

FOSTERING A JUST ENERGY TRANSITION

A framework for policy design



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KEY MESSAGES

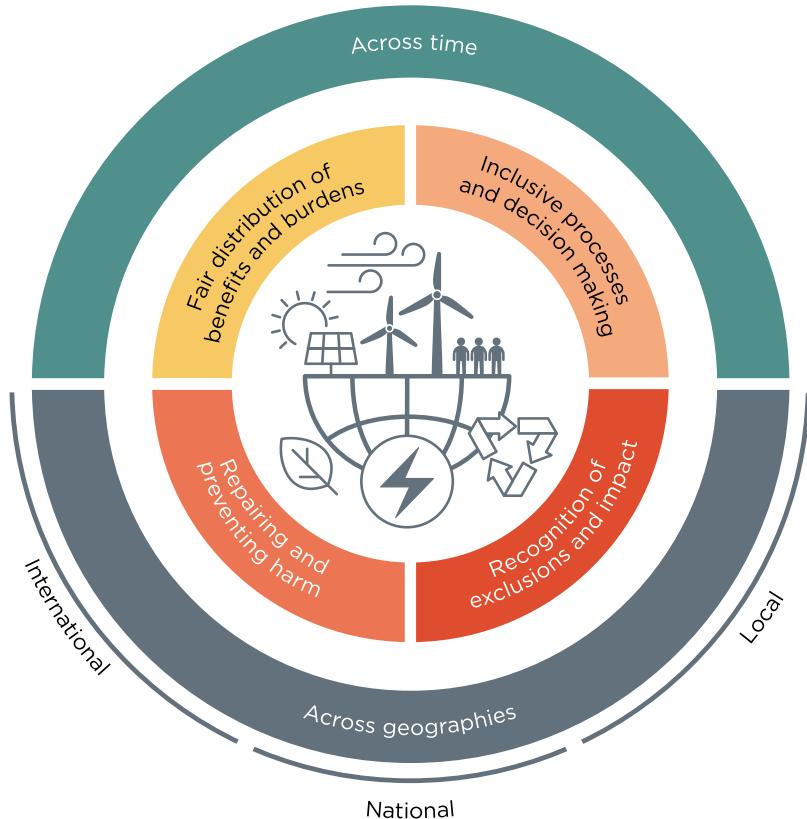
While the energy transition promises considerable economic, social and environmental benefits, it will not automatically or inevitably yield a just outcome. The transition is taking place within an energy system that already exhibits significant inequalities. Reliable and affordable energy services remain out of reach for hundreds of millions of people in both developing and developed countries, while the ownership of – and economic benefits derived from – energy assets are unevenly distributed. Nations, communities and households most in need lack access to suitable financing and assistance, while the adverse impacts of climate change disproportionately affect marginalised and low-income groups. Meanwhile, these groups continue to struggle to have their voices heard in both national and international decision making. Without the deliberate inclusion of just principles in policy making and implementation, existing structural inequalities may simply be replicated during the energy transition, and new injustices may emerge.

Despite ubiquitous calls for a just energy transition, a universally agreed-upon definition has remained elusive, given varying lived experiences, needs and world views across the globe. Emerging initially as a labour union concept, its meaning has widened over time. Today, visions of a just energy transition range from support to workers affected by decarbonisation measures to a systemic change of the economic and political structures that are perceived to underlie the current sustainability and social crises. As the review undertaken for this paper shows, this breadth of vision reflects the diversity of values among stakeholders and the ways in which the current energy system serves them (or fails to). Previous experiences with energy reforms that had significant adverse impacts – from physical displacement and job losses to disproportionate environmental impacts on low-income and marginalised communities – further inform just energy transition perspectives. At the same time, as references to the just energy transition proliferate, the term is also being increasingly co-opted. Claims of a just energy transition must therefore be critically evaluated to ensure that they represent a commitment to substantive action towards a more equitable energy future, rather than rhetoric to preserve the status quo.

While continued efforts to develop a shared understanding are essential to guide collective action, making a universal static definition a precondition for action towards a just energy transition could delay and undermine meaningful progress. Ultimately, justice – both as a demand and as a recognisable outcome – acquires meaning within specific local and international contexts. Suitable approaches, principles and policies to address injustices must therefore be developed by relevant stakeholders acting in good faith. These should be tailored to particular geographical, political, cultural and social contexts.

A working definition that can serve as a starting point to inform policy making is as follows: A just energy transition requires the equitable distribution of benefits and burdens, grounded in inclusive processes and decision making, and committed to addressing the challenges experienced by affected and marginalised groups as well as preventing and repairing harm that may occur during the transition.

Figure S1 Framework for assessing energy transition and informing just energy policy design



A just energy transition encompasses not only the vision of achieving equitable outcomes but also efforts to ensure that the process of reaching these outcomes is just. *Fair distribution of benefits and burdens* concerns outcomes - the way social, economic and environmental benefits and burdens are shared amongst different population groups. *Inclusive processes and decision making* emphasises the importance of fairness in decision making, through measures such as participatory and transparent planning processes, meaningful engagement of affected groups, as well as mechanisms for accountability and legal redress. *Recognition of exclusions and impact* builds on the principle that all people deserve fair treatment, stressing that their needs and values must be acknowledged as part of the transition process. *Restoration and prevention of harm* emphasises the necessity of compensation for, and rehabilitation from, harm caused by past and present energy policies and projects. These dimensions play out across geographies, necessitating attention to intra-country disparities, localised impacts, transboundary implications of energy decisions as well as regional disparities in progress. Temporal justice highlights the importance of considering impacts over time, affecting today's youth and future generations. Taken together, these dimensions offer a valuable framework for understanding the justice-related dimensions of the energy transition and informing policy design. Key considerations for each dimension, along with related policy instruments, are synthesised in Table S1.

Advancing a just energy transition requires a range of integrated policies and approaches; it cannot be accomplished via any single instrument. Nationally, and in concert with other countries, policy makers need to address a range of technological, economic and social challenges, critically assessing not only policies and practices, but also the underlying institutional frameworks. Credible policies and narratives addressing these challenges, accompanied by sufficient resources, are key to securing public support. The population at large needs to see tangible benefits and feel reassured that the needed adjustments will be equitably shared and will not impose undue hardship, especially on low-income and vulnerable populations.

To bring about transformative change, just energy transition efforts need to go beyond the energy sector and address structural drivers. Many of the challenges are linked to wider economic and social systems, and can manifest in various ways at the household, national and international levels. For instance, at the national level, developing nations face the dual challenge of securing low-cost energy financing while operating within international trade and investment regimes that prioritise investor-state dispute settlements, global intellectual property rights and restrictive trade obligations, all of which can limit the policy space needed for advancing just energy transitions. At the individual level, structural inequalities can make energy-efficient homes unaffordable for lower-income populations. While the energy transition cannot be expected to address all social and economic wrongs, understanding and addressing the underlying issues is necessary to prevent the transition from further perpetuating existing inequalities, which could undermine public acceptance, government support and, ultimately, efforts to achieve a just energy transition.

Inaction and delay carry their own justice implications. The energy transition is unfolding amid challenging circumstances, including widening economic and social inequalities, geopolitical tensions, diminishing trust in institutions, great uncertainties about the future and the increasingly urgent need to address the climate emergency. Yet, delaying action exacerbates an already challenging situation, driving up costs and potentially leading to increasingly non-optimal trade-offs in transition-related activities.

While it is not always possible to find consensus on all aspects of a just energy transition, advancing this transition requires strong multi-stakeholder coalitions and a shared vision around key issues. As the transition unfolds, collective action is needed at the local, national and international levels. Stakeholders must work together to create positive visions and agree on shared principles, as ‘guiding stars’ that outline how the energy sector can contribute to a more equitable world. These visions can in turn catalyse system-wide reforms, inform targeted policy design and support new governance frameworks. Insights from past experiences can inform decision making, but bold ambitions are needed to accelerate progress towards a more just and inclusive future.

Table S1 Key considerations for just energy transition policies

KEY CONSIDERATIONS FOR POLICY DESIGN	ILLUSTRATIVE LIST OF (COMPLEMENTARY) POLICY AREAS AND MEASURES	CROSS-CUTTING MEASURES
Fair distribution of benefits and burdens	<p>Direct and indirect social, economic and environmental impacts</p> <p>Distribution of benefits, burdens, resources and assets among different groups</p> <p>Structural economic, social, political and environmental factors influencing impacts and distribution</p>	<p>Energy poverty and affordability</p> <p>Economic development, infrastructure and industrialisation programmes</p> <p>Inclusive workforce development, social protection and labour rights</p> <p>Impact assessments and life-cycle analyses, environmental standards and taxes</p>
Inclusive processes and decision making	<p>Meaningful engagement of stakeholders in planning, decision making and implementation</p> <p>Equitable access to participation opportunities and addressing unequal influence</p> <p>Effective of conflict resolution, legal redress and accountability mechanisms</p>	<p>Mandatory, early, structured and ongoing public consultation</p> <p>Social dialogue and stakeholder dialogue</p> <p>Policy shaping councils and advisory groups that include underrepresented groups</p> <p>Inter-ministerial co-ordination and just (energy) transition commissions</p> <p>Legal aid and corporate accountability mechanisms</p>
Recognising those excluded and different values/identities	<p>Evaluation of social, cultural and historical context of different groups</p> <p>Acknowledgement of the needs and experiences of marginalised, affected or vulnerable groups</p> <p>Biases and social exclusions (including unintentional)</p> <p>Balance of minority and majority interests as well as protection of human rights</p> <p>Respectful treatment and trust building</p>	<p>Rights-based approaches, including protection of indigenous rights, human rights and land rights</p> <p>Equitable benefit-sharing mechanisms, prior informed consent, consultations and reparation of harm</p>
Preventing and repairing harm	<p>Evaluation of historic and ongoing harm from energy activities on the (sub)-national and global levels</p> <p>Rehabilitation and restoration of harm caused by energy policies and projects</p> <p>Anticipating, mitigating and preventing adverse impacts</p>	<p>Remediation and redress mechanisms, including restitution, compensation, conciliation and other reparative measures</p>
Justice across geographies	<p>Intra-country disparities and localised impacts</p> <p>Transboundary impacts of domestic and supply chain energy decisions</p> <p>Regional/global disparities in energy transition progress</p>	<p>Regional and local economic development/diversification strategies</p> <p>Mandatory due diligence for supply chains and standards for sustainable sourcing</p> <p>Strengthened international co-operation and reform of the international economic architecture</p>
Justice across time	<p>Evaluation of impacts over time, including potentially irreversible harm (such as climate impacts, resource depletion and irreversible environmental degradation)</p> <p>Balance of short- and long-term impacts and benefits</p>	<p>Assessments of inter-generational impacts</p> <p>Ombudspeople for future generations</p> <p>Ambitious climate policies</p> <p>Sustainable approaches to resource management and the circular economy</p>

Note: The considerations outlined in the table may overlap, given that they reflect the inter-connectedness of energy systems. Yet, each dimension provides a unique perspective on existing or emerging barriers and responses. Similarly, measures listed under one category may address multiple challenges (on intersections, see also Chapter 3).

CHAPTER 1

INTRODUCTION: WHY JUSTICE CONSIDERATIONS MATTER FOR SUCCESSFUL ENERGY TRANSITIONS¹

The current energy system faces significant sustainability challenges and requires a fundamental and rapid transformation to avoid catastrophic climate impacts, while advancing towards the goal of sustainable energy for all (IPCC, 2014, 2018, 2023a, 2023b). Renewable-energy-based systems are critical to mitigating the adverse impacts of climate change on people and the planet (IPCC, 2023b; IRENA, 2023a). They also offer health and environmental benefits, in particular by reducing air pollution. The transition from fossil-fuel-based to renewables-based energy systems promises many other benefits, including a large potential to create new jobs and support the livelihoods of millions; bridge the energy access gap and improve the affordability of electricity services; create local value and contribute to economic diversification; reduce dependence on imported fuels; and enhance energy security and resilience to external shocks (IRENA and GCGET, 2019; IRENA, 2020, 2023a).

However, IRENA's work indicates that the benefits of the energy transition will not automatically extend to everyone (IRENA, 2021). The restructuring of the energy sector and other parts of the economy resulting from the shift away from polluting energy sources will involve adverse impacts. Emerging misalignments and resulting economic and social challenges must be addressed proactively (IRENA, 2022). This is all the more the case as the energy transition will not inevitably be a just transition, as historical pathways of energy transition have largely been characterised by unsustainable and inequitable patterns (Jones, 2013).

Policy choices, and the interests they serve, are of immense importance. These choices involve a wide range of issues, including: which energy technologies to prioritise; where to manufacture and how to source materials; the size of project(s) and where they are located; who owns and operates them; who they will serve; what they cost and how they will be financed; as well as what their environmental impact will be. Each of these choices carry significant implications for justice. Who decides the pathways to pursue, who is consulted, and whose values and priorities take precedence, will further shape the distribution of opportunities and benefits as well as the burdens of adjustment. With a limited carbon budget and finite resources, decision-makers also need to consider how to balance national and global energy production and consumption patterns in ways that support human and environmental well-being, with the responsibility to preserve a habitable planet for future generations.

A key challenge lies in addressing the tension between the speed and scale needed for a climate-safe energy transition and the concerns of equity and social justice. A transition that occurs too slowly fails to address climate tipping points and is unjust to both present and future generations who will suffer the impacts of climate change. At the same time, an accelerated transition is, by definition, more disruptive, and requires careful consideration of the inherent trade-offs. Moreover, it is likely to involve top-down decision making. Striking a balance between the demands of rapid change and more time-intensive, consultative and inclusive approaches is one of the fundamental challenges for achieving a just energy transition (Newell, 2021).

¹ In this text, the singular “just energy transition” refers to the need for global collective efforts or to just energy transition as a concept, while the plural use recognises that, as part of global efforts, just energy transition pathways will take different shapes at national and local levels. The phrase “just transition” refers to the historical concept, emerging from the labour movement (see Box 1).

The energy transition is unfolding in the context of growing economic inequalities (Chancel, *et al.*, 2022). The costs and benefits of the current energy system are unevenly spread among different communities and regions. While the transition cannot be expected to resolve all inequities, failing to address pre-existing structural drivers of injustice in the energy sector and the wider economic and social system risks perpetuating existing inequalities or creating new ones. This, in turn, can undermine public acceptance and thus government support. As noted by the Intergovernmental Panel on Climate Change, “outcomes seen as equitable can lead to more effective cooperation” (IPCC, 2014). Backlash to climate policies perceived as unfair, such as the yellow vest protests in France, and the legal challenges to large-scale renewable energy projects by the Sami people in Norway, highlight the importance of securing broad stakeholder buy-in for transition policies and projects (Hofverberg, Elin, 2021; WWF, 2021). Credible policies and narratives that address these challenges, along with sufficient resources, are key to securing public support.

As the energy transition progresses and the technological, economic and social contexts in which it is embedded evolve, policy makers need to work iteratively, both within and across borders, to design an ecosystem of policies and institutions that support justice. A just energy transition is not a one-off effort; it is both a process and an outcome. It requires continuous examination of the justice implications of energy transition pathways and the development of inclusive visions that garner broad public support, while ensuring that both the development process and the pathway to realising these visions are just.

This report is intended to contribute to a better understanding of the different visions for a just energy transition, the challenges of defining it and key considerations to integrate into energy policies and plans. To this end, Chapter 2 provides an overview of relevant discussions and diverging perspectives. While the term “just transition” is increasingly referenced, it remains contentious, and building consensus requires an understanding of these diverging perspectives as well as the difficulties related to adopting a universal definition. Chapter 2 also outlines the key elements that need to be considered for a transition to be deemed just. Chapter 3 discusses the existing and emerging justice implications of energy policies and sets out a framework of key considerations for decision makers to inform the development of additional policies and strategies. Chapter 4 concludes with reflections on the path ahead.

CHAPTER 2

THE “JUST” IN JUST ENERGY TRANSITION

Appeals for a just energy transition² emerge from discussions around a just transition for labour, as well as from broader debates on climate and environmental justice. Despite the widespread use of the term “just transition” or “just energy transition”, no single definition has gained widespread acceptance. This chapter briefly explains the difficulties in developing shared definitions for a just energy transition and explores different perspectives on what such a transition might look like. The chapter concludes by considering how countries can advance a just energy transition regardless of these conceptual challenges and outlines the key elements of ensuring equity while making the switch to sustainable sources of energy.

2.1 NAVIGATING DEFINITIONS AND PERSPECTIVES ON A JUST ENERGY TRANSITION

CONCEPTUAL AND PRACTICAL CHALLENGES

Despite the perception that justice is universal and objective, it is ultimately a human construct that holds different meanings for different people. Our notions of justice are shaped not only by prevailing cultural norms but also by factors such as personal experiences, available information, social contexts and emotions (Baasch, 2023). The absence of a “shared interpretation of the right or good” renders a universal definition of justice elusive – one that also complicates the definition of a just energy transition (Hall, 2013). Perspectives on the scope of a just energy transition may also be shaped by how much individual actors stand to gain or lose from the energy transition as well as by the current status of the energy sector, economy, society and environment in which they are embedded (see also Box 1).

Different perspectives on what is considered “just” within and across countries not only complicate the definition of a just energy transition, but also have significant implications for policy making, which necessarily involves decisions that favour some values and interests over others. For instance, radically different outcomes could arise from the prioritising the protection of individual liberties over community interests or the well-being of current generations over that of future generations.

The absence of a shared understanding and clear definition has led to the indiscriminate use of the term “just energy transition”. Just energy transition are at times be equated simply with an energy transition or also with energy transitions that enable national or regional sustainable development.² Similarly, on the international stage, the terminology surrounding “just energy transition” often includes phrases such as equitable, fair, inclusive or orderly (see, e.g. (UN, 2023)).

Concerningly, references to a just energy transition can also be used to deflect attention from a lack of meaningful action (Bainton *et al.*, 2021; Wang and Lo, 2021). This mirrors the historical and present use of the term “sustainable development”. The term is often referenced in plans and activities that do not align with the core objectives of sustainability. This usage aims to distract from the absence of fundamental change and/or

² In today’s context, “energy transition” generally refers to the shift from a global energy system primarily reliant on fossil fuels to one driven by renewable energy sources. IRENA’s definition of the term also encompasses additional, related changes that support and complement this process, including the implementation of energy efficiency and conservation measures; the updating and modernisation of grid infrastructure; the development and application of relevant technologies; and various financial, legislative, policy and regulatory measures, and any other enabling actions vital for a successful transition. Meanwhile, as outlined throughout the text, the infrastructure and projects related to the energy transition have their own justice implications, which must be addressed to ensure that the transition is just. The term “just” (energy) transition is often linked to sustainable development, which is defined as “development which meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987). At the international level, the most recent universal expression of this concept is encapsulated in the UN 2030 Agenda, which comprises 17 Sustainable Development Goals (UN, 2015). While deeply intertwined and overlapping, the concepts of the just energy transition and sustainable development have their own distinct histories, scope and challenges, which are useful to keep in mind when referencing these terms.

from an actor's environmentally or socially harmful activities. A practice also referred to as "greenwashing", which has become so pervasive in net zero-pledges that the UN Secretary General established a High-Level Expert Group tasked with issuing recommendations to address this challenge (UN, 2024). Similar dynamics are already unfolding in the context of the just energy transition. Careful attention is thus needed to ensure that this practice does not also extend to *de facto* justice washing.

Evolving notions of how justice is to be interpreted and applied are not specific to the just energy transition. The lack of a universally agreed-upon definition of justice does not necessarily hinder efforts to create a more equitable energy system. Nobel prize-winning economist Amartya Sen, in discussing a similar challenge related to social justice, advocates for embracing pluralistic understandings. He stresses the importance of considering different perspectives and contexts, suggesting that even when consensus on specific definitions or visions of justice cannot be reached, it may still be possible to agree on existing injustices and ways to address them (Sen, 2010). Calls for completeness and full reconciliation of competing visions for a just energy transition may delay or thwart meaningful action. After all, suggesting that action or progress is not possible because there is no consensus on a definition of a just energy transition means, *de facto*, arguing that the status quo is preferable to transformative efforts. This, however, does not preclude the need for common principles and priorities to guide action, as discussed in the next section.

Box 1 The evolution of a concept: The just transition and related perspectives

The concept of a "just transition" was originally conceived by labour union members and activists, and its scope has evolved over time. Emerging in the United States in the 1970s and 1980s, in its earliest conception, it focused on ensuring the occupational safety and health of workers in the fossil fuel, chemical and atomic industries. Discussions and advocacy also centred on developing alternative economic models rooted in social and environmental justice (Morena *et al.*, 2019). References to a "just transition" have increasingly entered mainstream international and national climate-related debates since the 2010s, when the concept began to gain momentum. "Just transition of the workforce" was included as a policy goal in the 2015 Paris Agreement (UNFCCC, 2015). Since then, the understanding of a just transition in the context of climate negotiations has expanded to also cover socio-economic and other dimensions (Johansson, 2023).³

Different actors have championed different visions and solutions for a just energy transition. Depending on their political, economic and philosophical perspectives, views can range from re-training fossil fuel workers to advocating for a fundamental transformation of the economic system. Across this spectrum (see also Figure 1), researchers have conceptualised visions for a just transition that differ in scope and ambition:

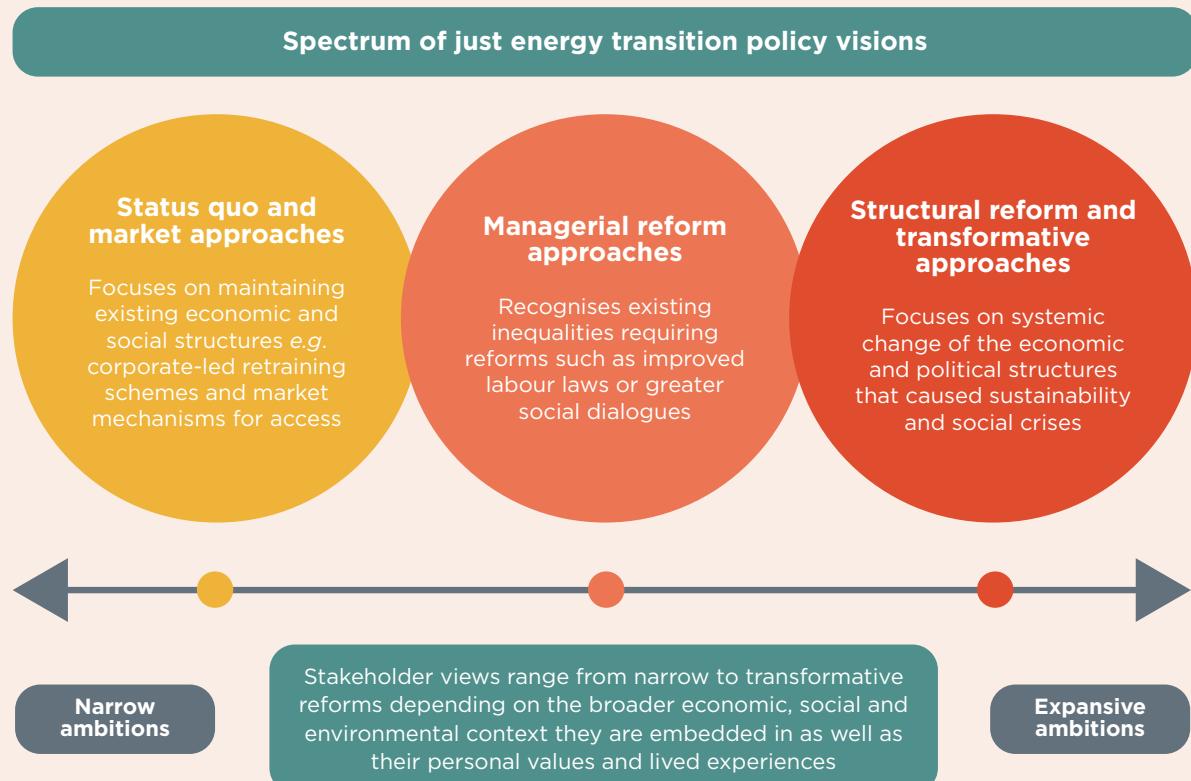
1. *Status quo/market approaches* focus primarily on maintaining existing economic and social structures while addressing the adverse impacts on workers. The state is primarily seen as responsible for creating an enabling environment for predominantly profit-oriented companies and corporations that provide basic services, while social and environmental objectives are envisaged to be achieved through market mechanisms. Typical examples of policies championed include corporate-led re-training or compensation schemes, including early retirement, rather than universal policies and rights.
2. *Managerial reform approaches* go a step further by recognising existing inequalities that are compounded/exacerbated by fossil-fuel-based energy systems, and aim to pursue greater equity and improve policies and standards within the existing system. Reforms may include improved

³ For a detailed discussion of the scope and understandings of a just transition, see also a synthesis report of the Intergovernmental Panel on Climate Change (Lecocq, *et al.*, 2022).

labour laws, increased social dialogue and government measures that stimulate the economy during downturns and temper it during booms, thereby ensuring sustainable long-term economic stability.

3. *Structural reform approaches and transformative approaches.* Structural change seeks more fundamental changes to existing institutions. Proponents argue that market-based approaches alone are insufficient to drive the energy transition and advocate for more progressive economic structures as well as changes to existing power arrangements. Policy goals include, among others, the establishment of stronger social democracies rooted in broad protections and rights. Transformation suggests the need for even greater systemic change of the economic and political structures that contributed to sustainability and social crises in the first place. Advocates challenge the currently prevailing system built on continuous growth, profit and the private accumulation of resources, arguing for a different relationship between societies and nature. Examples of policy proposals include global green deals, although no comprehensive vision has as yet been implemented at a national or regional level. It also includes alternative development approaches such as sufficiency and degrowth, which employ more multi-dimensional measures than gross domestic product and economic growth to inform policy making and assess economic and social progress.

Figure 1 Spectrum of just transition visions



Note: Adapted from (Just Transition Research Collaborative, 2018; Krause *et al.*, 2022).

As calls for a just transition proliferate, it is important to understand this spectrum of different visions. Doing so allows stakeholders to more clearly articulate differing perspectives, while identifying common ground as well as fundamental disagreements. It also provides an analytical framework to evaluate the ambition and scope of different proposals and assess trends. For instance, an analysis of 159 climate policies across 61 countries found that only six featured transformative approaches (Chan *et al.*, 2024).

2.2 THE JUST ENERGY TRANSITION AS A PROCESS AND A VISION

Ultimately, justice – as a demand, a recognisable outcome and a process – acquires meaning within the specific local and international contexts of the unfolding energy transition. It cannot be easily defined in the abstract, a priori or from a top-down perspective. Rather, relevant stakeholders have to develop suitable approaches and policies that consider their unique geographical, political, cultural and social contexts, along with broader interactions with the energy system (see section 3.3). For instance, the lived experiences and priorities of energy workers and communities in developing countries are markedly different from those in wealthier nations. This includes the prevalence of precarious and informal work environments as well as limited union representation, which are particularly pronounced in many parts of the developing world (Alarcon *et al.*, 2022; ILO, 2025).

More than a precise universal definition, what matters most is whether appeals to justice in the context of the energy transition actually shape public and private policies to achieve the desired outcomes. A just energy transition can be conceived as both a process and a vision of what a just energy future entails. Policies and measures must be discussed and negotiated, designed and ultimately implemented in an inclusive manner within a specific context. As the next chapter shows, various justice issues and claims arise throughout the energy transition: some are mutually reinforcing, while others require difficult trade-offs.

Ultimately, just energy transitions require the equitable distribution of benefits and burdens, grounded in inclusive processes and decision making, and committed to addressing the challenges experienced by affected and marginalised groups as well as preventing and repairing harm that may occur during the transition.

In line with these considerations, there is no one-size-fits-all solution, and no single policy instrument that can ensure that an energy transition is equitable. Yet, fundamental principles and standards are necessary to safeguard against attempts to undermine a just energy transition, while ensuring that it produces widely accepted and supported outcomes. Given the far-reaching nature of the transition, it will likely entail a complex patchwork of various sectoral, regional and national policies, as outlined in section 3.3. Several principles have already been negotiated internationally, including the *COP26 Just Transition Declaration* and the *G20 Principles for Just and Inclusive Energy Transitions* (COP26, 2021; G20, 2024). Regional efforts are also ongoing, with the United Nations (UN) Economic Commission for Europe recently adopting the Guiding Principles for Just Transition (UNECE, 2025).

CHAPTER 3

A FRAMEWORK FOR DESIGNING MORE EQUITABLE AND INCLUSIVE ENERGY POLICIES

How just the energy transition will be, as well as the future of the global energy system, hinges on the choices made by policy makers and all implicated stakeholders, including businesses and civil society. This chapter provides a framework that covers key considerations for transition efforts. Section 3.2 delves deeper into the different aspects of the transition, including existing and emerging justice issues, and outlines key considerations for decision makers. Section 3.3 discusses the inter-linkages of these considerations, the trade-offs involved in justice considerations, and the application as well as the importance of holistic policy making.

3.1 KEY CONSIDERATIONS FOR A JUST ENERGY TRANSITION: ASSESSMENT AND POLICY DESIGN

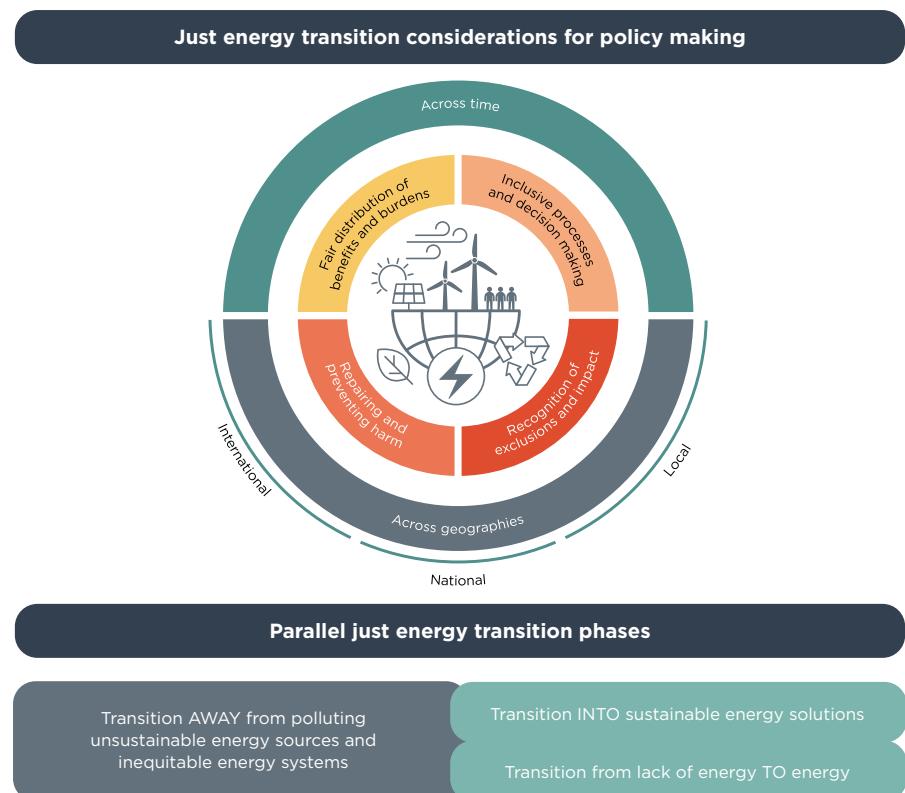
As summarised in Figure 2,⁴ a just energy transition requires policies that:

- Enable widespread sharing of benefits and the mitigation of burdens, ensuring their equitable distribution, where possible.
- Acknowledge the rights and needs of those who have been or may be affected and marginalised and ensure they feel heard and respected.
- Facilitate inclusive decision making, meaningful participation and access to justice for affected stakeholders.
- Alleviate prior harm and address existing vulnerabilities, while preventing future injustices.
- Consider the cross-border impacts and justice issues associated with the transition.
- Ensure the transition proceeds rapidly enough to avert irreversible catastrophic climate impacts and to keep the planet habitable for present and future generations.

These dimensions play out at the local, national and international levels, as well as throughout the energy life cycle (see Box 2). Existing power and political structures also affect the achievement of a just energy transition (see Section 3.2).

⁴ This framework builds on work by the environmental justice movement, further developed by energy justice scholars including (McCauley et al., 2013; Sovacool and Dworkin, 2014). Academic discussions are ongoing regarding whether energy justice or just transition represents the broader concept. If just transition is seen as primarily focused on workforce transitions, then energy transition can be argued to be the wider concept. Conversely, if a comprehensive vision is adopted for just transition, energy justice becomes part of efforts across sectors and the economy as a whole.

Figure 2 Framework for assessing the energy transition and informing just energy policy design



The dimensions outlined in Figure 2 provide a useful framework for decision makers and stakeholders to identify existing or potential injustices. This, in turn, can help inform policy priorities, policy design, differentiate between “more and less” just outcomes of decisions and policies, and balance competing interests during the transition (Heffron, 2022; Sovacool *et al.*, 2019). The following sections explore each dimension and its interplay with others in more detail. Depending on the context, some considerations may carry more weight and may serve as starting points for the assessment.

An important conceptual distinction exists between energy injustices that stem from the current energy system, those that arise during the shift away from polluting energy sources, and those that may emerge in the transition to a more sustainable future. While these injustices are interconnected, the following will focus primarily on future injustices, as their implications often receive less attention.

3.2 DIMENSIONS OF THE JUST ENERGY TRANSITION

DISTRIBUTIVE JUSTICE: FAIR DISTRIBUTION OF BENEFITS AND BURDENS

Questions regarding the distribution of benefits and burdens are at the core of reaching a meaningful agreement on future efforts towards a sustainable energy transition (De Vries *et al.*, 2024; Sovacool and Dworkin, 2014). Beyond moral arguments, strong empirical evidence indicates that equitable distribution is crucial for the acceptance of sustainable energy projects (Bal *et al.*, 2023). Therefore, policy design and implementation must strive to ensure that the benefits and burdens are distributed as fairly as possible across countries, communities and population groups.

Answers to distributive justice questions range from win-win scenarios to complex compromises. They also hinge on how justice is understood and what principles guiding distribution decisions. As discussed in more detail in subsequent sections, who is consulted, whose values are recognised and who has decision-making authority in energy policy and project developments directly shapes distributive justice outcomes.⁵

⁵ See also section 3.3.

Key issues and requirements for distributive justice

Affordability and availability of energy

The availability and affordability of sustainable energy services are central to a just energy transition. Energy is a pre-requisite for meaningful economic and social development as well as for individual well-being in modern societies. From a justice perspective, it is important to consider who has access to affordable energy and how energy costs are distributed across different segments of society, both within and across countries.

Currently, access to energy services is unevenly distributed, both globally as well as nationally. An estimated 666 million people still lack even basic access to electricity,⁶ while 2.1 billion rely on cooking technologies harmful to human health (IEA *et al.*, 2025). These dynamics have a strong spatial dimension: 85% of people without electricity access live in Sub-Saharan Africa, and almost 80% of those without access across the world live in rural communities (IEA *et al.*, 2025). Access to energy is unequal even when it exists, including in industrialised countries. In some locations, low-income individuals and households face difficult choices between paying for energy and meeting other basic necessities (e.g. food and nutrition, health care and education). Across countries, low-income and marginalised communities also tend to incur higher energy costs and dedicate a larger share of their income to cover these expenses. Inadequate or substandard energy equipment and infrastructure, coupled with limited financial resources for improvements, further exacerbate the situation (Biswas *et al.*, 2022).

Concerns regarding access, inequality and affordability of energy have multiple facets. Efforts towards a just energy transition need tailored national and international policies to address energy poverty and ensure that people have sufficient energy to live with dignity and can access opportunities. It is essential to consider how a given energy or infrastructure policy can either alleviate or worsen energy poverty and affordability challenges, as well as to assess how electrification and affordability policies impact different groups (see sections on recognition and geographies). Responses need to be framed against the wider socio-economic background. The issues of energy poverty outlined here reflect structural inequalities, rather than just individual hardships, as energy pricing systems, housing quality and ownership, and infrastructure investments often favour wealthier communities (Galvin, 2019; Ledger and Rampedi, 2022). Growing economic disparities exacerbate poverty, including energy poverty (Galvin, 2019) and with rising income and wealth inequalities globally (Chancel *et al.*, 2022), it is imperative that these issues are addressed holistically.

Social and economic opportunities and impacts

The distributive justice implications are significant, particularly on how socio-economic benefits and impacts from the energy transition are distributed. For instance, the energy transition is projected to create millions of new jobs, provided decision makers effectively implement their sustainable energy and climate commitments. However, it is essential to carefully assess and address the impacts on the workforce. While gains in energy-transition-related sectors are expected to offset loss of fossil fuel jobs (IRENA, 2021), potential misalignments may arise. For instance, new jobs may not be created in the same sectors or at the same time, and they may require different skills or be based in different locations (IRENA and ILO, 2021). The loss of livelihoods is central to the original understanding of a just transition, making it crucial to support workers who may struggle to provide for themselves and their families. Additionally, the quality of jobs also matters; the prevalence of precarious jobs across the economy is affecting the energy sector, including renewables. It is vital to ensure that the jobs created are secure and well-paying in line with the International Labour Organization's (ILO's) Decent Work Agenda. Overall, the design of just energy transition policies must consider the livelihood impacts of these policies, on specific (energy) sectors as well as different social groups and geographies. Complementary policies will also be necessary to ensure equity, ranging from inclusive workforce development programmes that address re-training and skill development, as well as social protection and labour rights standards, including fair wages and benefits.

⁶ Estimates suggest that numbers may be even higher than official statistics report. Analysis of satellite imagery indicates that for at least 1.18 billion people across developing nations, there appears to be no statistical evidence of electricity use (Min *et al.*, 2024).

Beyond job creation, the energy transition presents opportunities for economic development, including the creation of new industries and markets as well as export opportunities. IRENA, for instance, estimates that a pathway aligned with global climate objectives would lead to an annual average increase of 1.5%-2.6% in gross domestic product (GDP) up until 2050, depending on the policies chosen and investments made (IRENA, 2023a). Additionally, the transition can also alleviate the economic burden related to pollution and environmental restoration associated with fossil-fuel-based energy production and consumption, while strengthening energy security and independence. However, these opportunities will not be distributed evenly. A just energy transition must ensure that it creates value for various communities and groups through the benefits arising from business opportunities – both geographically within and across regions (as described in the section “Justice across geographies”) and socially in terms of gender, ethnicity, income or class. This includes empowering the poorest or most vulnerable, such as women, who are often overlooked in renewable energy programmes, including employment or subsidy initiatives (Galvin, 2019; IRENA, 2019; Johnson *et al.*, 2020).

Environmental impacts and externalities

Energy-transition-related projects, like any infrastructure development, have environmental impacts, such as those that stem from the entire supply chain, including the mining of transition minerals, the materials used for deploying renewable energy, and end-of-life management (Agrawal *et al.*, 2023; Levenda *et al.*, 2021). The distributive implications of these challenges require particular focus, especially given the widespread lack of awareness, interest or regard for the effects of damaging production conditions and externalities associated with different forms of energy or energy-transition-related materials. This lack of awareness, also referred to as “consumer blindness”, is especially prevalent among energy-importing countries or regions (Healy *et al.*, 2019). Marginalised groups are among those hardest hit by adverse environmental and health impacts – an issue highlighted in the section on recognition justice below.

Therefore, national and international policies must be designed to avoid or minimise remaining externalities across the supply chain and life cycle of sustainable energy projects (for more, see Box 2 on life-cycle impacts and the sections on restorative and inter-generational justice, which cover externalities such as greenhouse gas emissions and resource depletion). Where costs and other burdens are unavoidable, great care should be taken to fairly distribute them. But rather than reactive efforts, policies should also mandate upfront impact assessments to prevent and mitigate adverse effects, as highlighted in the following section.

Financing

The way finance is allocated and spent matters also from a justice perspective. While renewable energy is increasingly cost-competitive (IRENA, 2025a),⁷ there remains the question of who bears the costs for the new infrastructure and technologies required to ensure affordable access to energy and support climate mitigation and adaption (e.g. deployment of renewables; power grids; and energy flexibility, efficiency and other measures). This issue is especially pronounced in developing countries, which receive only a fraction of the global investments in renewables and face higher costs per kilowatt hour due to higher financing costs (for further details, see the section “Justice across geographies”). Adequate funding is also needed to support social interventions, both nationally and globally. For instance, social protection and active labour market interventions may be required to train or re-train workers and jobseekers. Yet, only around half of the global population is covered by social protection,⁸ with the largest gaps found among the poorest households in the least developed countries. The gap varies between 75% of the population lacking any social protection to 18% in high-income countries (World Bank, 2025). The source of financing can also influence the extent of space available for participatory processes and citizen engagement in shaping just energy transition pathways. Depending on their design, foreign direct investments, development aid and multilateral partnerships can leave limited space for stakeholder engagement (Newell, 2024), an issue further discussed in the next section.

⁷ On a levelised cost of energy basis, 91% of newly commissioned utility-scale renewable capacity delivered power at a lower cost than the cheapest new fossil-fuel-based alternative (IRENA, 2025a).

⁸ The ILO defines social protection as a “set of policies and programmes designed to reduce and prevent poverty and vulnerability across the life cycle. This includes child and family benefits, maternity protection, unemployment support, employment injury benefits, sickness benefits, health protection, old-age benefits, disability benefits and survivors’ benefits” (ILO, 2023).

Ownership

Those who own and control energy projects, programmes and related infrastructure significantly influence how benefits are distributed. Several large companies, energy-exporting firms and financial institutions hold a majority share of the ownership and profits associated with the resources underpinning the current fossil-fuel-dominated energy system (Biswas et al., 2022).

Studies show that community ownership tends to channel increased capital into local communities; that it helps empower communities through job creation, skill development and new economic opportunities; and fosters greater community acceptance through a more equitable distribution of costs and benefits (IRENA Coalition for Action, 2020; Muñoz Cabré and Araújo, 2022). This relationship is not automatic, however. Hence, transition-related projects aimed at enhancing, rather than diminishing, social justice may need to incorporate specific social objectives, such as benefiting the communities in which they are developed (IRENA, 2025b).

How diverse ownership arrangements will be and how actors behave is also a matter of deliberate policy choices and regulation. While the private sector is expected to play a key role in the energy transition, a transition driven by private investors will likely prioritise profit maximisation, resulting in heavy concentration of ownership along certain parts of the value chain. Private sector companies are accountable to their shareholders, and although they must maintain a social license to operate, the wider environmental externalities of their activities and the interests of host communities are often of not a primary concern.

Different ownership models – whether private, public, or public-private – each offer distinct advantages and challenges in the context of a just energy transition. Policy makers must therefore carefully assess which ownership structures align with their social, economic and environmental goals, and ensure that these models are complemented by targeted regulatory frameworks to support these objectives. For instance, renewable energy auctions can be structured to prioritise not only cost-effectiveness but also the social and environmental outcomes of proposed projects by incorporating criteria such as (local) ownership. Irrespective of ownership structures, regulatory tools, including auctions, can be used to support other socio-economic objectives, such as community benefits, job creation and environmental sustainability (IRENA, 2021, IRENA, 2026).

Considerations for policy makers

- What are the potential direct and indirect social, economic and environmental benefits of projects or policies related to the energy transition?
- Who reaps the benefits of the transition, and are any particular social groups or groups based in certain regions or parts of the supply chain particularly privileged/disadvantaged?
- To what extent do existing structures and inequalities skew the outcome of energy transition policies and disadvantage particular communities or population groups?
- Are there frameworks in place that support sharing of benefits?
- Does the policy promote access to affordable, reliable, sustainable and modern energy for all?
- Who owns infrastructure and projects related to the energy transition, who receives the majority of revenues, and are frameworks in place to enable and incentivise diverse ownership structures, including community ownership?
- What resources – financial and otherwise – are required to extend the potential benefits or mitigate possible burdens of a policy or project to disadvantaged and marginalised groups?

PROCEDURAL JUSTICE: PROCESSES, INCLUSIVE DECISION MAKING, MEANINGFUL PARTICIPATION AND REDRESS

Justice encompasses not only the distribution of benefits and burdens, but also the processes through which decisions about energy transitions are made. Procedural justice emphasises fairness in these decision-making processes. Linked to recognition justice (see next section), it also stresses the importance of including those impacted by decisions, ensuring they are directly or indirectly represented – a key principle of democracy. Research shows that more inclusive processes tend to result in improved decision making and that outcomes of processes perceived as fair are more readily accepted by the public (Bal *et al.*, 2023).

Therefore, key questions arise regarding the procedures, laws and institutions that facilitate a fair process to reconcile diverging needs and negotiate acceptable trade-offs among local, national and international governmental institutions as well as business and civil society organisations, including advocacy groups, labour union representations and Indigenous Peoples. Additionally, it is essential to establish safeguards to protect affected and marginalised groups from transition-related costs they cannot reasonably bear. Focus areas include due process, meaningful participation and representation, prior informed consent, full information disclosure by governments and industry, and appropriate engagement and redress mechanisms at the national and international level.

Key issues and requirements for procedural justice

Public participation, participatory processes and social dialogue

The degree of democratic space, civil society engagement and stakeholder involvement in just energy transition efforts varies widely across countries (Newell, 2024). In many countries, public participation and deliberation in national energy policies and strategies have historically been weak, often influenced by geostrategic considerations such as the availability of energy resources and reserves (Burke and Stephens, 2018; Newell *et al.*, 2021). While many national jurisdictions mandate consultations and impact assessments, these processes are frequently conducted as a formality and lack meaningful engagement (Owen *et al.*, 2022; Vanclay, 2020), which can impact a company's social license to operate. Indigenous Peoples and other land-connected peoples in particular face significant challenges in protecting their land rights (Owen *et al.*, 2022).

Communities directly impacted by energy and infrastructure projects are often excluded from decision-making processes, even in cases where formal and statutory environmental impact assessments are mandated (Agrawal *et al.*, 2023; Ciplet, 2021). Those affected by decisions made upstream and downstream are often not consulted, despite being impacted, which is particularly evident in the extraction of materials necessary for the energy transition. Where opportunities for engagement do arise, the groups that are able or willing to participate are frequently those privileged by wealth, education or social status (Scherhaufer, 2021). In sharp contrast, individuals from rural areas, indigenous communities, senior citizens, women, low-income groups and people with disabilities are more likely to be excluded, as their rights and/or voices are often unrecognised or the modalities of engagement do not allow for their participation (Suboticki *et al.*, 2023). Impacted communities frequently perceive such engagement as tokenistic or exploitative, especially in developing countries (Grant *et al.*, 2025).

Ensuring more open and meaningful processes that extend beyond merely providing information will be critical for a just energy transition (Newell, 2021; Scherhaufer, 2021). Concurrently, emerging insights are shaping how engagement processes can be structured, along with various modalities that promote inclusivity and meaningful engagement (IRENA, 2025c, 2025b). Social dialogue⁹ offers a vital collaborative mechanism

⁹ The ILO's working definition for social dialogue encompasses "all types of negotiation, consultation or information sharing among representatives of governments, employers and workers or between those of employers and workers on issues of common interest relating to economic and social policy" (ILO, 2013). In recent years, several countries have also included representatives from other groups, such as unemployed and informal workers, youth and rural populations, to address the shortcomings of the tripartite employer-employee-government dialogue (Tørres, 2021).

for both policy design and implementation. It is instrumental not only for ensuring a just transition for fossil fuel workers (ILO, 2015), but also for ensuring decent jobs in the renewable energy sector. Evidence shows that social dialogue supports improving working conditions and fostering fairer labour relations, thereby helping to reduce social inequalities (Tørres, 2021). Perceptions of equity and sincerity in both processes and outcomes are instrumental for participatory processes to build trust and garner public support (Newell, 2024).

Institutions and mandates

Many existing institutions involved in planning, financing and implementing the energy transition (e.g. government institutions, regulators, financing institutions and utilities) focus on technical feasibility, reliability and cost (Shelton and Eakin, 2022). Consideration of environmental and social impacts is sometimes required, but the way these impacts are assessed – and by whom – varies significantly. In some instances, these impacts are treated as externalities, effectively excluded from analysis altogether. Businesses in the energy sector, including those related to the transition, frequently operate without a mandate to address social justice concerns, although many adhere to standards related to human rights and environmental sustainability to which they have committed.

Public institutions, including government agencies, often lack the authority, mandate, processes and/or expertise to address broader social justice concerns, as they are typically limited to one particular portfolio. When mandates do exist, they tend to be fragmented, with sectoral silos contributing to duplication, inefficiencies and a lack of holistic planning. Issues also arise during the implementation stage, where institutions may lack the capacity to monitor and assess outcomes for the affected and marginalised populations. This institutional context significantly complicates the development of effective just energy transition policies, which require clear and inclusive institutional mandates, sufficient institutional capacity and adequate resources.

Inclusion in leadership and decision making

Progress on inclusive decision making and leadership in the energy sector remains inconsistent. Significant gender imbalances exist in the leadership of major energy companies. While gender representation is generally more balanced in the renewable energy sector, surveys indicate that women are particularly under-represented in leadership roles, holding only 19% of senior management positions, while being over-represented in administrative roles (45%) (IRENA, 2025d). Gender representation is uneven also within energy ministries. A review undertaken for this report reveals that only 17% of energy ministers or ministers responsible for energy transition related portfolios are women. Comprehensive data on the participation levels of minority groups, including Indigenous Peoples, in government or the energy sector are lacking. In many parts of the world, youth and future generations have limited opportunities to advocate for their interests, as discussed below. For marginalised groups to have a meaningful voice in decision making, measures tailored to the specific context are required, such as diversity goals, improved recruitment and appointment processes, stronger pathways for capacity and leadership development, and the removal of structural and cultural biases, including reform of organisational cultures.

International governance

Challenges to procedural justice also relate to the voice and influence of developing countries on the international stage. For instance, recipient countries and their citizens have limited influence over decision-making processes of international financial institutions and development banks (Gallagher, 2025), such as the Green Climate Fund, World Bank and International Monetary Fund. These institutions control access to resources that enable countries lacking the means to realise their energy, economic and social objectives. Moreover, developing countries also often lack access to financial resources, necessary to participate effectively in relevant global negotiations, from climate change to trade and other areas related to energy transition.

Challenges in international governance also include the fact that those most affected by failures to pursue effective energy transition pathways – including adversely impacted communities, young people and future generations – have a limited say not only in many national but also in international policy-making processes (Abram *et al.*, 2022). This underscores the importance of establishing legal safeguards and minimum human and environmental requirements for both development financial institutions (DFIs) and companies operating in third countries.

Considerations for policy makers

- Are systems, including legislation, in place for involving stakeholders in assessing the impacts of planned energy transition projects and to receive a social license to operate? Relevant focus areas include, but are not limited to, meaningful environmental and social impact assessments (including transboundary impacts to capture international impacts) and free, prior and informed consent. Elements to consider include participation across the life cycle, opportunity to be heard and express perspectives without fear of repercussions, comprehensive and timely information, fairness of and impartiality by decision makers, being treated with dignity and the ability to revise decisions when new information becomes available.
- Which institutions (ministries, agencies, commissions) are responsible for planning, implementing and monitoring the transition? Are their institutional roles and mandates clearly defined and complementary, or do overlaps/gaps exist?
- Who was involved in developing the legislation in place for participatory decision making, including social dialogue, and impact assessments, and are the interests of often overlooked stakeholders recognised?
- Has a stakeholder mapping taken place to ensure all relevant stakeholders are actively being engaged and that no groups have ([un]intentionally) been excluded? This can, for instance, include low-income groups, people from remote areas, women, indigenous/historically marginalised peoples, the elderly or people with disabilities.
- How are minority and majority interests balanced?
- Which methods for engagement are being considered for stakeholder participation in decision-making processes, and are these avenues suitable for affected groups? For example, online information or consultations may be difficult in areas where stakeholders may not have access to electricity/technology or for older individuals who are unfamiliar with technology.
- Is information about planned projects and policies available to all communities that are potentially being affected, including in their language and, if necessary, with explanations from officials, at early stages and with sufficient time for inputs?
- How are stakeholder inputs considered in the decision-making process, and are any perspectives ([un]intentionally) privileged? This concerns particularly the dominance of powerful groups, including balancing the interest of communities versus companies.
- Do effective and adequately resourced frameworks exist for access to information, inclusive and meaningful participation in decision-making processes, along with access to justice/redress mechanisms?

Recognition justice: Acknowledging, respecting and addressing vulnerabilities and bias

“Recognition justice” builds on the notion that everyone deserves fair treatment and an opportunity to participate in transition-related processes, and to be able to benefit from the transition, regardless of their social, economic, ethnic, racial and cultural background, or gender.

Recognition justice highlights the importance of acknowledging the identities, lived experiences and rights of affected, marginalised and historically oppressed groups, along with co-developing appropriate solutions. This is not only fundamental to efforts for greater equity; ensuring that people feel that their experiences are recognised also matters for efforts to ensure local acceptance and social cohesion (Tarasova, 2024).

A key question in this context is, “a just energy transition for whom?” *i.e.* whose interests and values are recognised in the energy transition. Does the transition account for the energy needs of those with particular vulnerabilities, including those who are poor, ill, disabled, unemployed or otherwise disadvantaged and marginalised? Since the marginalised are also often constrained in their capabilities to exercise and defend their rights, their particular concerns cannot be subsumed under distributional and procedural justice concerns.

Ultimately, recognition justice is foundational – without identifying, listening to and valuing adversely impacted groups, it will not be possible to achieve other dimensions of the just energy transition, including procedural, distributive and restorative justice. Recognition justice is not a one-off exercise but one that requires continuous interrogation through the policy process and energy life cycle.

Key issues and requirements for recognition justice

Marginalised groups, including Indigenous Peoples, have disproportionately suffered in the past from injustices related to energy development, including displacement, loss of land, and environmental and health impacts (Indigenous Peoples Major Group for Sustainable Development, 2019; Sovacool *et al.*, 2016).

Studies have also shown that energy poverty disproportionately affects people with disabilities (Bouzarovski, 2017), for instance. Similarly, people experience injustices due to their gender, income and race, but also their age, religion and even location. Ascertaining the full scope of injustice can be difficult as marginalised groups and their perspectives are often underrepresented or misrepresented in energy research, data and practice, if data are comprehensively collected in the first place.¹⁰

Closely related to recognising the transition’s impact on specific groups is recognising and addressing which (systemic) challenges particularly affect them. Issues affecting marginalised groups – such as energy poverty – are at times dismissed as personal or national failings and can be accompanied by stigmatisation (Bouzarovski and Simcock, 2017). Failure to recognise structural contributions and challenges in turn leads to policy neglect.

Energy modelling is another area where recognition justice concerns arise. Energy modelling is often dominated by cost-optimising narratives and tends to leave structural inequalities or the needs of marginalised groups unaccounted for, in the model parameters as well as the consultation process (Rubiano Rivadeneira and Carton, 2022). Well-designed models, along with participatory and inclusive modelling processes, can help to better address these issues and uncover blind spots in the models and beyond (IRENA, 2025c).

¹⁰ In the climate and energy justice discourse, focus on rights of nature has increased as the ecological crisis has worsened. Rights of nature entail recognising and protecting the intrinsic rights of ecosystems themselves, independent of their value to humans. Such considerations would also be in line with indigenous worldviews and other non-Western philosophies that have long recognised nature’s intrinsic value. This being said, further research is needed on benefits and limitations, as well as mechanisms (Newell *et al.*, 2021), and how to balance different rights, including human rights and development needs, in the context of a just energy transition.

Considerations for policy makers

- What is the social, cultural and historical context of the place where the policy/project is planned?
- Who are the beneficiaries of the policies or project? Does it primarily serve the dominant social groups, and are other affected/marginalised groups specifically and explicitly considered?
- If the policy is based on the modelling of a future scenario, do the underlying assumptions explicitly recognise different interests, including avoiding (unintentional) historical biases?
- Which stakeholders are recognised during the public engagement and decision-making process and hold sway over the process?
- Are frameworks in place to respect and protect political and civil rights as well as the economic and social rights of indigenous peoples and other marginalised groups, and are they being implemented and addressed?
- Does policy making seek to understand, acknowledge and address interrelated vulnerabilities and marginalisation (such as between historic oppression and poverty)?
- Are disaggregated data collected to understand the impacts of the energy transition on different groups?

Restorative justice: Repairing and preventing harm

Restorative justice focuses on rectifying injustices in the energy sector and repairing the harm done to people, communities and/or the planet. Restorative mechanisms and programmes to address past and ongoing harm resulting from fossil fuel and other energy projects should cover aspects such as responsible decommissioning and livelihood restoration plans as fossil fuels are phased out. Restorative justice also concerns mitigating any adverse impacts of renewable energy projects and related infrastructure across their life cycle (see also Box 2).

Beyond identifying responsibilities and liabilities, a focus on restorative justice can help policy makers consider what injustices may require restorative action in the first place and how injustice may be prevented in the future. Centring on the need for restoration also foregrounds assessments of whether certain energy activities may cause irreversible damage and whether the costs associated with reparations are prohibitive (Heffron and McCauley, 2017).

Key issues and requirements for restorative justice

Reviews of past experience show that the basic principle of “the polluter pays” is rarely followed for former industrial and mining sites and that the private sector often passes the costs of end-of-life damages to the public sector (Atteridge and Strambo, 2020). This makes legal intervention essential, especially in projects meant to support just transition efforts. Utility-scale renewable energy projects, for example, typically have significant land requirements and can have lasting impacts on the livelihoods of local communities, which may include Indigenous Peoples and pastoral communities (Waters-Bayer and Wario, 2022). Resettlement is among the most severe consequences of some large-scale renewable energy projects, but other programmes related to conservation and the carbon market also require careful design and effective compensation and governance mechanisms (Agrawal *et al.*, 2023; UN, 2019). Protests, as well as an increasing number of lawsuits against announced and already built projects (Agence France-Presse, 2021; Renkens, 2024; Stagner, 2024), highlight the need for better initial consultation – with potential changes to projects and their siting – and better compensation mechanisms and enforcement that account for the value of land lost to its traditional inhabitants.

Connected to procedural justice, restorative justice also necessitates greater national and international engagement to help implement mechanisms that are robust and accessible for adversely impacted populations and can be enforced regardless of the financial means of the affected groups.

Within broader just transition discussions in the international climate space, further international deliberations are required concerning the complexities related to the use of the remaining carbon budget, responsibility for energy-related emissions, along with suitable compensation and reparation mechanisms for those most affected.

Considerations for policy makers

- Which stakeholders are experiencing injustices based on past or current energy policies?
- What mechanisms are in place to address past or current injustices, and are they being used effectively?
- What additional resources, laws and/or policies are required to adequately consult with and restore harm/compensate groups incurring significant costs?
- Could the new policy/project lead to unintended consequences, and can these consequences be prevented?

Justice across geographies

The starting points for national energy transitions vary greatly across regions, countries and communities, given vastly different needs, economic capacities, resource endowments, historic legacies and injustices, institutional dynamics and infrastructure. They must be underpinned by the notion that all humans have equal moral worth. How different communities are impacted and are able to benefit from the energy transition must be considered regardless of geographic or national boundaries.¹¹

Accounting for people's diverse geographic and economic realities is essential for equitable policy design (Bouzarovski *et al.*, 2017; Fritsch *et al.*, 2023; Gürtler, 2023). This approach ensures a more holistic view of how benefits and burdens are distributed within and across countries, allowing for more targeted and effective responses. Tailored policies will be needed to promote social sustainability and cohesion, and address disparities. These can range from efforts towards regional and local economic development and diversification to place-based investment strategies or dedicated policies for cohesion. On the supranational level, strengthened international co-operation, benefit sharing and economic reforms are needed. Relevant measures include, among others, global financial, tax and trade law reforms, access to affordable and adequate finance, industrial/local content requirements, technology sharing and capacity-building/technical assistance.

Key issues and requirements for justice across geographies

Regional disparities in energy transition progress

The progress of renewables' deployment and the associated benefits vary by region. While renewables represented an unprecedented 91.1% of electricity capacity additions in 2024, their deployment is uneven (IRENA, 2025e). This disparity reflects trends in energy transition investments, with advanced economies and China seeing 90% of global investments (IRENA and CPI, 2025). Disparity exists also in renewable energy jobs, which are heavily concentrated among a handful of countries, with China leading (representing an estimated 45% of global jobs), followed by the European Union (11%), Brazil (10%), the United States (7%) and India (6%) (IRENA and ILO, 2024). Modelling the impacts of energy transition pathways aligned with the 1.5°C climate

¹¹ In academic discussions this is also framed as cosmopolitan justice (for more, see (Heffron, 2022; McCauley *et al.*, 2019), which can be seen as its own dimension or be evaluated across dimensions.

goal also shows that, depending on global and national policy and strategy choices, this distribution is likely to persist. IRENA's modelling projects that Asia might hold 55% of global renewable energy jobs by 2050, followed by Europe at 14%, the Americas at 13% and Sub-Saharan Africa at 9% (IRENA, 2023a).

Intra-country disparities and localised impacts

Within countries, policy makers need to pay particular attention to a just energy transition for low-income areas and rural/peripheral regions (Banerjee and Schuitema, 2023). Typically, urban centres have better infrastructure, and greater access to energy and other services. For instance, basic access to electricity is greater in urban areas, which have 98% access rates, compared with rural areas, where access rates are 84% (IEA *et al.*, 2025). Urban areas, especially more affluent neighbourhoods and commercial districts, also tend to host a high share of electric vehicle charging stations (Hennessy and Azevedo, 2024; Khan *et al.*, 2022). Communities where many livelihoods depend on fossil fuels are also concentrated in specific jurisdictions. Proactive policies will be needed to safeguard against job losses, diminished local revenue, and community decline and potential identity loss from the transition process, despite its widely documented health, environmental and broader economic benefits (Diluiso *et al.*, 2021; Ruppert Bulmer *et al.*, 2021).

Transboundary impacts of national energy policies

Decisions made in one place can adversely influence other geographies. Climate impacts from fossil-fuel-based energy systems are a prime example. Yet, technologies and activities related to the energy transition also exert transboundary impacts, which can also be more far reaching. Local mining of critical materials and the value that is created, for instance, are shaped by national and international decisions and systems (see also Box 2 for more on life-cycle impacts). Spatial justice approaches can reveal the potential limitations and justice implications of proposed solutions. For instance, researchers note that many pathways aligned with the Paris Agreement rely heavily on bioenergy-based negative emissions to maintain high energy consumption levels in industrialised countries. The assumption is that this would require the preservation of forests in developing countries, largely disregarding issues surrounding availability of land, sustainability and food security (Hickel and Slamersak, 2022).

As countries seek to implement the *UAE Consensus*¹², under which they committed to a transition away from fossil fuels, regions, countries and communities that depend on fossil fuel production will be particularly affected. This is especially the case for countries in the Middle East and North Africa, but also in parts of North America, Eurasia, South Africa and Asia Pacific that continue to rely economically on exporting oil, gas and coal. Many countries dependent on fossil fuel exports have been trying for decades to diversify their economies, with varying success. For instance, despite marked improvements in the countries of the Gulf Cooperation Council, hydrocarbon revenues constitute between 39% and 89% of public revenues (IRENA, 2023b).

Considerations for policy makers

- Does the policy contribute to shrinking global, regional or subnational disparities related to the energy transition?
- Does the policy/project adversely impact others within or across countries, and are any measures in place to address these effects?
- Where is value created and which communities/regions/businesses benefit?
- Are place-based impacts on specific communities and corresponding measures being considered?

¹² The *UAE Consensus* refers to the collective agreement and commitments reached during the 28th Conference of the Parties to the UN Framework Convention on Climate Change (COP28), hosted by the UAE in 2023. It includes a historic agreement by the 198 signatory nations to transition away from fossil fuels (UNFCCC, 2023).

Justice over time

Politics and policy priorities often consider short time horizons, yet the energy decisions made today have long-lasting implications. Decisions related to energy transition pathways are not only experienced by decision makers and voters, but also future generations and today's youth, with 40% of the world's population aged under 25 (UN DESA, 2024a). Drawing attention to the dimension of temporal justice aims to expand the time horizon under consideration. A policy focus on both short- and long-term impacts can inform trade-offs and more constructive discussions. It reminds those focused on rapid transitions to pay attention to the short-term impacts, especially potential hardships for marginalised and affected groups. At the same time, it requires that those favouring a more gradual transition concretely outline how to ensure inter-generational justice.

Inter-generational justice is a long-standing legal principle (Redgwell and Rajamani, 2020).¹³ In the energy space, inter-generational equity has been formulated to suggest that "future generations have a right to enjoy a good life undisturbed by the damage our energy systems inflict on the world today" (Sovacool *et al.*, 2017). Inter-generational justice is also at the heart of sustainable development; the United Nations in its preamble to the UN Agenda 2030 specifically states the determination "to protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations" (UN, 2015). Global, regional and national long-term energy planning and visioning based on scenario planning to explore potential future outcomes of current policies can help assess the impacts of the energy transition on future generations. Circular and resource efficiency policies can mitigate resource depletion. Impact assessment can further help assess the impacts of specific projects and programmes. They should be combined with meaningful public engagement, inclusive decision making (see also section on procedural justice) and specific implementation plans that consider inter- and intra-generational equity concerns.

Key issues and requirements for justice across time

Pace of the energy transition

Impacts of climate change are already felt in every corner of the globe (IPCC, 2023a). Global temperature increases are now expected to exceed 1.5°C, at least temporarily, which will be difficult to reverse (UNEP, 2025). Increasingly severe climate impacts from rising sea levels to extreme weather events and ecosystem disruptions will disproportionately affect today's young people and future generations. The coming years will be critical to limit global temperature increases and to ensure a liveable planet for current and future generations (IRENA, 2021). Failure to act increases not only the economic cost of moving to a sustainable energy system for future generations, but also adds to lives lost and adversely impacted as a result of climate impacts. Choices in infrastructure today also create lock-ins and technological path dependencies affecting current and future generations that need to be accounted for in policy making.

Resource depletion and (irreversible) environmental degradation

While energy sources such as sun and wind replenish, this is not necessarily the case with the materials needed for energy generation and distribution, which can be depleted over time. This includes inputs needed for the design of renewable energy technologies – including rare earth materials – as well as power lines and substations. Land use/siting choices can also impact the options and choices of future generations. While these challenges pale in comparison to the issues raised by the use of fossils fuels or by nuclear waste, policy makers need to proactively address these issues as the energy transition unfolds. Importantly, as with many issues raised in this text, the challenges extend beyond the energy sector. The modern energy and resource-intensive lifestyle prevalent in most industrialised societies is inconsistent with long-term sustainability and inter-generational justice efforts (Ohlsson and Skillington, 2023).

¹³ Three key principles underpinning inter-generational justice are the rights to "non-discriminatory access to the Earth and its resources", "comparable options" and "comparable quality in the environment" (Brown Weiss, 2013).

Issues of accountability/procedural justice

In terms of the procedures or processes of a just energy transition, inter-generational justice entails ensuring the views and needs of young people are reflected in decision making (Jaradat *et al.*, 2024; UNICEF, 2024). It also requires full consideration of the needs of future generations in planning processes and recognising the rights of children and future generations have, at a minimum, access to an equal quality of environment that enables full health and subsistence. This also relates to recognition justice. Yet few formal mechanisms for the consideration of future generations exist, despite recent, ground-breaking climate litigation centred on inter-generational justice claims and emerging legal pathways to safeguard the rights of current and future generations (Setzer and Benjamin, 2019). Most recently, the International Court of Justice in its Advisory opinion on the Obligations of States in Respect of Climate Change also affirmed legal obligations for inter-generational equity, noting that “[d]ue regard for the interests of future generations and the long-term implications of conduct are equitable considerations that need to be taken into account where States contemplate, decide on and implement policies and measures in fulfilment of their obligations under the relevant treaties and customary international law” (ICJ, 2025). Australia, Hungary and Wales have also experimented with ombudspersons for future generations (Newell, 2024).

Considerations for policy makers

- Which groups, individuals or sectors might be adversely impacted by the policy over time and how might those impacts manifest?
- How does the policy balance short-term and longer-term benefits and impacts? Does it include measures to protect vulnerable groups from hardship while serving the interests of today's youth and future generations?
- Does the policy consider possibly irreversible burdens being imposed on future generations?
- What measures are taken to ensure that energy development is aligned with the sustainable development principle, which requires that the needs of the present generation are met without compromising the ability of future generations to meet their own needs?
- Does the policy consider circular economy as well as resource and energy efficiency principles?
- Is the policy likely to create stranded assets and locked in carbon-intensive infrastructure and inequalities to be borne by current young people/future generation?

Box 2 Justice across the energy life cycle

A comprehensive approach to just energy transition policymaking requires broadening the lens beyond the deployment and use stages of energy. While this chapter has already highlighted benefits and challenges related to different justice dimensions, systematically mapping (in)justices across the energy supply chain enables the development of more holistic just energy transition programmes. It supports identifying solutions to minimise adverse impacts, ensuring that environmental and social externalities from energy production and consumption are borne fairly and that affected stakeholders are more meaningfully included in decision making processes.

Adopting a life-cycle perspective can enhance communication with end users and the wider public. This is particularly important as these impacts are not often obvious to energy consumers (Bouzarovski et al., 2017). By making the social and environmental consequences of the various aspects of global energy systems more explicit nationally and internationally, policy makers can also foster greater public awareness and support more informed, ethical choices.

For renewables, key stages of the life cycle encompass critical materials extraction, manufacturing, deployment (including project construction, installation and grid connection, operation and maintenance and energy delivery) and end-of-life management. As with all infrastructure, renewable energy systems entail multifaceted impacts that require careful and thorough consideration across the life cycle.

- The **extraction of transition minerals and materials** as well as refining offers a range of opportunities from job creation to local business development and revenue generation for governments. Yet it is also often associated with human rights and environmental concerns, including environmental degradation, pollution, dispossession and violations of land rights that must be prevented, including through legal and regulatory safeguards and robust enforcement mechanisms (Bainton et al., 2021; Business & Human Rights Resource Centre, 2025; UN, 2025). Policy makers also need to address environmental issues related such as water scarcity and pollution, soil erosion and contamination, as well as biodiversity loss and ecosystem disruptions (de Haes and Lucas, 2024).
- **Manufacturing** of energy-transition-related technologies can drive economic diversification, industrial development and the (up)skilling of local workers. However, employment opportunities remain geographically concentrated (see, also, section on Justice across geographies). Although it generates significant socio-economic gains, issues such as labour rights abuse (Clean Energy Council, 2022) also need to be addressed through measures such as mandatory human rights due diligence, enforceable labour standards and supply-chain transparency requirements. As with other manufacturing processes, greenhouse gas emissions associated with manufacturing as well as the shipping of components need to be reduced in line with climate targets.¹⁴
- **Renewable energy deployment** entails immense socio-economic benefits as detailed across the report. At the same time, efforts need to be made to prevent issues that have arisen in the past, especially for utility-scale projects, such as violations of land rights, displacement or adverse environmental and socio-cultural impacts related to altered land use. Policy makers also need to make sure that local communities benefit from projects – e.g. through improved access to electricity – and adopt comprehensive policy frameworks to address disparities at the national and international level (see Whole-system perspectives and holistic policy making).

¹⁴ However, one study estimates that, for instance, solar photovoltaic emits 8.0-83 grammes of carbon dioxide equivalent per kilowatt hour (gCO_2eq/kWh) and on-shore wind releases 7.8-16 gCO_2eq/kWh , compared with up to 1 095 gCO_2eq/kWh for coal and 403-513 gCO_2eq/kWh for natural gas across their life cycles (UNECE, 2021).

- Finally, proactive approaches are required to reduce the rising waste volumes at the **end of life** of renewable energy technologies and to restore areas impacted by mining or waste disposal. The scale of the energy transition has significant resource and environmental implications given that the global economy is built on a linear model in which resources are extracted, transformed, used and finally discarded. For instance, cumulative solar photovoltaic waste could reach more than 210 million tonnes globally by 2050 (IRENA, 2026b), while waste from wind turbine blades could reach 43.4 million tonnes (Liu and Barlow, 2017). A more circular approach can not only limit waste volume but also address related occupational health and safety concerns.

Figure 3 presents key considerations for policy design underpinning a just energy transition drawing on insights from this chapter, along with illustrative impacts across the four stages of the energy life cycle.

Figure 3 Just energy transition considerations across the life cycle

Illustrative justice considerations across the life cycle					
	Extraction and refining	Manufacturing	Deployment	End of life	
	Fair distribution of benefits and burdens	Equitable benefit sharing of extracted resources	Job creation and economic development	Diverse ownership / community energy	Equitable management waste disposal burdens
	Inclusive processes and decision making	Guarantee free, prior, informed consent	Prevent (labour) exploitation in global supply chains	Participatory planning and implementation	Meaningful stakeholder engagement of affected communities
	Recognising exclusion and impact	Protection marginalised communities	Engagement of communities in siting decisions	Fair and lasting benefit sharing	Safeguard communities from energy waste impacts
	Preventing and repairing harm	Restoration of ecosystems damaged by extraction	Legal remedies and compensation mechanisms	Comprehensive impact assessments	Ban or strictly regulate export of hazardous EoL waste
	Justice across geographies	Local value creation in mining communities and countries	Access to resources and fair trade	Equal access to affordable technologies and financing	Avoid waste dumping
	Justice across time	Sustainable extraction and revenue management	Avoid lock in of unsustainable production patterns	Sufficient speed for climate and development goals	Circular economy approaches

While it is important to address the impacts of renewable energy throughout its life cycle, adverse impacts should not be used to draw equivalencies that justify the continued use of highly-polluting energy sources. The far-reaching and severe impacts of fossil fuels are well documented. Beyond contributing to climate change, coal, oil and gas development as well as fracking pose myriad issues. For instance, they threaten waterways and groundwater. Environmental impacts range from site clearance and infrastructure development, to toxic run-offs and spills during extraction and development to oil spills during transport that threaten human health and biodiversity/ecosystems. Extracting fossil fuels also leads to severe land degradation, some of which is irreversible. Over five million excess deaths annually are estimated to be due to air pollution from fossil fuel use (Lelieveld *et al.*, 2023). Nuclear energy also presents challenges, ranging from the environmental impacts of uranium mining and processing, which lead to habitat disruptions and long-term contamination of land and water, to potentially catastrophic accidents during operations, as well as unresolved long-term problems around radioactive waste management (Sovacool, 2011).

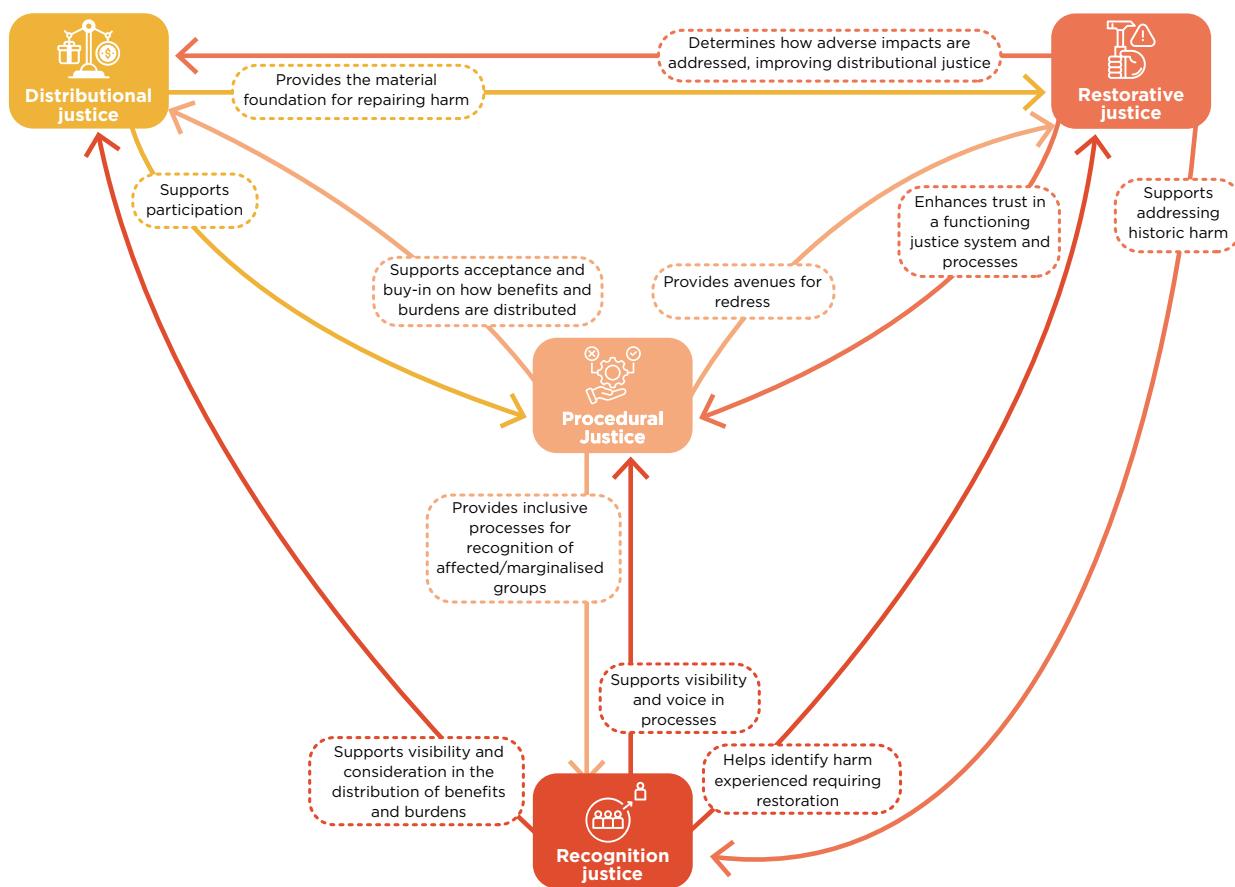
3.3 APPLICATION, INTERSECTIONS AND WHOLE-SYSTEMS PERSPECTIVES

The dimensions of a just energy transition highlighted above can assist policy makers in gaining a qualitative understanding of the justice impacts of policies as well as in identifying and articulating energy injustices that need to be addressed. The following sections illustrate how these different dimensions interact with each other, and underscore the importance of holistic policy making.

Intersections of justice considerations in policy design, and space for pluralism

Different aspects of justice can reinforce one another but may also come into conflict (Figure 4). For instance, procedural justice, which influences how decisions are made and who is given a voice, can positively influence social inclusion and ensure that negative impacts are not disproportionately borne by marginalised communities. However, extensive and inclusive consultations on policies and projects – while necessary – may impact the speed at which energy transition solutions are deployed (Newell *et al.*, 2022).

Figure 4 Interactions between key just energy transition dimensions



Policy design and implementation thus need to foster positive inter-linkages among various dimensions of justice, while resolving tensions related to the transition through inclusive processes based on shared beliefs and values.

The strength – but also to some extent the weakness – of the just energy transition framework outlined above is that it does not prescribe specific answers or how to resolve tensions. This flexibility allows for a pluralistic understanding of justice reflective of IRENA's diverse global membership, and tailoring solutions to the specific contexts of different countries and communities. Different principles and priorities of justice will yield different responses; however, explicit discussions on the different dimensions of justice, and the values that underpin decisions, can help shape more equitable and inclusive transition pathways.

In this context, IRENA's governing body meetings, along with its broader engagement with the energy, climate and development communities, provide a platform for strengthening the international procedural justice element, bolstering global efforts towards delivering a just energy transition.

Potential areas for application

The key considerations outlined above are relevant at the local, national and international levels. Examples of how the different dimensions of justice can be used to assess existing injustices and inform future strategies are beginning to emerge (see Box 3).

Box 3 Applying just energy transition principles: Case study of the LA100 equity strategies

In 2021, the Los Angeles Department of Water and Power (LADWP), a municipal utility serving over four million residents and local businesses, began developing a set of justice-oriented strategies to complement an earlier study on the feasibility of reaching 100% renewable energy by 2035. This study was jointly conducted by LADWP; researchers from the National Renewable Energy Laboratory and the University of California, Los Angeles; and local community-based organisations.

To develop equity strategies, the initiative integrated community engagement with modelling and analysis focused on recognition, procedural and distributional justice.

The *recognition justice* component examined past and ongoing energy inequalities, especially in underserved communities. Researchers investigated legacies of systematic practices and policies using both quantitative and qualitative analysis; reviewing documents such as government reports, policies and academic literature; and gathering insights from community engagement. They also mapped socio-economic and demographic disparities in access to and experiences with LADWP programmes and services. The procedural justice component aimed to identify procedural obstacles while ensuring robust community engagement throughout the initiative. This included convening an advisory committee comprising representatives from relevant municipal offices, the mayor's office, city council members' offices, unions and local organisations as well as a steering committee composed of leaders from community-based organisations. In addition, a series of community listening sessions were held to collect information from citizens about the challenges they face and their needs and priorities. Distributional justice considerations were informed by insights gained from the previous two components as well as in-depth analyses of key areas identified through community engagements.

To support recognition and procedural justice, the initiative identified several strategies including the implementation of a collaborative platform for continuous engagement, the co-development of programmes and services, and the provision of tailored outreach and education through trusted local messengers. To address issues of distributional justice, strategies were categorised into groups. This included measures aimed at ensuring more affordable and equitable rates, such as implementing robust low-income bill assistance programmes and exploring income-based fixed charges. To address issues related to house weatherisation and safe indoor temperatures, which can save lives, targeted programmes for low-income households were proposed. Similarly, the needs of low- and moderate-income households were considered across areas such as the installation of local solar and storage systems, household transportation electrification, truck electrification to improve air quality and health, as well as measures to improve equity in grid upgrades and resilience.

Note: For more on the initiative, see (Anderson *et al.*, 2023; Romero-Lankao *et al.*, 2023; Rosner *et al.*, 2023)).

The considerations outlined are relevant not only to individual policies but also to broader (just) energy strategies and plans. This encompasses policies to reduce carbon emissions and phase out polluting energy sources as well as those that promote a wider range of socio-economic and environmental objectives, including energy security, economic development and diversification, improved air quality and public health, and social equity. Examples of relevant policies include efforts to eliminate energy poverty, accelerate renewable energy deployment, and promote climate action, sustainable (re)industrialisation, infrastructure development, community energy initiatives, inclusive workforce development, research and innovation, and circular economy financing. These considerations can also apply to specific (renewable) energy projects, such as benefit-sharing agreements, or be integral to the development of just energy transition plans for phasing out fossil fuels.

Whole-system perspectives and holistic policy making

As this report has shown, energy policies have far-reaching impacts for societies, their economies and the planet. The overall ‘justness’ of the energy transition is not a guaranteed byproduct of technology deployment. Rather, the broader socio-economic contexts and policy choices significantly influence the success of just energy transition efforts.

Notably, energy-related injustices do not occur randomly; rather, many stem from deep-seated structural dynamics and choices made (Lee and Byrne, 2019). Recognising vulnerabilities, addressing adverse impacts, improving distribution and creating more inclusive public engagement processes in the energy transition are crucial, but on their own they may fail to capture the systemic causes that require additional action. Therefore, it is essential to scrutinise the systems, institutions, policies and practices that enable or fail to address these injustices, to understand how to enact change and deliver a just energy transition (Newell *et al.*, 2021; Stevis and Felli, 2020).

Structural questions include which economic systems are best suited to supporting just energy transitions. Researchers have questioned, for instance, the extent to which the prevailing economic model has supported – and can support – a just energy transition (McCauley and Heffron, 2018; Morena *et al.*, 2019). The linkages between globalisation and long-term, equitable economic prosperity are also debated, with implications for the energy transition. Challenges extend to the international economic and financial architecture. For example, international investment agreements and investor-state dispute mechanisms can create a regulatory chill in countries, leading to lawsuits against policies aligned with just energy transition efforts (Elemo, 2024). Access to affordable finance and technology remains elusive for most developing countries (IRENA *et al.*, 2025). While well-functioning markets, investments, trade and finance are critical, it cannot be assumed that they will inherently lead to just societies, especially for least developed countries and marginalised groups. Economic governance, at national and cross-border levels, can be pursued through a variety of approaches, each with its own benefits and drawbacks; but its interplay with just energy transition measures needs to be considered in policy design.

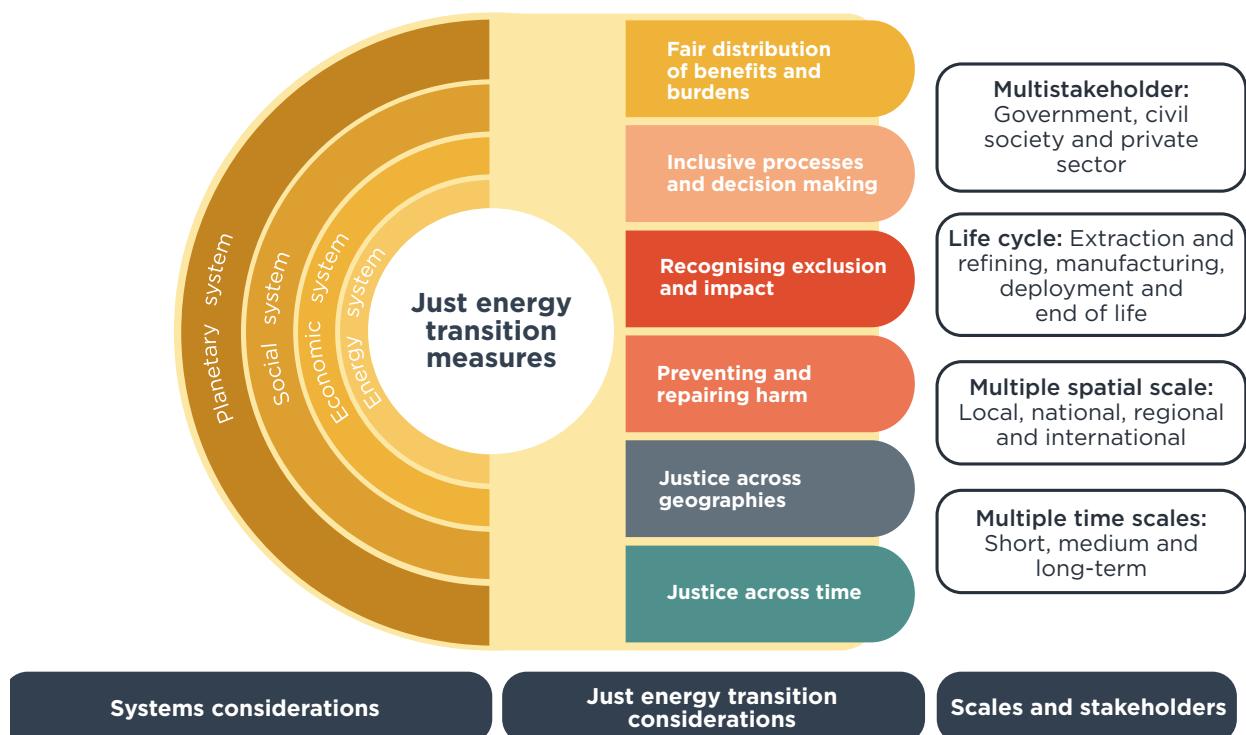
Social dynamics and power asymmetries also matter. The energy sector is embedded within social systems that often reinforce and perpetuate poverty and inequality in communities lacking economic or political resources, or the power to effect change (Newell, 2021). In contrast, incumbents often hold privileged positions within existing institutions and processes (Gürtler, 2023). As discussed in the section on procedural justice, it is therefore critical to ensure that all affected stakeholders – across governments, civil society and the private sector – are engaged in policy making processes.

Overall, advancing a just energy transition requires a whole-systems approach that embeds just energy transition measures within broader social, economic and environmental considerations (see Figure 5).

It also demands careful consideration of the linkages at the local, national, regional and international levels, acknowledging how decisions at one scale can influence opportunities and constraints at others. National energy choices affect the entire energy supply chain, from the demand for minerals used to produce renewable energy technologies and batteries to land requirements and end-of-life management.¹⁵

Effective energy policy making requires explicit consideration of trade-offs across distinct time horizons, alongside the strategic sequencing of policy instruments. For instance, near-term impacts of the energy transition often fall most heavily on low-income households, workers and energy-dependent regions. While long-term impact assessments are essential for integrating inter-generational equity into just transition frameworks, addressing immediate concerns while setting out credible pathways toward more sustainable and equitable energy systems can help build stakeholder trust and sustain political support over the extended timelines required for systemic energy transformation.

Figure 5 Whole-system perspectives and holistic just energy transition policy making systemic considerations



For policy makers, this means designing comprehensive policy frameworks that address inter-connected challenges and considerations in an integrated and coherent manner, rather than relying on isolated sectoral interventions.

IRENA's holistic policy framework approach has long emphasised that energy policies must be accompanied by a range of structural and just energy transition policies to be successful. A transition aligned with global development and climate ambitions requires the implementation of deployment policies that support the scaling up of renewable energy capacities as well as policies that facilitate the integration of renewables into power grids and in other energy delivery systems, while also considering their upstream and downstream impacts. Complementary just energy transition policies vary depending on the starting point and priorities of individual countries, and may include industrial policies, education and training strategies, labour market measures, community investments and appropriate financing strategies (IRENA, 2021). Table 1 illustrates the various policy areas associated with different just energy transition considerations, with the specific policy mix hinging on the issues to be addressed.

¹⁵ See section 3.1 and especially Box 2 on life-cycle impacts.

Acting early by anticipating system changes and proactively addressing justice concerns will be essential for achieving more just and inclusive outcomes.

The aim of this report is to provide an overarching framework that outlines key considerations relevant across energy transition policies and projects. IRENA continues to publish dedicated analyses and deep dives into specific policy areas pertinent to a just energy transition. This includes work related to energy jobs, gender, inclusion, industrial development, local value creation, community energy and environmental impacts, as well as considerations regarding international reforms and financing. Consultations under IRENA's Collaborative Framework for Just and Inclusive Energy Transition have highlighted the need for a deeper understanding of effective governance arrangements and planning approaches for a just energy transition, including tools for equitable benefit and burden sharing, workable approaches for public engagement, social dialogue and the empowerment of underrepresented groups, alongside suitable financing mechanisms. The consultations have also underscored the need to focus on concrete recommendations and insights for countries and regions that are most disadvantaged in the current energy and economic systems. The consultations within this framework, which bring together countries and other relevant stakeholders, will continue to inform the Agency's work and analyses in this area.

Table 1 Synthesis of just energy transition dimensions, considerations and policy instruments

KEY POLICY DESIGN/ANALYSIS CONSIDERATIONS

ILLUSTRATIVE LIST OF RELEVANT POLICY AREAS AND MEASURES

		CROSS-CUTTING MEASURES
<p>1 Fair distribution of benefits and burdens</p> <p>Energy affordability and availability</p> <p>Social and economic opportunities and impacts including jobs and economic development</p> <p>Environmental impacts and externalities</p> <p>Diverse ownership</p>	<ul style="list-style-type: none"> • Evaluating direct and indirect social, economic and environmental impacts; distribution of benefits, burdens, resources and assets among different groups; as well as structural economic, social, political and environmental factors influencing impacts and distribution • Assessing existing and establishing new measures as needed to equitably distribute benefits and share costs 	<ul style="list-style-type: none"> • Electrification policies, subsidies for low-income households, energy assistance programmes, regulatory reforms to lower energy prices, consumer education and empowerment • Industrial policies, sustainable energy job creation programmes, and public sustainable energy and infrastructure investment programmes • Inclusive workforce development including re-training programmes, vocational education and apprenticeship (with a particular focus on workers from fossil fuel communities, under-represented groups and youth) • Social protection and labour rights standards • Environmental and social impact assessments and life-cycle analyses • Carbon pricing, pollution reduction and sustainability standards for technologies and infrastructure • Land-use policies • Circular economy/end-of-life policies, energy efficiency, sufficiency • Climate resilience planning • Community energy and co-operative energy ownership models, access to capital for low-income and marginalised groups
<p>2 Inclusive processes and decision making</p>	<p>Participatory and transparent planning processes and implementation</p> <p>Diverse participation and leadership</p> <p>Legal redress and accountability mechanisms</p>	<ul style="list-style-type: none"> • Evaluating inclusiveness/diversity of participation in decision making, accessibility of the public engagement processes, timeliness and early engagement, transparency and availability of relevant and comprehensive information, genuine consideration of inputs and feedback, and effectiveness of conflict resolution and access to justice options • Assessing and establishing mechanisms for ensuring inclusive decision making

<p>3 Recognising those excluded and different values/ identities</p> <p>Recognising needs and experiences of marginalised or affected groups</p>	<p>Evaluating social, cultural and historical context and different groups; (unintentional) biases and exclusions; and balance of minority and majority interests as well as protection of human rights</p> <p>Assessing and establishing measures to ensure inclusion, respect and trust</p>	<ul style="list-style-type: none"> Rights-based approaches including protection of indigenous rights, human rights and land rights (Policy/rights) impact assessments to consider impacts on different groups Equitable benefits from the energy transition and repair of harm (see also points j and m) Independent human rights and environmental monitoring bodies
<p>4 Preventing and repairing harm</p> <p>Respectful treatment and trust building</p>	<p>Anticipating, mitigating and preventing adverse impacts</p>	<ul style="list-style-type: none"> Participatory and inclusive processes that accord voice and influence to marginalised groups (see above) as well as support building of trust among different groups, such as government, the private sector and communities
<p>5 Justice across geographies</p>	<p>Rehabilitation and restoration</p>	<ul style="list-style-type: none"> Long-term planning Impact assessments (see also point 1)
<p>6 Justice across time</p>	<p>Resource depletion and (irreversible) environmental degradation</p>	<ul style="list-style-type: none"> Remediation and redress mechanisms including restitution, compensation or other reparative measures; Energy Financial Reserve Obligation policies to ensure funding for remediation Cultural preservation including of traditional knowledge Mediation and reconciliation (including redress mechanisms and recognition – see also points 2 and 3)
		<p>Data for assessments and evidence-based policy-making</p> <p>Inclusive governance and institutional arrangements</p> <p>Adequate financing, resources and capacities</p> <p>• Regional and local economic development/ diversification policies</p> <p>• Place-based investment strategies and cohesion policies</p> <p>• Transboundary impact assessments, mandatory supply chain due diligence</p> <p>• Standards for sustainable and ethical sourcing</p> <p>• Strengthened international co-operation and benefit sharing including international economic reforms, tax reforms, access to affordable and sufficient finance, industrial/local content requirements, technology sharing and capacity building</p> <p>• Recognition, consultation of and rights-based mechanisms for youth and future generations in policy development, design and implementation (including, e.g. ombudsman for future generations)</p> <p>• Inter-generational impact assessments</p> <p>• Ambitious global and national climate, renewable energy and energy efficiency policies</p> <p>• Sustainable resource management, conservation regulation</p> <p>• Biodiversity protection</p> <p>• Resource efficiency and environmental waste reduction (see also point 1 above)</p>

Note: Key considerations and policy actions may vary depending on the local context and need to be adapted accordingly. Different dimensions are also closely inter-linked as explained in more detail in section 3.

CHAPTER 4

CONCLUDING REFLECTIONS

In addition to climate, environmental and health gains, the energy transition offers substantial socio-economic opportunities to advance inclusive development and reduce existing inequalities in the energy sector. Currently, ownership of energy assets, as well as the benefits they provide, are unevenly distributed. Adverse impacts disproportionately affect marginalised communities and low-income groups, and millions struggle to afford energy services. Those most affected often face limited access to energy and finance and are frequently excluded from decision-making processes. Targeted and sustained policy interventions are therefore needed to ensure the energy transition reduces, rather than reinforces, existing inequalities, and avoids creating new ones.

Energy-related challenges do not exist in a vacuum; they are linked to wider economic and social structural issues. *Ad hoc* responses to global crises often fail to address systemic problems, sometimes further compounding inequalities (Arabadjieva *et al.*, 2023; Burke *et al.*, 2018). Voluntary approaches and market-based solutions have proven ineffective in addressing concerns related to the just energy transition and sustainability. While the private sector undoubtedly plays an important role in the energy transition, the provision of public goods and social equity cannot rely solely on making a business case for them.

A delayed energy transition carries significant justice implications, resulting in escalating costs imposed by the fossil fuel system and increasingly non-optimal trade-offs. Decades of inaction in addressing rising greenhouse gas emissions have intensified the climate crisis, necessitating urgent and fundamental systems transformation. The pathway to achieving global climate goals and ensuring universal energy access by 2030 is narrowing, and demanding increasingly rapid, disruptive and costly actions. The impacts of climate change and the lack of access to affordable energy are drastically impacting the well-being of people worldwide (IPCC, 2023a), rendering the status quo manifestly unjust.

Justice is not a monolithic or universally agreed-upon concept; its interpretation within the energy space is contested and evolving. However, this should not serve as an excuse for inaction. The lack of a consensus on an abstract, all-encompassing definition of a just energy transition is not an obstacle to specific actions, based on various justice dimensions outlined in this report, aimed at making the energy system more equitable and inclusive. While broadly shared principles and values are needed to guide our actions, the transition is occurring under circumstances not of our choosing, as climate change demands a swift response amid limited resources and geopolitical tensions. Honest conversations around difficult trade-offs must be pursued, recognising that there may not always be easy win-win solutions for every scenario.

The challenges of designing just energy transition policies are compounded by the far-reaching justice implications inherent in the energy transition – particularly the interplay between national decisions and international impacts – which can be difficult to grasp intuitively. Different individuals and societies have differing understandings of what justice entails. Our moral frameworks are also often ill-equipped to process the complexities of contemporary energy challenges (Markowitz and Shariff, 2012). Inclusive decision making at local or national levels regarding energy policies can have detrimental impacts across geographies and over time. This includes a range of challenges. For instance, personal mobility decisions such as the increased use of electric vehicles can adversely affect communities in regions where raw materials are sourced; decisions on carbon offsets can impact land availability in developing countries; and a slow and “orderly” phaseout of fossil fuels in coal and oil and gas regions can have severe repercussions for millions worldwide through increasingly severe climate impacts. Therefore, finding effective ways to communicate these issues and designing acceptable pathways that balance different concerns will require careful consideration.

Incorporating justice considerations into policy and institutional design is integral to success. Discontent is ripe in many societies, as governments and institutions struggle to effectively meet the needs of significant parts of their populations. In the climate and energy arena, protesters demand both more and less ambitious transition measures (Newell, 2021; Skjølsvold and Coenen, 2021). Research indicates that for people to accept societal and personal costs and shift towards more sustainable energy behaviour, fairness is an essential element (Bal *et al.*, 2023). Developing shared perspectives and narratives – and rooting policies in an understanding of the necessity to equitably share burdens and benefits – should be a key part of creating buy-in for climate and energy transition initiatives and rebuilding trust in institutions.

Policy makers must balance the urgency of energy sector reforms, driven by climate and development imperatives, and the time required for meaningful consultation with affected stakeholders. Strong government leadership remains indispensable for providing the structural backbone of the transition, including setting clear policy direction, mobilising finance at scale, enabling global coordination, and aligning actions across national and sub-national institutions. However, top-down approaches alone are insufficient to achieve a just energy transition. Policies that fail to account for local social, economic and cultural contexts risk eroding public trust, inciting social resistance and undermining implementation. Justice in the energy transition therefore depends not only on adopting just transition measures, but also on inclusive processes that ensure they account for diverse experiences, power asymmetries, and place-specific impacts.

Tailoring solutions and policies to their specific context, prioritising people's welfare and ensuring inclusive decision making is key to just energy transition efforts. The history of international development efforts is replete with examples of the failures that arise from implementing technological solutions without considering local capacities and contexts, including institutions, knowledge, skills and available resources (Jasanoff, 2018; Newell, 2021). Participatory planning and decision making are thus central to ensuring that solutions are contextually appropriate, socially accepted and effective in addressing the specific needs of the communities they are intended to serve.

Without adequate financing and resources, just energy transition efforts will fail. Constrained resources and human capacities add to the difficulties faced by national and international civil servants, politicians and leaders to effectively govern and foster a just energy transition. Energy transition financing is insufficient and inequitably distributed, while funding for fossil fuel development and use remains high. Financing for a just energy transition must consider issues such as the most appropriate financing approaches, equitable ownership structures, benefit sharing and reforms to the governance of international and national financial systems. Aligning existing financial flows with just energy transition objectives, alongside mobilising and utilising additional resources more effectively, will be essential (IRENA, 2021; IRENA *et al.*, 2025). International financing and reforms to the global financial architecture will be particularly critical to open up policy space in developing countries to pursue just energy transition efforts, given macro-economic constraints (Newell *et al.*, 2021; UN DESA, 2024b; UNCTAD, 2019).

Making global progress towards a just energy transition is fundamentally about political choices and the policy priorities that are valued and funded. Governments have demonstrated their ability to print money, raise debt ceilings or redirect resources when an issue is deemed an urgent political priority. This was evident during the 2008 bank bailouts, COVID-19 stimulus packages and increases in defence budgets in response to the Ukraine war. While these measures can be seen as reactions to immediate, existential threats such as potential financial collapse and national security, they also illustrate that, ultimately, funding decisions are often less about fiscal limitations and economic feasibility, and more about who defines what is necessary and possible. Risk tolerance appears to also vary across policy domains, with social and climate programmes generally held to more stringent expectations regarding cost efficiency and return on investment. Thus, realising a just energy transition requires a shift in momentum to ensure the same ambition and urgency is applied to social well-being and climate action as to other policy areas.

The pursuit of a just energy transition requires ongoing learning, vision building, and iterative and continuous efforts. The speed, direction and form of the energy transition and justice efforts are not singular or linear, nor can they be achieved through a single initiative, policy or financing instrument. As the transition unfolds, collective action is needed across local, national and international levels. All stakeholders must collaborate in good faith to create positive visions of the world we wish to inhabit, and consequently reform or develop the necessary instruments and institutions. Insights from past experiences can inform decision making, but bold ambitions are crucial to transcend past failures for a more just and inclusive future.



REFERENCES

Abram, S., et al. (2022), "Just Transition: A whole-systems approach to decarbonisation", *Climate Policy*, vol. 22/8, pp. 1033–49, Taylor & Francis, <https://doi.org/10.1080/14693062.2022.2108365>

Agence France-Presse (2021), "Norway court rules two windfarms harming Sami reindeer herders", www.theguardian.com/world/2021/oct/11/norway-court-rules-two-windfarms-harming-sami-reindeer-herders-turbines-torn-down (accessed 15 May 2024).

Agarwal, H., et al. (2023), *Enabling a Just Transition: Protecting Human Rights in Renewable Energy Projects*, Columbia Center on Sustainable Investment, New York, <https://ccsi.columbia.edu/content/enabling-just-transition-protecting-human-rights-renewable-energy-projects> (accessed 2 July 2023).

Alarcon, P., et al. (2022), "Policy Brief: Rethinking 'Just Transition': Critical Reflections for the Global South", www.researchgate.net/publication/362726229_Policy_Brief_Rethinking_%27Just_Transition%27_Critical_Reflections_for_the_Global_South

Anderson, K., et al. (2023), *LA100 Equity Strategies: Executive Summary*, <https://doi.org/10.2172/2221830>

Arabadjieva, K. et al. (2023), "Transformative ideas – ensuring a just share of progress for all", ETUI, Brussels, www.etui.org/publications/transformative-ideas-ensuring-just-share-progress-all

Atteridge, A., and Strambo, C. (2020), "Seven principles to realize a just transition to a low-carbon economy", www.sei.org/publications/seven-principles-to-realize-a-just-transition-to-a-low-carbon-economy (accessed 12 June 2021).

Baasch, S. (2023), "Towards an integrative understanding of multiple energy justices", *Geographica Helvetica*, vol. 78/4, pp. 547–58, <https://doi.org/10.5194/gh-78-547-2023>

Bainton, N., et al. (2021), "The energy-extractives nexus and the just transition", *Sustainable Development*, <https://doi.org/10.1002/sd.2163>

Bal, M., et al. (2023), "A fairway to fairness: Toward a richer conceptualization of fairness perceptions for just energy transitions", *Energy Research & Social Science*, vol. 103, pp. 103213, <https://doi.org/10.1016/j.erss.2023.103213>

Banerjee, A., and Schuitema, G. (2023), "Spatial justice as a prerequisite for a just transition in rural areas? The case study from the Irish peatlands", *Environment and Planning C: Politics and Space*, pp. 23996544231173210, SAGE Publications Ltd STM, <https://doi.org/10.1177/23996544231173210>

Biswas, S., et al. (2022), "Ending the Energy-Poverty Nexus: An Ethical Imperative for Just Transitions", *Science and Engineering Ethics*, vol. 28/4, pp. 36, <https://doi.org/10.1007/s11948-022-00383-4>

Bouzarovski, S. (2017), "Energy Poverty: (Dis)Assembling Europe's Infrastructural Divide" (Energy Poverty: (Dis) Assembling Europe's Infrastructural Divide) (p. 117), <https://doi.org/10.1007/978-3-319-69299-9>

Bouzarovski, S., and Simcock, N. (2017), "Spatializing energy justice", *Energy Policy*, vol. 107, pp. 640–8, <https://doi.org/10.1016/j.enpol.2017.03.064>

Brundtland, G. (1987), "Report of the World Commission on Environment and Development 'Our Common Future' (1987), annexed to UNGA Res A/42/427", <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>

Burke, M. J., and Stephens, J. C. (2018), "Political power and renewable energy futures: A critical review", *Energy Research & Social Science*, vol. 35, <https://doi.org/10.1016/j.erss.2017.10.018>

Business & Human Rights Resource Centre (2025), "Transition Minerals Tracker", www.business-humanrights.org/en/from-us/transition-minerals-tracker (accessed 21 September 2025).

Chan, T., et al. (2024), "Mapping justice in national climate action: a global overview of just transition policies", www.lse.ac.uk/grantham-institute/publication/mapping-justice-in-national-climate-action-a-global-overview-of-just-transition-policies

Chancel, L. et al. (eds.) (2022), "World Inequality Report 2022", *Belknap Press*, Cambridge, MA, <https://wir2022.wid.world>

Ciplet, D. (2021), "From energy privilege to energy justice: A framework for embedded sustainable development", *Energy Research & Social Science*, vol. 75, pp. 101996, <https://doi.org/10.1016/j.erss.2021.101996>

Clean Energy Council (2022), *Addressing Modern Slavery in the Clean Energy Sector*, www.cleanenergycouncil.org.au/resources/resources-hub/addressing-modern-slavery-in-the-clean-energy-sector?token=992

COP26 (2021), "COP26 Declaration: Supporting the Conditions for a Just Transition Internationally", <https://ukcop26.org/supporting-the-conditions-for-a-just-transition-internationally>

De Vries, A., et al. (2024), "Distributing Climate Costs Fairly" (Research for Policy), *Justice in Climate Policy* (pp. 1-13), Springer Nature Switzerland, Cham, https://doi.org/10.1007/978-3-031-59427-4_1

Diluiso, F., et al. (2021), "Coal transitions—part 1: a systematic map and review of case study learnings from regional, national, and local coal phase-out experiences", *Environmental Research Letters*, vol. 16/11, pp. 113003, <https://doi.org/10.1088/1748-9326/ac1b58>

Elemo, D. I. (2024), "Breaking Barriers: Integrating Energy Justice to Overcome Investor-State Dispute Settlement (ISDS) Roadblocks to Climate Change Mitigation Efforts" (Just Transitions), in R.J. Heffron and L. de Fontenelle (eds.), *The Power of Energy Justice & the Social Contract* (pp. 93-103), Springer Nature Switzerland, Cham, https://doi.org/10.1007/978-3-031-46282-5_14

Fritsch, M. et al. (2023), "Spatial Justice and Cohesion: The Role of Place-Based Action in Community Development" (1st edition), Routledge, London, <https://doi.org/10.4324/9781003229681>

G20 (2024), "Principles for Just and Inclusive Energy Transitions", www.g20.utoronto.ca/2024/241004-energy-principles.html

Gallagher, K. P. (2025), *The international financial architecture and sustainable prosperity*, WIDER Working Paper, No. 2025 (Volume 2025), UNU-WIDER, <https://doi.org/10.35188/UNU-WIDER/2025/571-4>

Galvin, R. (ed.) (2019), "Inequality and Energy: How Extremes of Wealth and Poverty in High Income Countries Affect CO₂ Emissions and Access to Energy", Elsevier.

Grant, R., et al. (2025), "Unjust or just unfortunate? Examining claims of procedural (in)justice in the pursuit of universal electricity access in Rwanda", *Energy Research & Social Science*, vol. 127, pp. 104246, <https://doi.org/10.1016/j.erss.2025.104246>

Gürtler, K. (2023), "Justice in energy transformations as a spatial phenomenon: A framework for analyzing multi-dimensional justice claims", *Energy Research & Social Science*, vol. 105, pp. 103277, <https://doi.org/10.1016/j.erss.2023.103277>

de Haes, S., and Lucas, P. (2024), "Environmental impacts of extraction and processing of raw materials for the energy transition", www.pbl.nl/system/files/document/2024-02/PBL-2024-Environmental-impacts-of-extraction-and-processing-of-raw-materials-for-the-energy-transition-5364.pdf

Hall, S. M. (2013), "Energy justice and ethical consumption: comparison, synthesis and lesson drawing", *Local Environment*, vol. 18/4, pp. 422-37, <https://doi.org/10.1080/13549839.2012.748730>

Healy, N., et al. (2019), "Embodied energy injustices: Unveiling and politicizing the transboundary harms of fossil fuel extractivism and fossil fuel supply chains", *Energy Research & Social Science*, vol. 48, pp. 219-34, <https://doi.org/10.1016/j.erss.2018.09.016>

Heffron, R. J. (2022), "Applying energy justice into the energy transition", *Renewable and Sustainable Energy Reviews*, vol. 156, pp. 111936, <https://doi.org/10.1016/j.rser.2021.111936>

Heffron, R. J., and McCauley, D. (2017), "The concept of energy justice across the disciplines", *Energy Policy*, vol. 105, pp. 658-67, <https://doi.org/10.1016/j.enpol.2017.03.018>

Hennessy, E. M., and Azevedo, I. M. L. (2024), "Emerging environmental justice issues at the intersection of transportation and electricity systems", *Progress in Energy*, vol. 6/3, pp. 033003, IOP Publishing, <https://doi.org/10.1088/2516-1083/ad422e>

Hickel, J., and Slamersak, A. (2022), "Existing climate mitigation scenarios perpetuate colonial inequalities", *The Lancet Planetary Health*, vol. 6/7, pp. e628-31, [https://doi.org/10.1016/S2542-5196\(22\)00092-4](https://doi.org/10.1016/S2542-5196(22)00092-4)

Hofverberg, Elin (2021), "Norway: Supreme Court Rules Windmill Park in Sami Area Violates Indigenous Rights", Library of Congress, Washington, D.C. 20540 USA, www.loc.gov/item/global-legal-monitor/2021-10-25/norway-supreme-court-rules-windmill-park-in-sami-area-violates-indigenous-rights (accessed 23 April 2024).

ICJ (2025), "Obligations of States in Respect of Climate Change (Advisory Opinion)", International Court of Justice, www.icj-cij.org/case/187

IEA, et al. (2025), *Tracking SDG7: The energy progress report 2025*, International Energy Agency, International Renewable Energy Agency, United Nations Statistics Division, the World Bank and World Health Organization, Geneva, www.irena.org/Publications/2025/Jun/Tracking-SDG-7-The-Energy-Progress-Report-2025

ILO (2013), *National Tripartite Social Dialogue: An ILO guide for improved governance*, www.ilo.org/publications/national-tripartite-social-dialogue-ilo-guide-improved-governance

ILO (2015), *Guidelines for a just transition towards environmentally sustainable economies and societies for all*, International Labour Organization, Geneva, www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_ent/documents/publication/wcms_432859.pdf

ILO (2023), *Social protection for a just transition*, www.ilo.org/global/topics/green-jobs/publications/just-transition-pb/WCMS_867426/lang--en/index.htm

ILO (2025), *World employment and social outlook: Trends 2025*, ILO, Geneva, <https://doi.org/10.54394/IZLN1673>

Indigenous Peoples Majors Group for Sustainable Development (2019), "Global Report of the Situation of Lands, Territories and Resources of Indigenous Peoples", *Indigenous Peoples Majors Group for Sustainable Development*, www.iccaconsortium.org/2019/04/25/global-report-on-the-situation-of-lands-territories-and-resources-of-indigenous-peoples

IPCC (2014), "Climate Change 2014 Synthesis Report Summary for Policymakers In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change", Cambridge University Press, www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

IPCC (2018), Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, Cambridge, UK and New York, NY, USA, <https://www.ipcc.ch/sr15>

IPCC (2023a), Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, <https://doi.org/10.1017/9781009325844>

IPCC (2023b), AR6 Synthesis Report: Climate Change 2023, www.ipcc.ch/report/sixth-assessment-report-cycle

IRENA (2019), Renewable energy: A gender perspective, International Renewable Energy Agency, Abu Dhabi, www.irena.org/publications/2019/Jan/Renewable-Energy-A-Gender-Perspective (accessed 31 January 2022).

IRENA (2020), Post-COVID recovery: An agenda for resilience, development and equality, International Renewable Energy Agency, Abu Dhabi, www.irena.org/publications/2020/Jun/Post-COVID-Recovery

IRENA (2021), World energy transitions outlook: 1.5°C pathway, International Renewable Energy Agency, Abu Dhabi, www.irena.org/publications/2021/Jun/World-Energy-Transitions-Outlook

IRENA (2022), World Energy Transitions Outlook 2022: 1.5°C Pathway, International Renewable Energy Agency, Abu Dhabi, www.irena.org/publications/2022/Mar/World-Energy-Transitions-Outlook-2022

IRENA (2023a), World Energy Transitions Outlook 2023: 1.5°C Pathway, International Renewable Energy Agency, Abu Dhabi, www.irena.org/Publications/2023/Jun/World-Energy-Transitions-Outlook-2023

IRENA (2023b), Renewable energy markets: GCC 2023, International Renewable Energy Agency, Abu Dhabi, www.irena.org/Publications/2023/Dec/Renewable-energy-market-analysis-GCC

IRENA (2025a), Renewable power generation costs in 2024, International Renewable Energy Agency, Abu Dhabi, www.irena.org/Publications/2025/Jun/Renewable-Power-Generation-Costs-in-2024

IRENA (2025b), A just energy transition for communities: Large-scale wind and solar projects in Sub-Saharan Africa, International Renewable Energy Agency, Abu Dhabi, www.irena.org/Publications/2025/Jan/A-just-energy-transition-for-communities-Large-scale-wind-and-solar-projects-in-Sub-Saharan-Africa

IRENA (2025c), Participatory processes for strategic energy planning: A toolkit for national energy planners, International Renewable Energy Agency, Abu Dhabi, www.irena.org/Publications/2025/Sep/Participatory-processes-for-strategic-energy-planning-A-toolkit-for-national-energy-planners

IRENA (2025d), Renewable energy: A gender perspective (Second edition), www.irena.org/Publications/2025/Oct/Renewable-Energy-A-Gender-Perspective

IRENA (2025e), Renewable energy statistics 2025, International Renewable Energy Agency, Abu Dhabi, www.irena.org/Publications/2025/Jul/Renewable-energy-statistics-2025

IRENA (2026a), Renewable energy auctions: Design and risk allocation, International Renewable Energy Agency, Abu Dhabi, www.irena.org/Publications/2026/Jan/Renewable-energy-auctions-Design-for-risk-allocation

IRENA (2026b), Local environmental impacts and benefits of large-scale solar PV plants, International Renewable Energy Agency, Abu Dhabi, www.irena.org/Publications/2026/Jan/Local-environmental-effects-and-benefits-of-large-scale-solar-PV-plant

IRENA Coalition for Action (2020), "Stimulating Investment in Community Energy: Broadening the ownership of renewables", https://www.irena.org/-/media/Files/IRENA/Coalition-for-Action/IRENA_Coalition_Stimulating_Investment_in_Community_Energy_2020.pdf

IRENA and CPI (2025), *Global landscape of energy transition finance 2025*, International Renewable Energy Agency and Climate Policy Initiative, Abu Dhabi, www.irena.org/Publications/2025/Nov/Global-landscape-of-energy-transition-finance-2025

IRENA, and GCGET (2019), *A new world: The geopolitics of the energy transformation*, International Renewable Energy Agency and Global Commission on the Geopolitics of Energy Transformation, Abu Dhabi, www.irena.org/Publications/2019/Jan/A-New-World-The-Geopolitics-of-the-Energy-Transformation

IRENA and ILO (2021), *Renewable energy and jobs: Annual review 2021*, International Renewable Energy Agency, International Labour Organization, Abu Dhabi, Geneva, www.irena.org/publications/2021/Oct/Renewable-Energy-and-Jobs-Annual-Review-2021

IRENA and ILO (2024), *Renewable energy and jobs: Annual review 2024*, International Renewable Energy Agency and International Labour Organization, Abu Dhabi, www.irena.org/Publications/2024/Oct/Renewable-energy-and-jobs-Annual-review-2024

Jaradat, A., et al. (2024), "Youth as energy citizens or passive actors? A critical review of energy transition scholarship", *Energy Research & Social Science*, vol. 108, pp. 103405, <https://doi.org/10.1016/j.erss.2023.103405>

Jasanoff, S. (2018), "Just transitions: A humble approach to global energy futures", *Energy Research & Social Science*, vol. 35, pp. 11-4, <https://doi.org/10.1016/j.erss.2017.11.025>

Johansson, V. (2023), "Just Transition as an Evolving Concept in International Climate Law", *Journal of Environmental Law*, vol. 35/2, pp. 229–49, <https://doi.org/10.1093/jel/eqad017>

Johnson, O. W., et al. (2020), "Intersectionality and energy transitions: A review of gender, social equity and low-carbon energy", *Energy Research & Social Science*, vol. 70, pp. 101774, <https://doi.org/10.1016/j.erss.2020.101774>

Jones, C. F. (2013), "Building More Just Energy Infrastructure: Lessons from the Past", *Science as Culture*, vol. 22/2, pp. 157–63, <https://doi.org/10.1080/09505431.2013.786991>

Just Transition Research Collaborative (2018), *Mapping Just Transition(s) to a Low-Carbon World*, [www.unrisd.org/80256B3C005BCCF9/\(httpPublications\)/9B3F4F10301092C7C12583530035C2A5?OpenDocument](http://www.unrisd.org/80256B3C005BCCF9/(httpPublications)/9B3F4F10301092C7C12583530035C2A5?OpenDocument)

Khan, H. A. U., et al. (2022), "Inequitable access to EV charging infrastructure", *The Electricity Journal*, vol. 35/3, pp. 107096, <https://doi.org/10.1016/j.tej.2022.107096>

Krause, D., et al. (2022), "Just transitions for a new eco-social contract: analysing the relations between welfare regimes and transition pathways", *Transfer: European Review of Labour and Research*, vol. 28/3, pp. 367–82, SAGE Publications Ltd, <https://doi.org/10.1177/10242589221127838>

Lecocq, F., et al. (2022), "Mitigation and Development Pathways in the Near to Mid-term", *Climate Change 2022 - Mitigation of Climate Change* (1st edition, pp. 409–502), Cambridge University Press, <https://doi.org/10.1017/9781009157926.006>

Ledger, T. and Rampedi, M. (2022), "Hungry for electricity", Public Affairs Research Institute (PARI), Johannesburg, South Africa.

Lee, J., and Byrne, J. (2019), "Expanding the Conceptual and Analytical Basis of Energy Justice: Beyond the Three-Tenet Framework", *Frontiers in Energy Research*, vol. 7, www.frontiersin.org/articles/10.3389/fenrg.2019.00099

Lelieveld, J., et al. (2023), "Air pollution deaths attributable to fossil fuels: observational and modelling study", *BMJ*, vol. 383, pp. e077784, British Medical Journal Publishing Group, <https://doi.org/10.1136/bmj-2023-077784>

Levenda, A. M., et al. (2021), "Renewable energy for whom? A global systematic review of the environmental justice implications of renewable energy technologies", *Energy Research & Social Science*, vol. 71, pp. 101837, <https://doi.org/10.1016/j.erss.2020.101837>

Liu, P., and Barlow, C. Y. (2017), "Wind turbine blade waste in 2050", *Waste Management*, vol. 62, pp. 229–40, <https://doi.org/10.1016/j.wasman.2017.02.007>

Markowitz, E. M., and Shariff, A. F. (2012), "Climate change and moral judgement", *Nature Climate Change*, vol. 2/4, pp. 243–7, Nature Publishing Group, <https://doi.org/10.1038/nclimate1378>

McCauley, D., et al. (2013), "Advancing Energy Justice: The Triumvirate of Tenets", *International Energy Law Review*, vol. 32/3, pp. 107–10., Sweet and Maxwell.

McCauley, D., et al. (2019), "Energy justice in the transition to low carbon energy systems: Exploring key themes in interdisciplinary research", *Applied Energy*, vols 233–234, pp. 916–21, <https://doi.org/10.1016/j.apenergy.2018.10.005>

McCauley, D., and Heffron, R. (2018), "Just transition: integrating climate, energy and environmental justice", *Energy Policy*, vol. 119/C, pp. 1–7, www.sciencedirect.com/science/article/abs/pii/S0301421518302301

Min, B., et al. (2024), "Lost in the dark: A survey of energy poverty from space", *Joule*, vol. 8/7, pp. 1982–98, <https://doi.org/10.1016/j.joule.2024.05.001>

Morena, E. et al. (eds.) (2019), "Just Transitions: Social Justice in the Shift Towards a Low-Carbon World", Pluto Press, <https://doi.org/10.2307/j.ctvs09qr>

Muñoz Cabré, M., and Araújo, J. A. V. (2022), *Considerations for a just and equitable energy transition*, www.sei.org/publications/just-equitable-energy-transition

Newell, P. (2021), "Power Shift: The Global Political Economy of Energy Transitions", Cambridge University Press.

Newell, P., et al. (2021), "Toward Transformative Climate Justice: An Emerging Research Agenda", John Wiley & Sons, <https://doi.org/10.1002/wcc.733>

Newell, P. (2024), "Landscapes of (in)justice: Reflecting on voices, spaces and alliances for just transitions", *Social Science*, www.sciencedirect.com/science/article/pii/S2214629624002925

Newell, P. J., et al. (2022), "Navigating tensions between rapid and just low-carbon transitions", *Environmental Research Letters*, vol. 17/4, pp. 041006, <https://doi.org/10.1088/1748-9326/ac622a>

Ohlsson, J., and Skillington, T. (2023), "Intergenerational Justice", Theorising Justice (pp. 223–39), Bristol University Press, <https://bristoluniversitypressdigital.com/display/book/9781529232233/ch014.xml>

Owen, J. R., et al. (2022), "Fast track to failure? Energy transition minerals and the future of consultation and consent", *Energy Research & Social Science*, vol. 89, pp. 102665, <https://doi.org/10.1016/j.erss.2022.102665>

Redgwell, C., and Rajamani, L. (2020), "And Justice for All? Energy Justice in International Law", in I. del Guayo et al. (eds.), *Energy Justice and Energy Law* (p. 0), Oxford University Press, <https://doi.org/10.1093/oso/9780198860754.003.0004>

Renkens, I. M. (2024), "Mind the Gap: Conflicts in the Implementation of Kenya's Lake Turkana Wind Power Project", *Forum for Development Studies*, <https://doi.org/10.1080/08039410.2024.2351879>

Romero-Lankao, P., et al. (2023), *LA100 Equity Strategies. Chapter 1: Justice as Recognition*, <https://doi.org/10.2172/2221831>

Rosner, N., et al. (2023), *LA100 Equity Strategies. Chapter 2: Procedural Justice*, No. NREL/TP--5400-85949, 2221836, MainId:86722 (p. NREL/TP--5400-85949, 2221836, MainId:86722), <https://doi.org/10.2172/2221836>

Rubiano Rivadeneira, N., and Carton, W. (2022), "(In)justice in modelled climate futures: A review of integrated assessment modelling critiques through a justice lens", *Energy Research & Social Science*, vol. 92, pp. 102781, <https://doi.org/10.1016/j.erss.2022.102781>

Ruppert Bulmer, E., et al. (2021), *Global Perspective on Coal Jobs and Managing Labor Transition out of Coal: Key Issues and Policy Responses*, World Bank, <https://doi.org/10.1596/37118>

Scherhaufer, P. (2021), "The complex relations between justice and participation in collaborative planning processes for a renewable energy transition", *Routledge Handbook of Energy Democracy*, Routledge.

Sen, A. (2010), "The Idea of Justice", Penguin UK.

Setzer, J., and Benjamin, L. (2019), "Climate Litigation in the Global South: Constraints and Innovations", *Transnational Environmental Law*, www.cambridge.org/core/journals/transnational-environmental-law/article/abs/climate-litigation-in-the-global-south-constraints-and-innovations/C2FE951D203AC61414E72C9244125258

Shelton, R. E., and Eakin, H. (2022), "Who's fighting for justice? Advocacy in energy justice and just transition scholarship", *Environmental Research Letters*, vol. 17/6, pp. 063006, <https://doi.org/10.1088/1748-9326/ac7341>

Skjølvold, T. M., and Coenen, L. (2021), "Are rapid and inclusive energy and climate transitions oxymorons? Towards principles of responsible acceleration", *Energy Research & Social Science*, vol. 79, pp. 102164, <https://doi.org/10.1016/j.erss.2021.102164>

Sovacool, B. K., et al. (2016), "Energy decisions reframed as justice and ethical concerns", *Nature Energy*, vol. 1/5, pp. 16024, <https://doi.org/10.1038/nenergy.2016.24>

Sovacool, B. K., et al. (2017), "New frontiers and conceptual frameworks for energy justice", *Energy Policy*, vol. 105, pp. 677-91, <https://doi.org/10.1016/j.enpol.2017.03.005>

Sovacool, B. K., et al. (2019), "Decarbonization and its discontents: a critical energy justice perspective on four low-carbon transitions", *Climatic Change*, vol. 155/4, pp. 581-619, <https://doi.org/10.1007/s10584-019-02521-7>

Sovacool, B.K. (2011), "Contesting the Future of Nuclear Power: A Critical Global Assessment of Atomic Energy", *World Scientific*.

Sovacool, B.K. and Dworkin, M.H. (2014), "Global energy justice : problems, principles, and practices", Cambridge University Press.

Stagner, T. D. (2024), "Tribes turn to the U.N. for help intervening in gigantic Arizona wind project", *High Country News*, www.hcn.org/articles/tribes-turn-to-the-u-n-for-help-intervening-in-gigantic-arizona-wind-project (accessed 13 May 2024).

Stevis, D., and Felli, R. (2020), "Planetary just transition? How inclusive and how just?" (Exploring Planetary Justice), *Earth System Governance*, vol. 6, pp. 100065, <https://doi.org/10.1016/j.esg.2020.100065>

Suboticki, I., et al. (2023), "Fostering justice through engagement: A literature review of public engagement in energy transitions", *Energy Research & Social Science*, vol. 99, pp. 103053, <https://doi.org/10.1016/j.erss.2023.103053>

Tarasova, E. (2024), "Rethinking justice as recognition in energy transitions and planned coal phase-out in Poland", *Energy Research & Social Science*, vol. 112, pp. 103507, <https://doi.org/10.1016/j.erss.2024.103507>

Tørres, L. (2021), *Social Dialogue as a Tool to Fight Inequality & Recover After a Pandemic*, <https://cic.nyu.edu/resources/social-dialogue-as-a-tool-to-fight-inequality-recover-after-a-pandemic>

UN (2015), "UNGA Resolution A/RES/70/1 - Transforming our world: the 2030 Agenda for Sustainable Development", www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf (accessed 16 March 2016).

UN (2019), "International Expert Group Meeting 'Conservation and the rights of indigenous peoples' (Articles 29 and 32 of the United Nations Declaration on the Rights of Indigenous Peoples)", www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/12/EGM_2019_ConceptNote.pdf

UN (2023), *Policy Briefs in Support of the High-Level Political Forum 2023 - Ensuring Universal Energy Access and Advancing Just, Inclusive and Equitable Energy Transitions*, <https://sdgs.un.org/sites/default/files/2023-07/2023%20Policy%20Briefs%20in%20Support%20of%20the%20High-Level%20Political%20Forum-071023.pdf> (accessed 16 July 2023).

UN (2024), "Greenwashing – the deceptive tactics behind environmental claims", United Nations, www.un.org/en/climatechange/science/climate-issues/greenwashing

UN (2025), "A/80/188: A human rights-based approach to the energy transition - Report of the Special Rapporteur on the promotion and protection of human rights in the context of climate change", www.ohchr.org/en/documents/thematic-reports/a80188-human-rights-based-approach-energy-transition

UN DESA (2024a), "World Population Prospects 2024", <https://population.un.org/wpp>

UN DESA (2024b), "Report of the Inter-agency Task Force on Financing for Development: Financing for Sustainable Development Report 2024" (Report of the Inter-Agency Task Force on Financing for Development), United Nations, <https://doi.org/10.18356/9789216040031>

UNCTAD (2019), *Trade and Development Report 2019 - Financing a global green new deal*, Geneva, <https://unctad.org/publication/trade-and-development-report-2019>

UNECE (2021), *Life Cycle Assessment of Electricity Generation Options*, <https://unece.org/sed/documents/2021/10/reports/life-cycle-assessment-electricity-generation-options>

UNECE (2025), "Guiding Principles for Just Transition", https://unece.org/sites/default/files/2025-08/CSE_34%202025%20INF3%20UNECE%20Guiding%20Principles%20for%20Just%20Transition%20.pdf

UNEP (2025), "Emissions Gap Report 2025: Off Target - Continued Collective inaction puts Global Temperature Goal at Risk", United Nations Environment Programme, <https://doi.org/10.59117/20.500.11822/48854>

UNFCCC (2015), "The Paris Agreement", <https://unfccc.int/process-and-meetings/the-paris-agreement>

UNFCCC (2023), *Outcome of the first global stocktake, revised advance version, No. FCCC/PA/CMA/2023/L.17; Draft decision CMA.5*, United Nations Framework Convention on Climate Change, https://unfccc.int/sites/default/files/resource/cma2023_L17_adv.pdf

UNICEF (2024), "Meaningful Youth Engagement in the Multilateral System: Voices for Impact", www.unicef.org/innocenti/reports/meaningful-youth-engagement-multilateral-system

Vanclay, F. (2020), "Reflections on Social Impact Assessment in the 21st century", *Impact Assessment and Project Appraisal*, vol. 38/2, pp. 126–31, <https://doi.org/10.1080/14615517.2019.1685807>

Wang, X., and Lo, K. (2021), "Just transition: A conceptual review", *Energy Research & Social Science*, vol. 82, pp. 102291, <https://doi.org/10.1016/j.erss.2021.102291>

Waters-Bayer, A., and Wario, H. T. (2022), "Pastoralism and large-scale renewable energy and green hydrogen projects", www.boell.de/en/2022/05/18/pastoralism-and-large-scale-renewable-energy-and-green-hydrogen-projects

World Bank (2025), "State of Social Protection Report 2025", <https://openknowledge.worldbank.org/server/api/core/bitstreams/3a191516-270b-40c9-acdf-79e3f382c708/content>

WWF (2021), "Just Energy Transformation - A discussion paper", https://wwfint.awsassets.panda.org/downloads/wwf_discussion_paper___just_energy_transformation.pdf



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