human Rights. Grant Agreement number or2021-83193 and Vote number 500/675/095 to support training on debt and human rights and increase participation in Fiscal Policy Research.

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.

9. Tax Administration

9.1 Overview

187. 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. The experience of some developed countries is that tax administrations were at times not properly equipped to deal with the new tax rules.

188. 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 is thus higher than in other areas, especially when the regulators are new to the subject.

189. 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.

190. 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 results in a public sector utility that has taken on the characteristics of a taxpaying entity with different economic drivers than was formerly the case.

9.2 Key challenges

191. 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.

192. 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 negotiations; however, this is gradually changing.

193. Managing the expectations of the wider community is also a significant challenge. On the one hand, 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.

194. 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 an independent external audit. There can be important synergies to be gained in coordinating assurance rules for private carbon markets and accounting standards for ESG.

9.3 Organization and staffing for administering tax rules for energy transition

195. 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 the application of special provisions, if any, for repurposing and decommissioning.

196. 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.

197. While staff in such specialized units are generally more technically skilled, there are limitations. Given these limitations, and 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.

9.4 Monitoring frameworks for energy transition.

198. Most tax administrations 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 bodies do not provide verifiable data. This can lead to the abuse of any tax concessions granted.

199. 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.

200. While on the one hand 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 benchmarking 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.

201. 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: Challenges for developed and developing countries in energy transition

Issue	Developed Countries	Developing Countries
<p>Capital Investment: Total annual investments in the energy sector are projected to grow by between 2 and 4 percent per annum, reaching between \$2 trillion and \$3.2 trillion in 2040.</p> <p>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%).⁵³ 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 which focuses on reducing economic challenges while addressing climate change, and new initiatives in Europe, Japan, China and others.</p>	<p>Capital needs: Offering incentives to accelerate the transition to a clean energy economy can help attract investment. For resource rich nations, enhanced tax relief for decommissioning existing assets can accelerate this process.</p> <p>Developed economies have fiscal headroom, capital markets, and regulatory capacity to implement targeted investment promotion policies better.</p> <p>The industry's investment in clean fuels, such as bioenergy, hydrogen, and Carbon Capture, Utilisation, and Storage (CCUS), is picking up in response to more supportive policies but remains well short of where it needs to be in climate-driven scenarios.⁵⁴</p>	<p>Capital needs and policy capacity: Clean energy investment in emerging economies is vital for our global decarbonization efforts. Developing nations cannot fund their energy transitions without significant international investment.</p> <p>The Global South only received 20% of the world's clean energy investments in 2022.⁵⁵ 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 drive their economies and ensure the security of supply⁵⁶.</p>
<p>Regulatory and policy framework: Policies are crucial, and they will play a crucial role in facilitating energy transitions. According to UNCTAD, two-thirds of nations have enacted policies and laws specifically dedicated to renewable energy, and only one-half of least developed nations and a third of small island developing states have done so.⁵⁷ There is also a need to encourage the enactment of policies for</p>	<p>Entrenched market players and regulatory frameworks: the policy framework in developed nations emphasises established regulatory systems, extensive social welfare programmes and strong institutional structures focusing on sustainable economic growth, innovation and technological advancement. While this may be the case, developed nations often have complex regulatory</p>	<p>Limitations in regulatory and policy formulation capacity: Developing countries face challenges such as weaker institutional capacities, and limited resources. Their focus is on basic needs such as infrastructure, education and health care. Thus, their policies may prioritize economic development, poverty alleviation, public service delivery than needing to formulate and adopt policies and</p>

⁵³ World Energy Investment 2023

⁵⁴ World Energy Investment 2023

⁵⁵ The work being done by the Climate Investment Fund (CIF) is commendable. Through its implementing entity African Development Bank, 43 investment plans across 27 African countries have been undertaken to unlock climate action. See <https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/climate-investment-funds-cif>

⁵⁶ Quoting Espen Mehlum, Head of Energy and Materials Programme at the World Economic Forum, "Attracting much higher levels of financing for energy transition in the developing world hinges on addressing a few key factors that hinder investment such as the cost of capital, currency risks and political risks. Such risks whether real or perceived- can deter investors from working with developing nations."

⁵⁷ <https://unctad.org/news/investing-energy-transition-countries-need-more-balanced-policies>

<p>phased retirement of fossil fuel infrastructure.</p> <p>Policy and regulatory frameworks should facilitate the deployment, integration and trade of renewables-based energy, improve social, economic and environmental outcomes and promote equity and inclusion.</p>	<p>frameworks and vested interests in the fossil fuel industry.</p> <p>Implementing new policies and regulations to support clean energy can face opposition and political challenges.</p>	<p>strategies specific to renewable energy.⁵⁸</p> <p>Further, 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.</p>
<p>Infrastructure: Transitioning to renewable energy sources requires significant investment in upgrading or replacing existing infrastructure, which can be expensive and time-consuming.</p> <p>According to IRENA, transmission and distribution will need to accommodate both the highly localised, decentralised nature of many renewable fuels, as well as different trade routes. Planning for interconnectors to enable electricity trade, and shipping routes for hydrogen and derivatives, must consider vastly different global dynamics and proactively link countries to promote the diversification and resilience of energy systems.⁵⁹ Further, infrastructure should facilitate national, regional and global strategies for new supply-demand dynamics.</p>	<p>Legacy Infrastructure: The European Commission defines energy infrastructure to include transmission, distribution, and storage infrastructure for electricity, gas and oil e.g., electricity smart grids, gas transmission and distribution pipelines; underground storage facilities of gas; regasification or decompression facilities for liquefied natural gas; oil pipelines and pumping stations; CO2 networks of pipelines).⁶⁰</p> <p>Developed nations 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.</p>	<p>Infrastructure deficiencies and capacity: Energy transition in developing nations will require an unprecedented transformation of the power sector infrastructure, with scaling up of energy efficiency and renewal energy as well as phasing down of coal-fired power generation.⁶¹ Developing nations often pay more for electricity; they cannot access energy efficiency or renewable energy projects and are locked into fossil fuel projects with high and volatile costs termed the triple penalty.</p> <p>Further, many developing nations lack a robust energy infrastructure, especially a flexible nation-electricity grid.</p> <p>Building the necessary energy infrastructure in developing nations 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.</p>
<p>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</p>	<p>Diversifying production and consumption patterns: Several developed nations are currently dependent on fossil fuels. Some</p>	<p>Dependence on fossil fuels both as a source of energy and for revenue: Many developing countries are heavily dependent on fossil fuels for their</p>

⁵⁸ UNCTAD, World Investment Report 2023. Available at <https://unctad.org/publication/investment-policies-energy-transition-incentives-and-disincentives>

⁵⁹ See <https://www.irena.org/Digital-Report/World-Energy-Transitions-Outlook-2023>

⁶⁰ EEAG Guidelines 2014

⁶¹ World Bank's proposed Framework titled, "Scaling Up to Phase Down"

<p>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.</p> <p>Despite pressures on financing, global investment in clean energy is set to reach almost the amount going to fossil fuels in 2024, helped by improving supply chains and lower costs for clean technologies, according to a new IEA report.⁶²</p> <p>Coal without CCUS is expected to be phased out gradually.</p>	<p>have increased their fossil fuel use and expanded exports in recent months following political unrest in some European countries and the ensuing turmoil in global energy markets. While these countries have acquired enough reserves to finance the shift, the move is complex and disrupts current distribution economics.</p>	<p>energy needs. Developing countries with unexplored or unexploited fossil fuel assets need to balance development and climate goals; without significant investment, there will be a drive to exploit the resources while they still retain value.</p> <p>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.</p>
<p>Energy poverty and resource limitations: Balancing the need for immediate energy access with transitioning to cleaner sources can be a significant challenge.</p>	<p>Distribution and access: Energy poverty may only affect developed nations 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.</p>	<p>Limited resources and greater energy poverty: Many developing nations 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.</p> <p>Developing nations may have limited financial, technological, and human resources for large-scale renewable energy projects.</p>
<p>Economic transition: The International Labour Organization (ILO) estimates that the 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 developing nations.</p>	<p>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.</p> <p>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.</p>	<p>Planning needed for transition in the economy: Developing nations often need to build the technical and institutional capacity to plan, implement, and manage the transition. Large nations 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. The development of new skills will have to be considered.</p>
<p>Technological change and innovation: Patenting rates suggest that more technological innovation has taken place in the field of clean energy technologies</p>	<p>Ensuring a level playing field: In developed countries, innovations such as advanced renewable energy technologies, smart grids, energy storage</p>	<p>Balancing transition needs with building domestic capacity and industry: Building the necessary energy infrastructure in developing nations often requires significant</p>

⁶² See <https://www.iea.org/news/investment-in-clean-energy-this-year-is-set-to-be-twice-the-amount-going-to-fossil-fuels>

<p>than in traditional energy fields such as fossil fuels and nuclear.⁶³</p> <p>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.</p> <p>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.</p> <p>Both developed and developing nations can benefit from international cooperation, knowledge sharing and investment to facilitate the energy transition while ensuring economic stability and social equity.</p>	<p>solutions, and electric vehicles are driving progress towards a low-carbon future. These nations usually have the financial resources and infrastructure to adopt and integrate these technologies efficiently.</p> <p>Given 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 (EVs and heat pumps, and green hydrogen for hard-to-abate sectors like heavy transport and industry),⁶⁴ but there could be a risk that electricity grids become a bottleneck by favouring specific generation sources.</p>	<p>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 has to be balanced against the desire to develop domestic industrial and technical capacity in this new and promising field.</p> <p>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.</p>
<p>Energy security: Fundamental changes are taking place in the global energy system which will affect almost all countries and will have wide-ranging geopolitical consequences.</p> <p>The ongoing transition to renewables involves a transformation of the world’s energy systems. Transitioning nations must ensure that clean energy sources are as reliable and secure as fossil fuels are, especially in times of crisis.</p>	<p>Geopolitics and security constraints: One of the biggest threats to energy security in developed nations is geopolitics.⁶⁵ Issues of energy access can be entangled with national security concerns, and this reduces the pace of transitions.</p>	<p>Capacity and economic constraints: In developing nations, capital limitations and capacity challenges are the major risks to energy security.</p>

⁶³ 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.

⁶⁴ See, <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>

⁶⁵ 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

Appendix 2: Inventory of energy transition measures in select countries

This summary includes recent legislative updates up to November 2024, concerning energy transition policy measures. It is stressed that these measures are subject to frequent change in view of the dynamic nature of this policy area.

ARGENTINA

<i>Tax incentives</i>	Argentina offers various tax incentives through the <i>Renewable Energy Law No. 27,191</i> , including VAT exemptions, accelerated depreciation, extended loss carry-forwards, exemption from income tax on profit distributions reinvested in new infrastructure projects for renewable energy projects.
<i>Extractive industry tax policies</i>	Argentina is the fourth-largest lithium producer worldwide and allows the private ownership, exploration, development, and production of lithium resources. In addition to investing in renewable projects, as part of their energy transition policies, Argentine oil and gas companies have been investing in lithium and copper projects. The extractive sector, especially in mining is supported by tax policies such as export duty reductions and special tax regimes to attract investment.
<i>Research and development tax incentives</i>	Argentina provides incentives for R&D particularly focused on renewable energy technologies and lithium battery development. However, funding and participation in global innovation initiatives remain constrained. Argentina provides significant subsidies to natural gas, as part of its strategy to boost domestic production and reduce reliance on imports. Additionally, a portion of revenues from a one-time wealth tax was allocated to gas exploration and development. These policies indicate a prioritization of energy security over subsidy reform aligned with climate goals.
<i>Fossil fuel subsidy reforms</i>	Argentina has made limited progress in fossil fuel subsidy reform. While there is acknowledgment of the need to phase out subsidies, political and social concerns about energy affordability have slowed substantive action. Subsidies remain significant, especially for natural gas and oil.
<i>Decommissioning of fossil fuel energy assets</i>	Decommissioning of fossil fuel assets is in its early stages. Most efforts focus on gradual reductions in oil and gas production and reliance, but there is no large-scale decommissioning plan in place. 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.
<i>Repurposing of fossil fuel energy assets</i>	Repurposing initiatives are minimal. However, there is potential for using existing fossil fuel infrastructure (e.g., natural gas pipelines) for renewable energy transport or hydrogen projects in the future.

AUSTRALIA

<i>Tax incentives</i>	The <i>Renewable Energy Act 2000</i> aims to stimulate investment in renewables by requiring entities to purchase and surrender a certain number of Renewable Energy Certificates, to meet their obligation under the Renewable Energy Target scheme (RET) each year. This was replaced by large-scale generation certificates and small-scale technology certificates. Australia provides accelerated depreciation for renewable energy assets under the RET scheme. The <i>Future Made in Australia Bill 2024</i> introduced a Hydrogen Production Tax Incentive, providing AU\$2 per kg of renewable hydrogen produced (2027–2039). Critical Minerals Production Tax Incentive is intended to support downstream refining and processing of Australia’s 31 critical minerals to improve supply chain resilience.
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<i>Extractive industry tax policies</i>	<p>The critical minerals incentive supports processing and refining with a 10% rebate on costs for Australia's 31 critical minerals. This complements the goal of increasing renewable technology production in Australia. However, broader incentives, like the Technology Investment Roadmap, aim to transition industries toward low-emission technologies, including clean hydrogen and carbon capture initiatives. Resource taxation Petroleum Resource Rent Tax exists but lacks direct links to renewable energy funding</p> <p><i>Australian Renewable Energy Agency Act 2011</i> provides financial assistance for the R&D, and commercialization of renewable energy and related technologies. The Australian R&D Tax Incentive allows businesses to claim refundable or non-refundable tax offsets for eligible R&D activities. For renewable energy, this includes incentives for research into clean technologies, battery storage, solar panel efficiency improvements, hydrogen, and carbon capture projects, with co-investment opportunities supported by initiatives like Australian Renewable Energy Agency.</p>
<i>Research and development tax incentives</i>	<p>Australia has not undertaken significant reforms to phase out its fossil fuel subsidies, which remain substantial. In the 2023-24 financial year, fossil fuel subsidies provided by the Australian federal and state governments totaled approximately AUD 14.5 billion, marking a 31% increase from the previous year. Key components include the Fuel Tax Credit Scheme, which alone accounted for AUD 9.6 billion, along with various state-level incentives for coal and gas industries.</p>
<i>Fossil fuel subsidy reforms</i>	<p>Australia is actively decommissioning coal assets, with a target of 82% renewable energy in the electricity mix by 2030. Specific programs target transitioning workers and repurposing infrastructure, including hydrogen hubs and renewable energy facilities. Broader federal strategies encourage a shift to clean energy assets. Australia has been slow to decommission coal-fired power plants, although closures have begun. Plans exist to phase out coal by the 2030s.</p>
<i>Decommissioning of fossil fuel energy assets</i>	<p>Decommissioned coal power stations are being converted for use in green hydrogen and battery storage. Projects like the National Electricity Market reforms and renewable energy zones are pivotal in replacing retiring fossil fuel plants with renewable generation capacity. Some projects focus on repurposing sites for hydrogen hubs or battery storage. Some coal plants are being repurposed for renewable energy projects, such as turning closed sites into battery storage facilities.</p>
<i>Repurposing of fossil fuel energy assets</i>	

BOLIVIA

<i>Tax Incentives</i>	<p>Limited tax incentives: some measures exist for solar and hydro projects, but the policy framework is underdeveloped compared to regional peers. Fiscal incentives have been provided on a case-by-case basis or with regional and time limited scope. For example, <i>Law 3279 and Law 31525 of 2005</i> provided 5 years of VAT and import duty exemptions for renewable energy equipment in the Departments of Beni and Pando respectively. <i>Decree 280 of 2009</i> provided import duty exemption for solar and small-scale wind power equipment from the EU Euro-Solar cooperation project.</p>
<i>Extractive industry tax policies</i>	<p>Extractive industries (mainly natural gas and minerals) are heavily taxed, but these revenues are not strategically redirected to support renewables. 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.</p>
<i>Research and development tax incentives</i>	<p>Minimal focus on R&D incentives for renewable energy; investments are limited to pilot projects in solar and lithium processing.</p>

<i>Fossil fuel subsidy reforms</i>	Subsidies remain high, particularly for gasoline and diesel, as they are used to control inflation, maintain social stability and support the economy. Reforms face political resistance. Bolivia has not comprehensively reformed its fossil fuel subsidies despite periodic discussions and attempts. Efforts to reduce these subsidies have faced political and public resistance due to the economic burden it would place on consumers and businesses.
<i>Decommissioning of fossil fuel energy assets</i>	Bolivia remains reliant on gas exports and domestic fossil fuel use. Bolivia does not have explicit national policies specifically aimed at repurposing fossil fuel energy production assets. However, the country is actively pursuing a transition to renewable energy and reducing its dependence on fossil fuels.
<i>Repurposing of fossil fuel energy assets</i>	Bolivia's energy transition efforts primarily focus on developing renewable energy infrastructure rather than explicitly repurposing existing fossil fuel facilities.

BRAZIL

<i>Tax incentives</i>	Brazil offers tax exemptions and reductions for renewable energy projects, particularly in wind, solar, and biomass sectors. Special Incentive Regime for the Development of Infrastructure include tax exemption of certain taxes on goods and services employed in the development of those projects, zero rate of importation tax on components used in solar generation projects, discounts on the transmission system usage rate and distribution system usage rate of 50% are also available for solar, wind and biomass generation projects the capacity of which is 300MW or lower.
<i>Extractive industry tax policies</i>	Limited specific policies directly linking extractive industry taxation to renewable energy promotion. However, royalties from natural resource extraction are increasingly being earmarked for renewable energy and sustainability projects.
<i>Research and development tax incentives</i>	Brazil's Innovation Law provides tax deductions for R&D expenditures, and energy-focused innovation can qualify for these benefits. Petrobras and other major companies also fund R&D under legal obligations. Additionally, the National Development Bank offers financing with favourable terms for innovative renewable energy technologies.
<i>Fossil fuel subsidy reforms</i>	Brazil heavily supports the oil and gas industry, making reforms inconsistent. Brazil has begun shifting its focus toward renewable energy subsidies, moving away from fossil fuel subsidies. As of 2024, subsidies for renewable energy are expected to surpass those for fossil fuels. Specifically, Brazil plans to allocate more funds to renewable energy projects like wind and solar than to its existing fossil fuel subsidy fund, known as the CCC, which supports isolated areas reliant on fossil fuels.
<i>Decommissioning of fossil fuel energy assets</i>	Brazil has limited formal policies for decommissioning fossil fuel energy production assets. Brazil continues to rely heavily on oil and gas production. The focus has been on integrating renewable energy into the grid rather than directly phasing out fossil fuel infrastructure.
<i>Repurposing of fossil fuel energy assets</i>	Repurposing efforts are nascent, with limited examples of converting fossil-based infrastructure to renewable energy facilities. Offshore wind power projects offer an alternative to the removal and final disposal of infrastructures, a potential solution to Brazilian offshore decommissioning.

CANADA

<i>Tax incentives</i>	Canada offers investment tax credits for renewable energy projects, including wind, solar, and geothermal, under programs like the <i>Clean Energy for Rural and Remote Communities Program</i> . These incentives help reduce upfront costs for developers. Canada's renewable energy investment tax credit is a refundable incentive that offers up a percentage of the cost of capital investment, providing 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 incentives for carbon capture, utilization and storage (CCUS), including direct air capture projects and equipment for transportation, storage and use.
<i>Extractive industry tax policies</i>	Some tax credits are designed to encourage the mining of critical minerals (e.g., lithium, cobalt) essential for renewable energy technologies. These policies include incentives under the <i>Critical Mineral Exploration Tax Credit</i> to support sustainable resource extraction.
<i>Research and development tax incentives</i>	Canada provides R&D tax credits under the <i>Scientific Research and Experimental Development Program</i> , which supports innovation in clean energy technologies like advanced battery systems, hydrogen production, and grid modernization.
<i>Fossil fuel subsidy reforms</i>	Canada has committed to phasing out inefficient fossil fuel subsidies by 2025 as part of its obligations under the <i>G20 Fossil Fuel Subsidy Reform Agreement</i> . Recent reforms include ending subsidies for new oil and gas projects and shifting investments toward clean energy.
<i>Decommissioning of fossil fuel energy assets</i>	Federal and provincial governments are introducing measures to retire coal-fired power plants by 2030 under the <i>Pan-Canadian Framework on Clean Growth and Climate Change</i> . Financial assistance is provided to impacted communities to transition to cleaner industries.
<i>Repurposing of fossil fuel energy assets</i>	Canada has explored repurposing oil and gas infrastructure for renewable energy, particularly in provinces heavily reliant on the fossil fuel industry. Programs like the <i>Just Transition Initiative</i> support repurposing fossil fuel infrastructure for renewable energy, such as converting retired coal plants into biomass or solar facilities. Some provinces, like Alberta, are exploring geothermal energy from abandoned oil and gas wells.

CHILE

<i>Tax incentives</i>	Chile offers various tax benefits, such as accelerated depreciation for renewable energy investments and exemptions for imported equipment used in renewable projects. The quota system requires power companies that have an installed capacity of more than 200 MW and that withdraw energy 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.
<i>Extractive industry tax policies</i>	The mining sector, especially lithium and copper producers, is incentivized to adopt renewable energy sources for operations, benefiting from lower energy costs and tax credits.
<i>Research and development tax incentives</i>	Chile is focusing on green hydrogen and battery storage technologies as emerging areas for innovation. 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 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.
<i>Fossil fuel subsidy reforms</i>	Fossil fuel subsidies are gradually being reduced, with funds redirected toward renewable energy development. However, subsidies for certain industries remain a challenge.
<i>Decommissioning of fossil fuel energy assets</i>	Chile has committed to phasing out coal-fired power plants by 2040, with significant progress already made. Decommissioning plans involve collaboration with private stakeholders.
<i>Repurposing of fossil fuel energy assets</i>	Decommissioned coal plants are being considered for repurposing as renewable energy hubs or for energy storage, particularly pumped hydroelectric storage.

CHINA

<i>Tax & market-based incentives</i>	<p>China offers preferential tax policies for renewable energy projects, including reduced corporate income tax rates and exemption from corporate income tax. Energy service companies are entitled to exemption of VAT, and refund of incremental uncredited input VAT amounts are also provided for solar and wind power generation. Since 2021, China has a national market for emissions. It is the world's largest carbon market by emissions. The government offers:</p> <ul style="list-style-type: none"> - FiTs, providing a fixed price for renewable electricity generation. National, regional and local subsidies reduce upfront costs for renewable projects, making them more financially viable. - Tax incentives in VAT and income tax to support the development of renewable energy. - Green Electricity Certificate scheme.
<i>Extractive industry tax policies</i>	<p>Tax reforms encourage resource efficiency in the extractive industries. The government has implemented resource tax adjustments to promote cleaner extraction processes and reinvestment in renewable energy technologies.</p>
<i>Research and development tax incentives</i>	<p>Generous R&D tax incentives are available, including super-deductions of up to 75% on qualifying R&D expenses. Renewable energy innovation is prioritized under the "Made in China 2025" initiative, targeting advancements in wind turbines, solar PV, and battery technologies. A resident enterprise may deduct 200% of qualifying R&D expenses incurred 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 200% of the actual R&D costs.</p>
<i>Fossil fuel subsidy reforms</i>	<p>While China has begun to reduce subsidies for coal and oil, progress is uneven. Subsidy reductions are being redirected toward renewable energy incentives, though fossil fuel support remains significant for energy security reasons.</p>
<i>Decommissioning of fossil fuel energy assets</i>	<p>China has set clear timelines for phasing out small, inefficient coal plants, replacing them with advanced clean coal or renewable energy projects. Pilot projects for coal-to-solar conversions are being implemented in regions like Shanxi and Inner Mongolia.</p>
<i>Repurposing of fossil fuel energy assets</i>	<p>The government has launched initiatives to repurpose decommissioned coal mines and power plants into renewable energy hubs, including large-scale solar farms and energy storage facilities. Examples include using abandoned mining sites for pumped hydro energy storage projects.</p>

EGYPT

<i>Tax incentives</i>	Egypt provides tax exemptions for renewable energy projects, especially in solar and wind sectors, under its investment incentives framework. However, the scope is limited, and implementation challenges exist. 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.
<i>Extractive industry tax policies</i>	Egypt's extractive industries, including oil and gas, do not currently have tax policies directly aimed at supporting renewable energy transitions. Most tax revenue is focused on fossil fuel extraction.
<i>Research and development tax incentives</i>	Egypt has limited R&D tax incentives for renewable energy. While some innovation in solar technologies is emerging, there is a need for enhanced fiscal support for research. 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.
<i>Fossil fuel subsidy reforms</i>	Egypt has made significant strides in reducing fossil fuel subsidies since 2014, implementing phased price adjustments. However, subsidies still constitute a large share of energy spending, especially for natural gas.
<i>Decommissioning of fossil fuel energy assets</i>	Efforts to decommission fossil fuel-based assets are limited due to heavy reliance on natural gas for power generation. Egypt's Integrated Sustainable Energy Strategy 2035 prioritizes renewables but retains significant fossil fuel use and on optimizing existing fossil fuel infrastructure.
<i>Repurposing of fossil fuel energy assets</i>	Few examples exist of repurposing fossil fuel infrastructure, though Egypt has shown interest in converting existing gas facilities for hydrogen production and integrating renewable energy into grids.

FINLAND

<i>Tax incentives</i>	<p>Finland offers tax incentives such as reduced taxes for renewable energy production, including wind, solar, and bioenergy. Incentives focus on supporting clean energy projects and grid integration. Temporary green investment incentive to accelerated investments such as battery and hydrogen projects and the fossil-free steel industry designed to be 20 per cent of the total investment cost, subject to a ceiling of EUR 150 million per project.</p> <p>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.</p>
<i>Extractive industry tax policies</i>	Finland imposes strict environmental regulations and taxes on the extractive industry. Revenues from these taxes are partly reinvested in renewable energy and sustainability initiatives.
<i>Research and development tax incentives</i>	Generous R&D tax incentives are available for companies and research institutions working on renewable energy technologies, particularly in wind, solar, and biomass innovation. Finland prioritizes innovations in energy storage and efficiency. 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.

<i>Fossil fuel subsidy reforms</i>	Finland has eliminated most fossil fuel subsidies and implemented taxes on fossil fuel consumption. Policies aim to discourage fossil fuel use and redirect resources toward renewables.
<i>Decommissioning of fossil fuel energy assets</i>	Finland has a clear plan for phasing out coal-fired power plants by 2029. Support is available for energy companies transitioning to clean energy sources.
<i>Repurposing of fossil fuel energy assets</i>	Repurposing efforts include converting old coal plants into bioenergy facilities and integrating storage solutions into existing infrastructure. Finland promotes circular economy principles in repurposing projects.

FRANCE

<i>Tax and market-based incentives</i>	<p>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). The price, set by the minister of economy, is higher than the market price.</p> <ul style="list-style-type: none"> - Tax credits for renewable energy producers, particularly for wind and solar power. - Accelerated depreciation on renewable energy assets for businesses.
<i>Extractive industry tax policies</i>	Carbon pricing through a carbon tax that applies to extractive industries, encouraging them to transition to low-carbon alternatives. Energy transition tax credits and grants for oil and gas companies investing in renewable energy infrastructure. Support for offshore wind development as part of the extractive sector's diversification.
<i>Research and development tax incentives</i>	Crédit Impôt Recherche: A research tax credit that offers companies a deduction of up to 30% of R&D expenses, including those focused on renewable energy innovations. 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.
<i>Fossil fuel subsidy reforms</i>	France has progressively reduced fossil fuel subsidies, aligning with its carbon neutrality goals by 2050. Carbon pricing has raised the cost of fossil fuels for industries, effectively reducing subsidies for fossil fuel extraction and consumption.
<i>Decommissioning of fossil fuel energy assets</i>	France committed to closing all coal-fired power plants by 2022 as part of the transition to cleaner energy sources. Plans to reduce nuclear capacity and phase out older plants, in line with diversification into renewable energy.
<i>Repurposing of fossil fuel energy assets</i>	France is investing in the conversion of oil platforms into offshore wind farms. Some older coal plants are being repurposed for biomass energy generation. 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

<i>Tax and market-based incentives</i>	Germany provides robust tax incentives for renewable energy, including exemptions from VAT for certain renewables, favorable tax treatment for renewable energy companies, and tax credits for solar and wind energy investments. In 2000, Germany introduced a FIT policy offering all producers of renewable energy an above-market fixed price for a twenty-years period. Germany decided to reform the Renewable Energy Act and, since 2017, only small facilities under 100 kW have kept on benefiting from the FIT, while large renewable energy producers are subject to auctions.
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<i>Extractive industry tax policies</i>	Germany has introduced policies aimed at reducing the tax burden for extractive industries that transition to renewable energy production. There are incentives for mining companies that invest in renewable energy generation, particularly in the context of lithium and rare earth metals for battery production. However, extraction of fossil fuels is heavily taxed to discourage continued reliance on coal and oil.
<i>Research and development tax incentives</i>	Germany offers substantial R&D tax incentives through programs like the Innovative Energy Technologies Program and the Federal Ministry for Economic Affairs and Energy (BMWi) funding for renewable energy innovation. R&D tax credits are available for companies developing new technologies for solar, wind, hydrogen, and energy storage solutions. The R&D incentives regime in Germany is predominantly based on two pillars: <ol style="list-style-type: none"> 1. non-refundable cash grants, provided through various programs via a competitive application process and 2. R&D tax credit that offers companies a legal entitlement to R&D funding, currently up to EUR1 million per year (per company group, max funding amount p.a. fixed until 1 July 2025).
<i>Fossil fuel subsidy reforms</i>	Germany is actively phasing out fossil fuel subsidies, with specific measures such as the Coal Exit Law (Kohleausstiegsgesetz), which outlines a clear timeline for phasing out coal power by 2038. The country is also reducing subsidies for fossil fuels in favor of supporting renewable energy projects through direct funding and financial incentives. Financial support has been redirected to renewable energy development and supporting workers in coal-dependent regions through a Just Transition framework.
<i>Decommissioning of fossil fuel energy assets</i>	Germany has a structured approach to decommissioning fossil fuel plants, particularly coal. The Coal Exit Law mandates the gradual shutdown of coal-fired plants, with compensation provided for affected regions and workers. Decommissioning efforts are accompanied by plans for retraining workers and ensuring a just transition.
<i>Repurposing of fossil fuel energy assets</i>	Germany is exploring repurposing former fossil fuel sites for renewable energy projects. This includes using decommissioned coal plants for biomass production, renewable gas, and hydrogen production, as well as integrating solar and wind energy into these sites. Germany is also developing carbon capture and storage (CCS) technologies and reusing fossil fuel infrastructure to support green hydrogen production.

GHANA

<i>Tax incentives</i>	The Ghana Renewable Energy Act, 2011 (Act 832) provides incentives for businesses and individuals involved in renewable energy development. These incentives include Tax exemptions on renewable energy equipment: Import duties, VAT, and other levies are waived for renewable energy equipment and related materials. Renewable energy projects may qualify for tax holidays under the Ghana Investment Promotion Centre Act, depending on the location and nature of the investment. Renewable energy companies that register with the Ghana Investment Promotion Centre can access additional benefits, including customs duty exemptions and reduced corporate tax rates for projects that qualify under the strategic investment framework. Incentives for renewable energy manufacturing and assembling firms including substantial tax reduction; exemption of materials,
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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.

Extractive industry tax policies

Tax policies for the extractive sector (oil and gas) have not yet fully integrated incentives to promote renewable energy. Ghana's Petroleum Revenue Management Act channels oil revenues into development funds, but limited allocation is specific to renewable energy.

Research and development tax incentives

The National Renewable Energy Fund is designed to support R&D activities, capacity building, and the promotion of renewable energy technologies. The government encourages private sector participation in renewable energy R&D through grants, partnerships, and technical assistance.

Fossil fuel subsidy reforms

Ghana still provides subsidies for fossil fuels (e.g., gasoline and diesel). However, there are discussions about phasing out subsidies, but the reform process is slow and challenging due to public and political resistance.

Decommissioning of fossil fuel energy assets

Ghana has no formal decommissioning strategy for fossil fuel energy production assets. There are no clear policies or incentives to close or repurpose coal, oil, or gas plants in favor of renewable alternatives.

Repurposing of fossil fuel energy assets

Repurposing efforts are not yet visible in Ghana's energy sector. The country is still heavily reliant on thermal power generation from fossil fuels, and there is no systematic approach to repurpose these assets for renewable energy.

INDIA

Tax and market-based incentives

India provides tax incentives for renewable energy, such as accelerated depreciation (80% in the first year) for renewable energy projects, and tax exemptions for profits in certain renewable energy sectors (e.g., solar and wind). Renewable Energy Certificates is a market-based instrument to promote renewable sources of energy, and the development of the market in electricity. Separate Scheme for Solar Sector under GST was introduced for solar sector projects wherein 30% of value is deemed as 'supply of service' and 70% as 'supply of goods. Local manufacturing of solar modules is supported by increased import charges.

Extractive industry tax policies

India's extractive industries (mainly coal and oil) have faced limited tax incentives aimed directly at supporting renewables. However, there are some tax credits for companies investing in clean energy infrastructure. The tax system generally supports renewable generation with respect to energy projects but is still predominantly focused on fossil fuels.

Research and development tax incentives

India provides R&D tax incentives, including deductions on in-house R&D expenses for companies. This has encouraged some private and public sector firms to invest in renewable energy innovation. Additionally, the government supports R&D in clean energy through initiatives like the National Mission on Enhanced Energy Efficiency. However, the level of investment is still below the scale seen in leading renewable markets. 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%
<i>Fossil fuel subsidy reforms</i>	India has been slow in reducing fossil fuel subsidies, though there are some gradual steps towards reform, particularly for petroleum products. The government has partially removed subsidies on coal and petroleum products, but natural gas and electricity subsidies remain in place. There is ongoing debate regarding the need for further subsidy reforms, especially for the coal industry. India has reformed consumer subsidies for kerosene and LPG (cooking gas), replacing them with direct benefit transfer schemes. It has also reduced diesel subsidies and increased taxes on coal to fund renewable energy and rural electrification projects
<i>Decommissioning of fossil fuel energy assets</i>	India is in the early stages of decommissioning fossil fuel plants. While there have been discussions on the transition of coal-fired plants to cleaner energy, active decommissioning has been slow.
<i>Repurposing of fossil fuel energy assets</i>	Some states are experimenting with repurposing coal plants for renewable energy projects, like solar and wind integration, but large-scale repurposing is still not common. The focus remains on expanding renewable generation capacity rather than repurposing existing fossil fuel infrastructure. India plans to repurpose fossil fuel thermal power plants for long-duration energy storage technology that can be deployed in the near term.

INDONESIA

<i>Tax incentives</i>	Indonesia has offers tax holidays (up to 20 years), tax allowances, and import duty exemptions for renewable energy projects. These include fiscal incentives for geothermal, solar, wind, and hydropower projects. 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 make the credits available to foreign buyers.
<i>Extractive industry tax policies</i>	The extractive sector in Indonesia (oil, gas, mining) is heavily reliant on fossil fuels, and there is limited direct tax policy supporting the integration of renewable energy. However, there are growing incentives for companies in the extractive industries to diversify into renewables, especially in the mining sector (e.g., lithium for battery storage).
<i>Research and development tax incentives</i>	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 incurred for certain R&D activities.
<i>Fossil fuel subsidy reforms</i>	Indonesia has made some efforts to reform fossil fuel subsidies, particularly in reducing subsidies for gasoline and electricity. However, significant fossil fuel subsidies remain in place for coal and natural gas, which hinder the transition to cleaner energy. Indonesia began phasing out fuel subsidies in 2014, linking fuel prices more closely to market rates. This reform has freed up government funds for social spending and infrastructure development.
<i>Decommissioning of fossil fuel energy assets</i>	Indonesia plans early retirement of coal plants through mechanisms like the Energy Transition Mechanism. Challenges include financing decommissioning and addressing job losses in coal-dependent regions. The government has committed to phasing out coal plants by 2050 as part of its net-zero target.
<i>Repurposing of fossil fuel energy assets</i>	Opportunities for repurposing coal plants into renewable energy hubs or industrial zones are being explored. Potential for converting old fossil fuel sites to battery storage facilities or solar farms. Policy frameworks to guide repurposing remain underdeveloped, and investment is needed to accelerate these transitions.

ITALY

<i>Tax and market-based incentives</i>	<p>Italy offers incentives for solar power generation through</p> <ul style="list-style-type: none"> - feed-in tariffs and premiums. - tax Deductions: Tax credits for renewable energy systems, including solar, wind, and geothermal energy. - Green Certificates: Renewable energy producers can trade certificates to meet renewable energy targets. <p>Italy offers tax deductions under its Ecobonus scheme, providing up to 110% tax deductions for energy efficiency upgrades, solar panel installations, and storage systems. The country also reduces VAT rates for renewable energy products. Corporate tax reductions apply to firms investing in renewable energy projects.</p>
<i>Extractive industry tax policies</i>	<p>Italy has begun leveraging higher taxes on extractive industries (e.g., windfall taxes on excessive profits in fossil fuel sectors) to fund renewable energy projects. Specific incentives encourage the transition of oil and gas firms toward renewable technologies. While still in development, Italy supports EU-wide carbon pricing mechanisms affecting extractive industries, driving them towards cleaner alternatives.</p>
<i>Research and development tax incentives</i>	<p>Italy provides significant tax credits (up to 50% of R&D spending) for innovation in renewable energy technologies. Funding for research and development of green technologies, particularly in solar and wind energy sectors. 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;</p>
<i>Fossil fuel subsidy reforms</i>	<p>Italy has committed to phasing out coal subsidies, aligning with the European Union’s goal to decarbonize by 2050. Although Italy has not yet fully implemented a national carbon tax, it participates in the EU Emissions Trading System (ETS), which impacts fossil fuel subsidies indirectly.</p>
<i>Decommissioning of fossil fuel energy assets</i>	<p>Italy has set a clear timeline to close all coal-fired power plants by 2025. The Italian government provides support for the decommissioning process, including incentives for the transition to alternative energy sources.</p>
<i>Repurposing of fossil fuel energy assets</i>	<p>Some gas plants are being converted to operate on hydrogen or biomass, supported by tax incentives and investment subsidies. Italy is repurposing some fossil fuel infrastructure for offshore wind energy generation, taking advantage of existing ports and grid connections. Eni has developed a dual use wave turbine that can convert decommissioned oil platforms into renewable energy islands.</p>

MOROCCO

<i>Tax incentives</i>	<p>Morocco offers tax credits and exemptions for companies investing in renewable energy projects, particularly solar and wind. Certain renewable energy equipment is exempt from VAT to encourage investments. Renewable Energy Law (Law 13-09) allows private investors to build, own, and operate renewable energy projects. 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.</p>
<i>Extractive industry tax policies</i>	<p>While Morocco is not a large oil exporter, royalties are levied on extraction activities, with some funds redirected to renewable energy projects. The government promotes a shift from fossil fuel dependence toward renewable energy by encouraging oil and gas companies to invest in solar and wind energy through tax incentives and favorable regulatory environments.</p>

<i>Research and development tax incentives</i>	Morocco provides tax incentives for R&D in renewable energy technologies, focusing on solar, wind, and energy storage innovations.
<i>Fossil fuel subsidy reforms</i>	Morocco has been implementing a phased removal of fossil fuel subsidies, focusing on reducing the burden of energy subsidies on the national budget. This is being done with the goal of promoting energy transition and making renewable energy more competitive.
<i>Decommissioning of fossil fuel energy assets</i>	Morocco has limited fossil fuel-based power generation, primarily using natural gas and coal. The decommissioning of fossil fuel plants is still in the early stages. The focus is more on expanding renewable energy rather than decommissioning existing fossil fuel plants. However, older plants are being replaced by renewable sources like solar and wind. Law No 21-90 and Decree No 2-93-786 do not contain specific decommissioning obligations.
<i>Repurposing of fossil fuel energy assets</i>	In the future, there are plans to repurpose certain coal plants to integrate more renewable energy into the grid and reduce emissions. This includes incorporating storage solutions and hybrid systems to complement renewable energy production. Morocco is looking at integrating large-scale energy storage as part of its renewable energy transition, which can utilize some infrastructure from fossil fuel plants.

NETHERLANDS

<i>Tax incentives</i>	The Netherlands offers substantial tax incentives for renewable energy production, including tax credits for wind, solar, and biomass energy projects. Investment deductions for renewable energy technologies are available for businesses. VAT reductions and accelerated depreciation schemes for renewable energy assets. The main support schemes that have been implemented are the Stimulerend Duurzame Energie (SDE++) and the Energy Investment Allowance (EIA). The SDE++ subsidy can be used for using carbon 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 of up to 11% to stimulate investments in energy-efficient technologies.
<i>Extractive industry tax policies</i>	While the extractive industry in the Netherlands is relatively small, there are some incentives to shift investments from fossil fuels to renewables. Companies are incentivized to invest in sustainable energy projects (e.g., wind farms) via tax relief programs. Fossil fuel extraction is increasingly subject to stricter environmental taxes, which encourages a shift to cleaner energy investments.
<i>Research and development tax incentives</i>	The Netherlands offers several tax incentives for R&D activities, including the WBSO (R&D Tax Credit), which provides a reduction in wage tax for research activities. The Innovation Box scheme offers tax reductions on profits derived from innovative activities in renewable energy sectors (e.g., solar, wind, bioenergy).- Specific funding programs support clean energy innovation through grants and tax relief. The Netherlands has several incentives to lower R&D costs and investments for a company. Effectively, these profits would be taxed at a rate of 9%.
<i>Fossil fuel subsidy reforms</i>	The Netherlands has gradually reformed its fossil fuel subsidies, aligning them with EU directives to phase out fossil fuel support by 2025. While some subsidies for natural gas and coal still exist, there is increasing pressure to reduce subsidies for fossil fuels and redirect funding to renewable energy.
<i>Decommissioning of fossil fuel energy assets</i>	The Netherlands is committed to phasing out coal-fired power plants by 2030, with several plants already being decommissioned.

Repurposing of fossil fuel energy assets Government-backed schemes allow for repurposing fossil fuel assets for renewable energy use, such as converting coal plants into biomass plants.- There are significant investments in offshore wind, with some fossil fuel infrastructure being repurposed for energy storage or green hydrogen production.- The SDE++ scheme (Stimulation of Sustainable Energy Production) supports projects that repurpose or retire fossil fuel-based energy production plants. The Netherlands has shown interest in repurposing oil and gas infrastructure for renewable energy, including offshore wind projects. Netherlands presents an illustrative case of coal phase-out through mechanisms of “industrial upgrade and regional renewal.

NORWAY

Tax incentives Norway offers tax incentives for renewable energy projects, including reduced property taxes for wind farms and exemptions from electricity tax for renewable generation. 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.

Extractive industry tax policies Norway maintains a robust petroleum tax system but uses revenue from the oil and gas sector to fund renewable energy investments, particularly offshore wind and hydrogen projects.

Research and development tax incentives 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. Generous R&D tax deductions are available through programs like SkatteFUNN, which supports innovation in renewable technologies such as offshore wind, hydrogen, and CCS.

Fossil fuel subsidy reforms Norway has minimal fossil fuel subsidies, focusing instead on transitioning away from subsidies and redirecting funding toward renewables and energy efficiency.

Decommissioning of fossil fuel energy assets Norway has a clear framework for decommissioning oil and gas platforms in the North Sea, including environmental safeguards and financial guarantees.

Repurposing of fossil fuel energy assets Norway is exploring repurposing oil and gas infrastructure for renewable applications, such as using existing platforms for offshore wind turbines or CO₂ storage under CCS initiatives.

SOUTH AFRICA

Tax incentives *Accelerated Depreciation:* Section 12B of the Income Tax Act provides solar PV panels tax deduction equivalent to 100% of the cost in one year for an installation of up to 1MW, and over three years at 50%:30%:20% for installations above 1MW. Section 12BA allows accelerated depreciation at 125% in the first year for all renewable energy projects for costs incurred for trade purposes of qualifying assets brought into use for the first time between 1 March 2023 and 28 February 2025.

	<p><i>Energy Efficiency Tax Incentive:</i> The main beneficiaries of the Section 12L incentive (effective until December 2025) are the mining and coal and gas to liquid fuels sectors. From inception in 2013 this incentive contributed to overall energy efficiency savings of 29.9 TWh and reduction in greenhouse gas emissions of 28.6 MtCO₂eq (September 2024).</p> <p><i>Proposed Green Hydrogen Tax Incentive:</i> Phase Two of the draft Carbon Tax discussion paper proposes supporting the green hydrogen value chain, by building on existing renewable energy-based tax incentives set out in the Income Tax Act.</p>
<i>Extractive industry tax policies</i>	<p>Limited targeted tax policies directly encouraging the extractive sector to transition toward renewable energy. However, some mining companies are investing in self-generation renewable energy (e.g., solar) to reduce operational energy costs.</p>
<i>Research and development tax incentives</i>	<p>The R&D Tax Incentive (Section 11D) encourages innovation, including clean energy technologies, though its impact on renewable energy remains modest due to limited sector-specific focus. Section 11D of the Income Tax Act allows companies to claim a 150% deduction on qualifying R&D expenditure, which includes projects aimed at advancing renewable energy technologies.</p>
<i>Fossil fuel subsidy reforms</i>	<p>South Africa subsidizes fossil fuel-based energy indirectly (e.g., diesel fuel tax rebates for certain industries). Despite the need to phase out subsidies to align with climate goals, fossil fuel subsidies have instead tripled in 2023 to approximately \$6.3 billion from 2018. Phase Two of the draft Carbon Tax discussion paper proposes the removal of fossil fuel subsidies and reallocation of subsidies to green hydrogen development.</p>
<i>Decommissioning of fossil fuel energy assets</i>	<p>Decommissioning of coal-fired power plants is part of South Africa's Just Energy Transition Partnership (JETP), which includes international funding to phase out coal responsibly. Progress is ongoing but constrained by reliance on coal for energy security.</p>
<i>Repurposing of fossil fuel energy assets</i>	<p>Eskom, the state-owned utility, has initiated projects to integrate renewables at decommissioned sites. South Africa plans to decommission the 56-year-old Komati coal-fired power plant. This will be replaced with a combination of 220 MW of renewable energy (150 MW solar PV solar and 70 MW wind) and 150 MW batteries, improving power supply and grid stability.</p>

SPAIN

<i>Tax incentives</i>	<p>Spain offers generous tax incentives, including reduced VAT rates and deductions for investments in renewable energy projects like solar panels and wind turbines. Companies can claim tax credits for installing renewable energy systems. 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.</p>
<i>Extractive industry tax policies</i>	<p>Spain's tax policies indirectly discourage fossil fuel extraction through environmental levies and promote diversification. Extractive industries receive no direct tax benefits but are incentivized to transition toward renewable energy integration.</p>
<i>Research and development tax incentives</i>	<p>Substantial tax credits are available for companies engaged in research and development of renewable energy technologies, such as advancements in wind, solar, and energy storage. Spain's "Science, Technology, and Innovation Strategy" further supports these efforts.</p>

- 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.
- 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.
- 12% tax credit for technological innovation activities.

Fossil fuel subsidy reforms Spain has implemented reforms to phase out subsidies for fossil fuels, aligning with EU regulations. Remaining subsidies are targeted only at transitional energy strategies, like reducing emissions from existing infrastructure.

Decommissioning of fossil fuel energy assets Spain has a clear plan to decommission coal-fired power plants, with most plants already closed or scheduled for closure by 2030. Support is provided for workers and communities affected by the transition.

Repurposing of fossil fuel energy assets Spain is repurposing former coal plant sites into renewable energy hubs, including solar farms and battery storage facilities.

SWEDEN

Tax incentives Sweden offers significant tax exemptions and reductions for renewable energy producers, including reduced energy taxes for solar, wind, and hydropower installations. Companies and households installing renewable systems are eligible for tax credits. The main incentive for building renewable energy production capacity is 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.

Extractive industry tax policies While Sweden has minimal reliance on fossil fuel extraction, it applies green taxes and policies to ensure that any extractive activities align with renewable transition goals. Revenue from mining is partially reinvested into renewable energy projects.

Research and development tax incentives Generous R&D tax credits are provided to companies and institutions working on renewable energy innovations, particularly in wind, bioenergy, and hydrogen technologies. Sweden also supports collaborative EU-funded energy projects. 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.

Fossil fuel subsidy reforms Sweden has largely eliminated fossil fuel subsidies, redirecting funds toward renewable energy and energy efficiency programs. The country consistently ranks as a global leader in fossil fuel subsidy reform. Sweden eliminated most fossil fuel subsidies in the 1990s and implemented a high carbon tax, which has been a key driver of its energy transition. The revenues are reinvested in renewable energy and efficiency programs.

Decommissioning of fossil fuel energy assets Sweden has nearly phased out coal power, with significant investments in dismantling fossil-based infrastructure. Fossil fuel plants have been closed or repurposed for renewable energy generation or energy storage projects.

Repurposing of fossil fuel energy assets Decommissioned plants have been repurposed for district heating, bioenergy production, and storage of renewable energy, demonstrating Sweden’s commitment to sustainable transition.

UNITED KINGDOM

Tax incentives Comprehensive tax incentives exist to promote renewables, including tax relief and reduced VAT rates. The Contracts for Difference (CfD) scheme incentivizes investment in low-carbon electricity projects. 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.

Extractive industry tax policies Policies aimed at encouraging diversification into renewables by extractive industries. Oil and gas firms can benefit from investment allowances when funding carbon capture or renewable projects.

Research and development tax incentives Strong support for R&D through tax credits and grants for green energy technology innovation. The R&D Tax Relief program supports innovation in energy storage, wind turbines, and hydrogen production. The UK offers volume-based super deductions and credits for qualifying revenue expenditure. Capital expenditure is excluded from the volume-based incentives. 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

Fossil fuel subsidy reforms The UK has significantly reduced fossil fuel subsidies over the years but still provides some support. Subsidies include tax relief for oil and gas decommissioning but are being scrutinized under net-zero goals.

Decommissioning of fossil fuel energy assets Progressive decommissioning of coal-fired plants and oil rigs aligned with the 2050 net-zero target. The Coal Phase-Out Plan aims to close all coal plants by 2024. Oil rig decommissioning is supported via tax breaks.

Repurposing of fossil fuel energy assets Focused on repurposing oil and gas infrastructure for renewable energy and carbon capture. The North Sea Transition Deal promotes repurposing offshore platforms for wind farms and carbon capture projects. 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

Tax incentives The U.S. offers extensive tax incentives under the *Inflation Reduction Act (IRA)*, including the Investment Tax Credit (ITC) and Production Tax Credit (PTC) for wind, solar, and other renewable projects. Enhanced credits are available for projects meeting labor and domestic content requirements. 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 Reduction Act, enacted in 2022, provides a 30 per cent investment tax credit for CHP projects that begin construction before January 1, 2025.

<i>Extractive industry tax policies</i>	Policies encourage extractive industries to pivot towards renewable energy investments through tax incentives. Companies can claim credits for renewable energy production and transition technologies (e.g., hydrogen and carbon capture).
<i>Research and development tax incentives</i>	The U.S. provides R&D tax credits for renewable energy projects, supporting innovations in storage technologies, grid integration, and advanced renewable systems. The US offers a non-refundable 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.
<i>Fossil fuel subsidy reforms</i>	While the IRA reduced some fossil fuel subsidies, significant tax benefits for oil and gas industries remain, such as deductions for intangible drilling costs and percentage depletion allowances. Reforms are ongoing but politically challenging.
<i>Decommissioning of fossil fuel energy assets</i>	Several coal plants have been retired, driven by economic factors and clean energy policies. Federal programs incentivize the decommissioning of fossil-based plants, especially through transition grants for affected communities.
<i>Repurposing of fossil fuel energy assets</i>	Repurposing initiatives focus on converting former fossil fuel sites into renewable energy hubs, such as solar and wind farms, and integrating battery storage. The IRA also supports carbon capture and sequestration projects at legacy sites. The U.S. has seen various initiatives to repurpose old oil and gas infrastructure.

Cooking fuel transition in Ghana and Indonesia

COUNTRY	Cooking fuels
Ghana	<ul style="list-style-type: none"> - Promote the establishment of dedicated woodlots for wood fuel production; - Promote the production and use of improved cookstoves; - Support the 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 the 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.

Appendix 3: Alternative Mitigation Approaches

	Carbon Tax	Emissions Trading Systems	Feebates⁶⁶	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 the most efficient way of reducing emissions	People and firms choose the most efficient way of reducing emissions	People and firms choose the 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 a specified trajectory)	No (unless includes price floors or similar mechanisms)	Yes (if a specified trajectory)	No (implicit prices vary with technology costs, energy prices, etc.)
Revenue generation	Yes (though exemptions may limit revenue base)	Maybe (if allowances are auctioned, but the 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.

⁶⁶ Feebates: They act as a negative price incentive used to encourage a behavioural change from traditional or energy-intensive technology to a similar but less emission intensive option.

Appendix 4: Tax and market-based renewable energy generation policy mix

The table below compares the renewable energy generation policy mix comprising tax and market-based incentives (net metering (NM) and feed-in-tariffs (FITs)) in South Africa, China, Germany, Denmark and India.

Table 1-1: Policy options in the comparative countries

	SOUTH AFRICA	CHINA	GERMANY	DENMARK	INDIA
TAX AND MARKET-BASED INCENTIVE POLICY MIX	NM draft FIT draft Accelerated depreciation R&D Carbon tax	R&D NM FIT Import duty and custom Accelerated depreciation VAT & CIT reduction	R&D FIT Import & custom duty Accelerated depreciation VAT & CIT reduction Carbon tax & fossil fuel taxes	R&D NM FIT Import & custom duty Accelerated depreciation VAT & CIT reduction Carbon tax & fossil fuel taxes	R&D NM FIT Import & custom duty Accelerated depreciation VAT & CIT reduction
<p>China</p> <p>FIT design China's FIT policy is zonal, and the tariff is based on the distribution of solar radiation resources in China. A zone with superior solar resources is subject to a lower tariff. The unique zonal feature of China's FIT policy in China offers improved identification opportunities to assess its influence on the expansion of PV capacity.</p> <p>NM design The impact of electricity usage is considered when designing a fair NM subsidy. To prevent excessive subsidies, the NM subsidies of distributed PV systems are lower for areas with high power demand.</p> <p>Tax design Waving of import taxes and customs duty on the purchase of RE equipment etc. Carbon tax and taxes on fossil fuel are implemented to raise revenue that is used for the upscale of RE. Both the fossil fuel tax and carbon tax assist in reducing GHG. VAT reduction and VAT exemption are also implemented as well as CIT reduction. VAT has minimal economic distortions and low administration costs, therefore making VAT reduction easier to implement.</p>					
<p>India</p> <p>FIT design FIT is efficient as it immediately lowers the cost of implementing RE projects, improving their financial viability. FIT agreements are for a period of 20 to 25 years in India.</p> <p>NM design Affordable, regulatory backing, and more business-friendly NM regulations. Simplicity is established with a single meter.</p> <p>Tax design The implementation of a single-window clearance system has enhanced the process of granting land for REG. The government has clear, uncomplicated administrative processes. The government further offers businesses grants and subsidies which are non-repayable direct cash to reduce the initial capital outlay of a</p>					

RE project and this enhances its viability. Mandatory policies are imposed on the energy utility to purchase electricity generated from RE projects. Tax exemptions, capital allowances, VAT exemptions, capital subsidies and credits incentivize the acquisition of RE technologies, reducing the financial constraints, and increasing the viability of RE projects. The waiver of excise duty and import tax for the purchase of RE related items is an important mechanism to facilitate the upscale of RE generation. The Indian government provides accelerated depreciation in year one of up to 80 to 100 per cent.

Germany

FIT design

The FIT system lowers entrance barriers. Timely modifications to pertinent policies and laws are crucial, as demonstrated by the growth of RE. Timely modifications are critical, especially with FIT policy agreements in line with the reduction of REG costs. The FIT system in Germany has lower administration costs, is simple to implement, and can quickly be revised to account for new capacities or to accommodate any modifications and or changes required. The design aspect of a FIT system is critical for its success.

Tax design

The German government supports RE businesses through a variety of additional measures, such as investment aid, tax exemptions or reductions, tax refunds, tax credits, R&D tax incentives, and deductions. Germany implemented tax policies that were highly restrictive, including ecological tax reform, by imposing a tax on the use of fossil fuel-derived electricity, primarily to lower GHG and support the economic development of RE.

Denmark

FIT design

It is suggested that policy design and commitment are key factors for success of the FIT policy.

NM design

A NM hourly policy is the most effective incentive responsible for the upscale of RE in Denmark.

Tax design

R&D investment grants such as direct subsidies, energy tax exemptions, energy supply taxes and tax exemptions are some of the incentives available for businesses in Denmark. Denmark levies a tax on CO₂ emissions from the burning of fossil fuels like coal. These taxes on CO₂ result in revenue to boost RE upscale.

Source: Ramushwana & Ramfol (2025:12)⁶⁷.

⁶⁷ Ramushwana, K.V. & Ramfol, R. 2025. Incentivising Renewable Energy Generation: Lessons for South Africa. *International Journal of Advanced Business Studies*, 4(1): 1-14.

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