



Original research article

Justice and modern slavery in energy sector value chains

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ABSTRACT

This article discusses the critical role of global supply chains in modern energy production, particularly in the renewable energy sector. As the demand for clean energy grows, concerns about modern slavery risks in the extraction and processing of materials for renewable technologies are highlighted with a law and policy approach. This article advocates for a comprehensive strategy that integrates environmental safeguards with robust human rights standards. This is an underexplored area of the energy sector, and its broad effect has not been considered in terms of combating modern slavery. The research focuses on one of the most advanced frameworks globally, specifically Australia's *Modern Slavery Act 2018*. It also adopts a comparative perspective and analyses it with reference to other frameworks, proposing practical strategies based on energy justice theories that have already been incorporated into other policy frameworks. It emphasizes the integration of distributive, procedural, restorative, recognition, and cosmopolitan justice principles in the development of energy value chains needed for the energy transition. If adopted, these principles provide support for modern slavery frameworks to improve their ability to impact citizen livelihoods and corporate behaviour.

1. Introduction

In today's interconnected global economy, transnational supply chains underpin the architecture of modern production systems. This dynamic extends beyond the manufacture of consumer goods, such as clothing and electronics; it penetrates the core infrastructure of global industries, particularly the energy. The transition to renewable energy is not merely technological; it is fundamentally a material transformation, driving unprecedented demand for critical minerals that are geographically concentrated and frequently sourced from high-risk regions [1,2]. The clean energy transition's vulnerability extends across technologies: the lithium and cobalt in electric vehicle batteries, the rare earth elements in wind turbines, the silver and copper in solar panels, and the nickel for grid storage, all are embedded in supply chains marked by

complex social risks. Among all the social risks in mineral supply chains, modern slavery emerges as a particularly pervasive and under-addressed concern.

Numerous scholarly studies underscore the significant prevalence of risks of modern slavery within the energy and resources sector [3,4]. These risks arise from a confluence of structural and operational factors, including intensified demand for low-skilled and migrant labour, operations in jurisdictions with weak regulatory oversight and pronounced socio-economic vulnerabilities, and the precarious, short-term nature of employment in construction and mining projects [5]. Compounding these vulnerabilities is the energy sector's heavy reliance on third-party contractors for mining, construction, and maintenance activities, as well as its involvement in sea transport, a domain widely recognised as high-risk¹ for labour exploitation [6]. Collectively, these conditions have

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E-mail addresses: ridoan.karim@monash.edu (R. Karim), raphael.heffron@adu.ac.ae (R.J. Heffron), shakoor.ahmed@monash.edu (S. Ahmed).¹ The term "high-risk" refers to sectors with a documented history of labour exploitation and weak regulatory oversight. According to reports by the International Labour Organization and the United Nations Office on Drugs and Crime, the sea transport sector is especially vulnerable to forced labour, human trafficking, and exploitative working conditions due to its complex transnational operations and lack of enforcement capacity in international waters.

prompted global discourse on the persistent challenge of enforcing accountability across energy supply chains.

This paper investigates these challenges through the lens of energy justice²—a framework that applies principles of distributive, procedural, restorative, cosmopolitan, and recognition justice to energy systems [7–9]—to ask: *How can modern slavery legislation be effectively designed and evaluated to mitigate exploitation in the energy sector's global supply chains?* To answer this, we conduct a critical legal analysis of Australia's *Modern Slavery Act 2018* as a key case study.

In recent years, numerous countries have enacted legislation to promote accountability across diverse supply chains, extending beyond the energy sector (see Section 2 of this article). These legislative measures aim to identify, assess and address various types of exploitation commonly denoted as “modern slavery”. For the purposes of this study, we adopt the umbrella term “modern slavery” as defined in the Australian *Modern Slavery Act 2018*, which encompasses crimes such as forced labour, wage exploitation, debt bondage, human trafficking, servitude, forced marriage, deceptive recruiting for labour services and severe forms of child labour [5].³ The law mandates that companies with an annual turnover exceeding \$100 million disclose their initiatives in recognizing and mitigating potential exploitation risks within their supply chains. Such companies are obligated to outline their risk assessment policies and the effectiveness of any corrective measures taken. Concurrently, the *Modern Slavery Act 2018 (NSW)* was introduced, focusing on businesses with a more modest annual turnover threshold of \$50 million. This particular law entrusts oversight responsibilities to the Anti-Slavery Commissioner of New South Wales.

We selected Australia as our primary case study for three key reasons. First, its legislation is relatively recent and shares a common heritage with the UK's pioneering Act, yet possesses distinct features such as a centralized government registry that enables to examine the entities' response systematically. Second, as a major economy heavily reliant on both energy exports and imports, Australia's supply chains are deeply enmeshed in the Asia-Pacific region, a documented hotspot for labour exploitation, making it particularly relevant for examining energy sector vulnerabilities. Third, its national reporting requirement provides a publicly accessible, standardized dataset of corporate statements, which offers a unique empirical basis for evaluating the law's practical impact.

It is also of interest in this article to see if the new legislative measures around the world have any impact on the energy sector from a legal perspective. While it is impossible to cover all jurisdictions in one article, the Australian legislation shows promise for evaluation because of the three key reasons identified in the previous paragraph. Hence, this

article explores Australia's modern slavery laws, placing a special focus on their implications for the country's energy sector.

Nevertheless, in order to thoroughly evaluate Australia's *Modern Slavery Act* as it pertains to the energy industry, we have reviewed and referenced the legal framework for combating modern slavery in other jurisdictions. Additionally, we have explored deeper into the feasibility of applying practical strategies based on energy justice theories to address concerns about modern slavery risks effectively.

Following this introduction, Section 2 of the article reviews recent legal developments related to modern slavery, including international conventions and human rights instruments. This overview demonstrates how these global standards are influencing national legislative responses. After understanding the latest legislative changes worldwide, Section 3 focuses on identifying modern slavery practices within the energy industry. In Section 4, we present a theoretical framework for addressing modern slavery in the energy sector, which is based on the principles of energy justice. Section 5 critically evaluates Australia's *Modern Slavery Act*, highlighting a missed opportunity from the perspective of energy justice. It is important to note that this study primarily focuses on Australia and its *Modern Slavery Act* as a case study to examine the law's effectiveness in managing risks within energy supply chains. The UK, EU, and US regimes are included not for comparative legal analysis per se, but to provide context and benchmarks for assessing Australia's legislative and policy design. Finally, Section 6 envisions how modern slavery legislation could be developed through the lens of energy justice, offering a forward-looking perspective.

2. Recent legal developments relating to modern slavery

International law provides a critical framework for combating modern slavery, an effort rooted in centuries of legal evolution. The movement to abolish slavery, driven by societal pressure and moral campaigns dating back to the 17th century, progressively shifted from moral advocacy to binding national laws, such as the *British Slave Trade Abolition Act of 1807* [10]. Inspired by Britain, France abolished slavery in 1848, Russia followed suit in 1861, and the USA did the same in 1863 with the Emancipation Proclamation, establishing the foundational principle that human beings cannot be property [11]. This principle was codified internationally when, in 1926, the League of Nations endorsed a convention to halt the slave trade and abolish slavery. This agreement, endorsed by 30 countries, was designed to eliminate slavery. According to Article 1.1 of the convention, slavery is defined as “the status or condition of a person over whom any or all of the powers attached to the right of ownership are exercised.” [12].

As legal understanding evolved, the focus expanded from the explicit ownership of people to the broader concept of forced labour. Article 2.1 of the *1930 Forced Labour Convention* by the International Labour Organization (ILO) outlines that forced labour occurs when an individual is compelled to work against their will, under the threat of punishment, and without volunteering for the work [13]. Together, the 1926 Convention and the 1930 ILO Convention established the bedrock definitions that continue to inform all modern instruments, expanding the legal prohibition from ownership-based slavery to coercion-based forced labour. The *European Convention on Human Rights of 1950*, under Article 4, also explicitly prohibits slavery and forced labour, aligning the region with this global commitment to eradicate these practices.

In the contemporary era, the umbrella term “modern slavery” has emerged to encompass these historical forms of exploitation, including both slavery and forced labour, alongside other severe practices like human trafficking and debt bondage. Since the inception of the United Nations (UN), it has been at the forefront of establishing fundamental

² Energy justice refers to the fair and equitable distribution of the benefits and burdens of energy production and consumption, ensuring that all individuals and communities—particularly marginalized or vulnerable groups—have access to affordable, reliable, sustainable, and modern energy services. It is grounded in five core principles: (a) distributive justice – the equitable allocation of energy-related costs, risks, and benefits across different social groups and geographies; (b) procedural justice – the establishment of inclusive, transparent, and participatory decision-making processes regarding energy development and policies; (c) recognition justice – the acknowledgment of and respect for the rights, dignity, and distinct experiences of all communities, especially historically marginalized or oppressed groups; (d) restorative justice – the active remediation of past and present harms caused by the energy system, including providing compensation and support to affected communities and workers; and (e) cosmopolitan justice – the application of global equity and ethical responsibilities that transcend national borders, ensuring that energy policies do not unjustly export burdens to vulnerable populations in other countries.

³ The Act defines: “*modern slavery* means conduct which would constitute:

(a) an offence under Division 270 or 271 of the *Criminal Code*; or
(b) an offence under either of those Divisions if the conduct took place in Australia; or
(c) trafficking in persons, as defined in Article 3 of the Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime, done at New York on 15 November 2000 ([2005] ATS 27); or
(d) the worst forms of child labour, as defined in Article 3 of the ILO Convention (No. 182) concerning the Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour, done at Geneva on 17 June 1999 ([2007] ATS 38).”

norms to combat modern slavery. Since 2011, the UN Human Rights Council has unanimously supported the UN Guiding Principles on Business and Human Rights (UNGPs) [14]. Commonly referred to as the *Ruggie Principles*⁴ or *Ruggie framework*, these principles are built upon three fundamental pillars: protect, respect, and remedy. The framework underscores the corporate responsibility to uphold human rights and guarantees that victims have accessible and effective remedies.

Building upon the UNGPs' foundational framework, regional and national legal regimes have progressively translated these principles into binding obligations. European laws, drawing their spirit from the *Ruggie Principles*, now serve as a critical instrument in the concerted battle to eradicate modern slavery. The *EU's directive on Non-financial and Diversity Information Disclosure in 2014* imposes reporting obligations on large companies, ensuring they disclose non-financial information, including measures taken to respect human rights.

The first wave of national legislation focused primarily on transparency and disclosure mandates, though with varying scopes and effectiveness. These international initiatives influenced national and local legislative responses. Recognizing the severity and illegitimacy of modern slavery in recent years has prompted governments to take decisive action. This response has led to the introduction of new legislation, including the *California Transparency in Supply Chains Act of 2010*, the *Dodd-Frank Act of 2010* in the United States, and the *Modern Slavery Act of 2015* in the UK. These laws specifically address how businesses operate and manage their supply chains, with the goal of preventing severe labour exploitation and crimes against humanity. Fig. 1 presents a global map highlighting significant actions taken to safeguard human rights in business operations and supply chains.

The evolution of mandatory disclosure laws represents a significant, yet limited, approach to addressing modern slavery in global supply chains, with direct implications for the energy sector. The pioneering U.S. *Dodd-Frank Act*, Section 1502 (2010) [15], targeted conflict minerals (3TG)⁵ from the DRC region, mandating supply chain due diligence and transparency through a structured reporting process [16]. While its effectiveness is debated, research indicates it raised corporate awareness, motivated responsible sourcing practices for minerals critical to electronics and renewable energy components, and contributed to alleviating mineral-related conflicts [17]. However, its limits are stark: it does not prohibit the use of conflict minerals, enforcement is weak and focused solely on reporting accuracy [18,19] and the complexity of mineral supply chains often leads to inconclusive determinations, failing to ensure ethical sourcing for critical materials used in batteries, solar panels, wind turbines, and other renewable energy technologies.

The global legislative landscape is evolving to address these gaps, yet its direct impact on energy supply chains remains uneven. The EU Conflict Minerals Regulation (2017/821) [20], fully enforced in 2021, moves beyond disclosure by imposing mandatory due diligence on EU importers of 3TG, obliging them to source from conflict-free suppliers. This regulation directly pressures European renewable energy firms to scrutinize and clean their mineral supply chains, particularly for materials essential to wind turbines, solar panels, and battery storage systems. Conversely, Canada's efforts have stalled, with a conflict minerals

bill (C-486) defeated and newer proposals (C-262, C-243, S-211) still under review [21], creating a regulatory lag that affects North American energy markets. In a different approach, South Africa's Upstream Petroleum Bill (2021) mandates Social and Labour Plans (SLPs), focusing on the social impacts of local mining operations rather than global supply chains [22]. This highlights a key limitation of many disclosure laws: their focus is often either on specific minerals (like 3TG) or on direct operations, thereby failing to comprehensively address the vast network of subcontracting, construction, shipping, and multi-tier procurement upon which the global energy sector, particularly renewable energy deployment, relies. This regulatory patchwork leaves significant blind spots, allowing exploitative labour practices to persist in the less visible tiers of energy supply chains, from lithium mines in South America to cobalt extraction in Central Africa to polysilicon processing facilities in Asia.

Recognizing these limitations, the UK's Modern Slavery Act 2015 attempted a broader sectoral approach, though with mixed results for the energy industry. In the UK, the *Modern Slavery Act 2015* emerged from Britain's decades-long efforts and commitment to combating slavery through civil society, NGOs, and government; then-home Secretary Theresa May announced the Act's development in 2013. While the UK Act was initially crafted to combat modern slavery, its early drafts lacked the crucial transparency clause. It was only after significant campaigning by civil society that Section 54, mandating organisational transparency and accountability in the supply chain regarding efforts to eliminate slavery and human trafficking, was incorporated into the Act's final version [23]. Under Section 54(8), the Act mandates that commercial organizations operating within the UK, with an annual turnover of £36 million or more, a threshold aligned with the Companies Act 2006 for classifying a "large" company, must disclose the measures taken within the financial year to prevent slavery and human trafficking in their supply chains and operations.⁶ These disclosures can either detail the actions undertaken or acknowledge that no steps have been taken [Section 54(4)]. An organization's slavery and human trafficking statement may include information about—

(a) the organization's structure, its business and its supply chains; (b) its policies in relation to slavery and human trafficking; (c) its due diligence processes in relation to slavery and human trafficking in its business and supply chains; (d) the parts of its business and supply chains where there is a risk of slavery and human trafficking taking place, and the steps it has taken to assess and manage that risk; (e) its effectiveness in ensuring that slavery and human trafficking is not taking place in its business or supply chains, measured against such performance indicators as it considers appropriate; (f) the training about slavery and human trafficking available to its staff. [Section 54(5)].

The evidence on the UK *Modern Slavery Act* reveals the core strengths and limitations of broad disclosure regimes for complex global industries like energy. Its primary strength lies in creating a baseline of transparency and raising corporate awareness, forcing board-level attention on modern slavery risks that were previously ignored [24,25]. However, its effectiveness is severely limited by a lack of enforcement and the voluntary nature of its substantive requirements, leading to widespread symbolic compliance rather than meaningful action [26], [27,28]. For the energy sector, these limitations are acutely felt.

The law's generic framework fails to mandate specific disclosures on high-risk energy activities, such as mineral extraction for renewable technologies, the use of migrant labour in large-scale construction projects for wind farms or solar installations, or the complex subcontracting chains in shipping and logistics that transport components across borders. Consequently, while many energy companies produce compliance statements, research demonstrates these often lack concrete details on due diligence for the specific, high-risk nodes within their supply chains,

⁴ Prof John Ruggie was the UN Special Representative for Business and Human Rights and architect of the UN

Global Compact. He conducted over 6 years (2005–2011) the multilayer consultation process with the

government, business, civic bodies and investors toward developing the UN Guiding Principles on Business

and Human Rights.

⁵ 3TG is an acronym that stands for the four minerals targeted by "conflict mineral" regulations like the U.S. Dodd-Frank Act (Section 1502) and the EU Conflict Minerals Regulation. These minerals are: Tin, Tungsten, Tantalum, and Gold. These minerals are considered "conflict minerals" because their mining and trade in certain regions, particularly the Democratic Republic of the Congo (DRC) and its adjoining countries, have been linked to funding armed groups responsible for severe human rights abuses.

⁶ Section 54 excludes public sector organizations and small businesses.

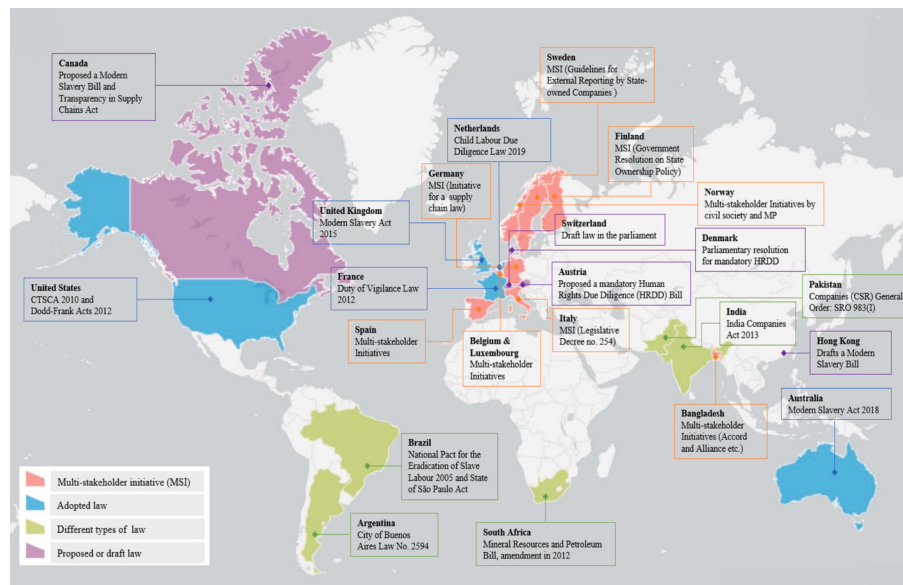


Fig. 1. Global initiatives to protect human rights in business and modern slavery legislation.

particularly in the upstream mining of cobalt, lithium, and rare earth elements, leaving exploitative practices in the renewable energy transition obscured and unaddressed [29,30].

This synthesis of global disclosure legislation from the mineral-specific Dodd-Frank Act to the broad but weakly enforced UK Modern Slavery Act establishes the critical context for analyzing Australia's legislative intervention. While the limitations of the UK *Modern Slavery Act* are well-documented, its pioneering role provided a critical blueprint. Heeding both its strengths and weaknesses, Australia has now emerged as the first Australasian nation to translate this global momentum into its own binding legal framework. Australia's *Modern Slavery Act* mandates certain organizations to disclose information about modern slavery in their operations, contributing to the global effort to eliminate this issue [31]. In Australia, various State legislatures have even enacted laws in relation to the federal *Modern Slavery Act*, including the *Modern Slavery Act of 2018 (NSW)* and the proposed *Supply Chain (Modern Slavery) Bill of 2020 (Tas)*. The primary objective of these laws is to enhance transparency in business operations and supply chains by mandating corporate disclosures, providing an effective mechanism to combat modern slavery practices.

The Australian legislation obliges targeted companies to report their assessments of modern slavery risks within their operations and supply chains. These reports must detail the steps taken to assess and address these risks, accompanied by an assessment of the effectiveness of the actions. Section 16 of the *Modern Slavery Act of 2018* establishes essential criteria for modern slavery statements, including the identification of the reporting entity, a comprehensive description of its structure, operations, and supply chains, an overview of modern slavery risks, actions taken for risk assessment and remediation, an assessment of effectiveness, details of consultation processes, and any other pertinent information deemed necessary by the reporting entity or the entity providing the statement.

This global review of disclosure legislation from the targeted mineral-focused Dodd-Frank to the broad but enforcement-weak UK Modern Slavery Act establishes a critical foundation for evaluating Australia's legislative model. Australia's Act represents a deliberate attempt to learn from these predecessors, incorporating a centralized government registry and a government-led review mechanism designed to address the enforcement and accountability gaps that plagued earlier transparency regimes. These structural innovations make it a compelling case study for assessing whether such "second-generation" disclosure laws can effectively mitigate modern slavery risks within the complex,

multi-tiered, and globalized supply chains characteristic of the energy sector, particularly in the context of the renewable energy transition, where demand for conflict-prone materials is rapidly escalating. The following section will now transition to a detailed identification of modern slavery risks specifically within the energy industry, examining how the material demands of decarbonization, energy price volatility, and land displacement create distinct vulnerabilities to exploitation. This sectoral analysis will provide the necessary empirical foundation to subsequently evaluate, in Section 5, the efficacy and limitations of the Australian Modern Slavery Act through the lens of energy justice principles.

3. Identifying modern slavery practices in the energy industry

Modern slavery is a pervasive and evolving issue that sits at the intersection of business, human rights, and regulatory governance. Despite its widespread usage, there is no universally agreed-upon legal definition of "modern slavery" [19]. The term is often used as an umbrella concept encompassing diverse form of "exploitative working conditions", including forced labour, debt bondage, human trafficking, and child labour, which are frequently rooted in coercion and power asymmetries.⁷ However, the term "exploitative working conditions" is also broad and requires a precise definition and contextualization [32].

This paper adopts internationally recognised definitions of forced labour, human trafficking, and debt bondage to anchor the discussion of "exploitative working conditions" in relation to the energy industry. Forced labour, as defined by the ILO, refers to "all work or service which is exacted from any person under the menace of any penalty and for which the person has not offered themselves voluntarily" [20]. Human trafficking, according to the *UN Palermo Protocol*, involves the recruitment, transportation, transfer, harbouring, or receipt of persons by means of coercion, deception, or abuse of power for the purpose of exploitation. Debt bondage occurs when a person is forced to work to repay a debt under terms that are not clearly defined or are excessively

⁷ Eg, in the context of the *Modern Slavery Act 2018*, s 4(a) defines an offence under the Criminal Code Act 1995 (Cth) ('Australian Criminal Code'). The Australian Criminal Code maintains that 'slavery remains unlawful and its abolition is maintained ...' (at s 270.2). Divisions 270 and 271 cover: Slavery and slavery like offences as actual slavery (at s 270.1), servitude (at s 270.4(1)), forced labour (at s 270.6(1)), trafficking in persons (at ss 271.2(1), (2)) forced marriage (at ss 270.7 A, 270.7B) and deceptive recruitment for labour and services (at s 270.7).

exploitative. In the context of energy supply chains, these internationally recognised forms of exploitation manifest through specific, observable practices that merit particular scrutiny: wage theft (non-payment or underpayment of wages); excessive working hours beyond legal or ethical limits; retention of identity documents, such as passports, to restrict worker mobility; threats of deportation or legal action against migrant workers; and substandard living and safety conditions.

Critically, the severity and nature of exploitation vary significantly across geographies (e.g., Southeast Asia versus Sub-Saharan Africa versus Latin America) and sectors (e.g., polysilicon processing versus rare-earth mining versus wind turbine construction). These variations necessitate context-sensitive due diligence and legal frameworks that respond to industry- and region-specific vulnerabilities. Understanding these differences is particularly important in the energy sector, where supply chains are global, multi-tiered, opaque, and often reliant on labour sourced from jurisdictions with weak regulatory enforcement. This complexity explains why it is crucial to explore the connection between modern slavery and the energy industry, and to understand how unaddressed exploitation simultaneously undermines workers' rights and compromises the legitimacy of the clean energy transition itself. This section examines modern slavery's manifestation in the energy industry by organizing the empirical evidence into three critical thematic pathways. This analytical approach helps to illustrate not only the prevalence of exploitation but also why addressing this issue through a justice lens is essential for achieving an equitable energy transition.

3.1. *The clean energy paradox: renewable technologies and modern slavery risks*

The Paris Agreement, adopted in 2015, marked a pivotal moment in global efforts to combat climate change, establishing binding commitments for all nations, irrespective of their income levels, to transition to clean energy [33]. As part of this commitment, each country party to the Paris Agreement must submit its plans for reducing greenhouse gas emissions, known as Nationally Determined Contributions (NDCs) [34]. These NDCs encourage nations to set ambitious targets for emission reductions and the adoption of renewable energy sources. Additionally, the Conference of the Parties (COP), the supreme decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC), convenes annually to review the implementation of the Kyoto Protocol, the Paris Agreement, and other legal instruments adopted by the COP. These international legal measures drive countries worldwide to shift from fossil fuels to clean energy [35].

Responding to these policy drivers, the ILO envisions a transformative shift in the global job market, predicting the creation of up to 100 million green jobs by 2030 as a direct result of the green transition [36]. However, this optimistic projection is tempered by the anticipated loss of approximately 80 million brown jobs,⁸ underscoring the uneven impact of these changes across different regions and communities [36].

This structural labour market disruption raises a critical question: which workers are most vulnerable during this energy transition? Understanding these vulnerabilities is essential because the political and economic pressures to rapidly scale renewable energy amidst anticipated job losses in legacy industries create conditions where labour exploitation risks are heightened, both in the phasing out of fossil fuels and in the construction of renewable infrastructure. First, those in specialized extraction roles, such as derrick or rotary drill operators in the oil and gas industry or coal mining machine operators are likely to face significant challenges [37]. Their expertise is highly specialized and not easily transferable to non-extraction industries, diminishing their

competitiveness in the broader labour market [37]. Even though some workers might possess skills that could be adapted to the solar or wind sectors, they are still likely to encounter difficulties related to retraining or relocation [37].

Second, workers with lower educational attainment in the extraction industry may face even fewer opportunities. For instance, former coal miners might struggle to find new employment, as their previous experience may not easily translate into other viable job roles [37]. The geographical concentration of mining industries, due to the fixed nature of fossil fuel reservoirs, further complicates the situation [37]. This immobility of labour and capital in these regions suggests that energy workers may find it challenging to secure jobs with similar wages within their communities. Moreover, strong community ties in fossil fuel regions can hinder workers' ability to relocate for better opportunities. The limited availability of fossil-fuel-rich land adds another layer of difficulty for firms in the mining sector to adapt to demand shocks.

Furthermore, local economies in fossil-fuel-rich communities are often heavily reliant on the mining industry. As a result, declines in the fossil fuel sector could have a profound impact on local labour markets, with non-mining sectors closely linked to mining also suffering. For example, industries related to the fossil-fuel supply chain, such as gas transportation or oil-dependent manufacturing, might decline, while service sectors like restaurants could experience revenue losses due to rising unemployment or the out-migration of energy workers.

However, the challenges extend far beyond employment displacement in fossil fuel regions. Paradoxically, this rapid transition has simultaneously exacerbated modern slavery risks through new mining operations in high-risk jurisdictions that supply critical minerals for renewable technologies [38]. Clean energy technologies, such as solar panels, wind turbines, and electric vehicle batteries, require significant amounts of raw materials, including rare earth elements, lithium, cobalt, and other critical minerals. To rapidly scale up the extraction of these raw materials to meet unprecedented demand, primary contractors often outsource various segments of their projects across multiple tiers of subcontractors [39]. These subcontractors further subcontract the work to smaller firms or independent labour suppliers, creating a complex and fragmented supply chain [37]. Each layer of subcontracting operates under different standards and practices regarding labour, leading to inconsistencies and gaps in oversight. Smaller subcontractors, especially those operating informally, often do not adhere to labour laws and safety regulations, resulting in poor working conditions for laborers [40]. The surge in demand for these materials has led to the initiation of new mining projects, often in regions where labour exploitation and human rights abuses are prevalent [41].

Recent reports from media and non-governmental organizations have exposed potential forced labour issues within the solar supply chain, particularly associated with China's Xinjiang Uyghur Autonomous Region [3,42]. This region plays a crucial role in the production of solar-grade polysilicon, a key component in most global solar modules. The gravity of the situation intensifies with reports detailing stringent labour programs affecting millions, notably Uyghur and Kazakh populations. In 2022, the United Nations Office of the High Commissioner for Human Rights highlighted significant human rights violations in Xinjiang, raising concerns about potential international breaches [43]. Despite China's rebuttals against these accusations [44,45], concerns persist about forced labour within the solar supply chain.

Concurrently, the rising demand for balsa wood, essential for manufacturing wind turbine blades, draws attention to labour and environmental challenges in Ecuador's Amazon region [46]. Furthermore, critical minerals for wind turbines, like copper and manganese, are linked to human rights issues, including health risks and labour exploitation [47].

The growing significance of lithium-ion batteries, pivotal to the expanding electric vehicle sector, heightens concerns about cobalt extraction, primarily sourced from the Democratic Republic of the Congo (DRC) [48]. Reports reveal alarming mining conditions, child

⁸ "Brown jobs" refer to occupations in industries that are highly reliant on fossil fuels or contribute significantly to environmental degradation, such as coal mining, oil and gas extraction, and certain manufacturing sectors. These jobs are often contrasted with "green jobs," which are associated with environmentally sustainable practices and the renewable energy transition.

labor involvement, and inadequate safety measures. Likewise, nickel production undergoes scrutiny for potential forced labour allegations [49,50].

Additionally, the relationship between energy and resource companies has evolved as power generator companies now focus more on renewable energy sources [51]. This shift means a wider variety of metals and minerals from mining companies are being used by renewable technology manufacturers to supply power generators [52]. These generators then sell the power to resource companies through complex carbon-neutral agreements. Moreover, energy retailers are increasingly purchasing renewable energy directly from third-party generators, such as wind and solar farms, to supply consumers [53]. The growing use of Power Purchase Agreements (PPAs) reflects companies' efforts to offset their carbon emissions and strive for carbon neutrality [54], exposing them to modern slavery risks in the manufacturing of renewable plants.

For instance, Malaysia is the second largest exporter of solar panels after China, producing over 10 % of the world's solar cells and modules, as reported by the International Energy Agency (IEA) [55]. However, various reports have emerged of forced labour in the Malaysian solar manufacturing industry [56]. Workers, often migrant laborers from countries like Nepal, Bangladesh, and Myanmar, are subjected to exploitative working conditions [57]. Additionally, many migrant workers incur large debts due to recruitment fees charged by labour brokers [58]. These debts trap workers in a cycle of debt bondage, forcing them to work under harsh conditions to repay the loans.

This evidence reveals a fundamental paradox at the heart of the renewable energy transition: While transitioning to cleaner energy sources and minimizing carbon emissions is crucial in combating climate change, this transition simultaneously generates new socio-economic vulnerabilities. In particular, it entails job displacement in the fossil fuel sector, alongside the emergence of exploitation risks within renewable energy supply chains, including instances of debt bondage and conditions conducive to modern slavery if not rigorously addressed. Beyond the extraction of critical minerals, which often occurs under exploitative conditions, segments of renewable energy manufacturing and deployment have also been linked to substandard labour practices and inadequate remuneration [40]. As the renewable energy sector expands, ensuring protection against modern slavery risks across all tiers of supply chains becomes imperative, underscoring the need for ethically procured resources and comprehensive due diligence frameworks that extend beyond first-tier suppliers to capture the full material footprint of the energy transition.

3.2. Energy price volatility and exploitation in the supply chain

Beyond the material demands of renewable technologies, a second critical pathway through which modern slavery manifests in energy systems is through price volatility and its cascading effects on labour standards. Volatile energy price fluctuations can also exacerbate cost-related pressures in procurement, thereby contributing to an elevated risk of modern slavery. Fluctuations in energy prices lead to increased costs for companies reliant on energy-intensive extraction processes [59]. To manage these costs, companies seek cheaper labour options, which often leads to the exploitation of workers [60].

From a distributive justice perspective, this dynamic reveals how the burdens of energy market volatility are inequitably distributed: while energy producers and traders may benefit from price fluctuations, the economic pressures are systematically displaced onto the most vulnerable workers in the supply chain. The North Sea Supply Vessel Incident in 2016 is another poignant example of how volatile energy price fluctuations can create conditions that foster modern slavery [61]. In 2016, global oil prices experienced significant volatility, with prices dropping dramatically. This had a direct impact on the financial stability of oil and gas companies operating in the North Sea, a major hub for offshore oil and gas production [61]. To cope with reduced revenues, these companies implemented aggressive cost-cutting measures. This included

negotiating lower charter rates for supply vessels, which are essential for transporting goods, equipment, and personnel to and from offshore platforms [61]. The reduced charter rates put immense financial pressure on vessel operators. To maintain profitability, they sought ways to lower operational costs, one of which was reducing labour expenses.

As a result, vessel operators began replacing local crews with cheaper labour from low- and middle-income countries, such as India. These workers were willing to accept lower wages and often lacked the legal protections available to local workers [61]. The Indian seafarers on the supply vessel in 2016 were subjected to severe exploitation, exemplified by the fact that they had not been paid for several months [61]. The unpaid seafarers faced harsh living and working conditions, including inadequate food, cramped quarters, and extended working hours without proper rest [61]. These conditions are consistent with many indicators of modern slavery as defined by the ILO's forced labour indicators.

This case exemplifies a broader structural pattern: energy price volatility does not affect all actors equally. While companies absorb financial shocks through cost externalisation, workers at the bottom of subcontracting chains, often migrant labourers with precarious legal status, bear the brunt of these economic adjustments. This distributive injustice is compounded by procedural failures: workers typically have no voice in the decisions that determine their wages, conditions, or employment security. The absence of effective grievance mechanisms and the threat of deportation further entrench their vulnerability, demonstrating how energy market dynamics can systematically create conditions conducive to exploitation in both fossil fuel and, increasingly, renewable energy supply chains.

3.3. Displacement and exploitation in the energy transition

The third critical pathway linking modern slavery to energy systems emerges through land appropriation and the displacement of Indigenous and marginalized communities. The initiation of green energy projects, such as hydroelectric dams, wind farms, and solar installations — can, in certain cases, lead to the displacement of Indigenous communities from their ancestral lands [62–64]. Such relocations, if executed without equitable compensation or the genuine consent of affected communities, risk infringing upon their rights and amplifying susceptibility to modern slavery practices.

In Mexico's Isthmus of Tehuantepec, one of Latin America's largest wind corridors, Indigenous Zapotec and Ikoos communities report the loss of communal lands through opaque contracts and coercive agreements, often signed without free, prior, and informed consent [65]. Similar dynamics are visible in India, where expansive solar parks in Rajasthan and Gujarat have led to dispossession of small farmers and pastoralists [66]. Compensation processes are frequently inadequate, while grazing lands essential to nomadic livelihoods are converted into energy infrastructure, eroding traditional forms of subsistence. Even small hydropower projects, typically promoted as a socially benign alternative to mega-dams, have displaced villagers in Himachal Pradesh and Nepal by diverting rivers critical to local agriculture and fisheries, thereby increasing household labour burdens and forcing families into exploitative labour arrangements to compensate for lost agricultural income [67,68]. These examples reveal how the promise of "clean energy" can reproduce older patterns of land appropriation and marginalization under a new technological guise.

From an energy justice perspective, these cases reveal multiple, intersecting failures. First, they represent failures of recognition justice: Indigenous communities are not acknowledged as distinct peoples with inherent rights to their ancestral territories, but rather treated as obstacles to development. Second, they constitute procedural justice failures: decisions about energy infrastructure are made without meaningful consultation, free prior and informed consent, or genuine participation by affected communities. Third, they embody distributive injustice: the benefits of renewable energy—cleaner air, climate

mitigation, energy security accrue primarily to urban consumers and industrialized nations, while the costs—displacement, loss of livelihoods, cultural disruption are borne disproportionately by Indigenous and marginalized communities in the Global South. As Laura Parsons [69] argues in *Carbon Colonialism*, the transition to renewable energy is increasingly shaped by a logic of “green extractivism,” where industrialized countries in the Global North outsource environmental risks, resource extraction, and exploitative labour conditions to marginalized populations in the Global South under the guise of climate action.

The green transition thus risks reproducing a modern form of colonial control: while the Global South continues to serve as a resource frontier, now for lithium, cobalt, and rare earth elements rather than oil and gas, the legislative frameworks championed by countries like Australia, the UK, and the US (countries historically responsible for the majority of cumulative carbon emissions) are dictating the contours of “sustainable” labour and environmental practices from a position of structural power imbalance. This raises deeper questions about climate justice and epistemic authority in the energy transition: who has the power to define what counts as “just,” whose knowledge systems are legitimised in shaping global policy, and how can the voices of those most affected—often in the Global South—be meaningfully included rather than marginalized? These questions demand a systematic exploration of the energy justice framework as an analytical lens for evaluating and reimagining modern slavery governance. The following section provides this theoretical foundation, explicitly connecting the empirical evidence presented here to the five principles of energy justice—distributive, procedural, restorative, recognition, and cosmopolitan—and demonstrating how their systematic application can address both the symptoms and root causes of exploitation in energy supply chains.

4. Energy justice & modern slavery

The transition to sustainable energy is often framed as a universally beneficial process—a shift toward cleaner technologies, lower emissions, and greener economies. Yet, this narrative frequently obscures the persistence of deep-seated inequalities embedded within existing energy systems. In fact, energy transitions may reproduce or even intensify existing asymmetries in power, access, and labour conditions, particularly in the Global South [8,72].

While the rhetoric of sustainability dominates global policy discourses, it is crucial to distinguish between “clean” energy and “just” energy. The mere adoption of solar, wind, or hydropower technologies does not inherently produce equitable outcomes. This distinction is particularly salient when examining modern slavery in energy supply chains: renewable technologies may reduce carbon emissions while simultaneously perpetuating or even creating new forms of labour exploitation if justice principles are not systematically integrated into policy frameworks. The theoretical framework of energy justice has therefore emerged as a critical response, aiming not only to decarbonize energy systems but to democratize and decolonize them [8]. Energy justice is not a singular concept but a dynamic, contested framework shaped by multiple geographies and epistemologies [71]. It offers a lens through which to interrogate how energy systems reproduce inequalities across race, class, gender, and place.

Five core principles form the conceptual architecture of energy justice, each addressing distinct but interconnected dimensions of equity in energy systems [73,74]. First, distributive justice involves a fair distribution of environmental benefits and burdens across communities, regions, and generations. Second, procedural justice emphasizes the importance of inclusive and fair decision-making mechanisms for energy policies ensuring that affected communities have meaningful participation and voice in decisions that impact their lives and livelihoods. Third, restorative justice aims to address existing imbalances within the energy sector by actively repairing harms caused by past and present energy systems. Fourth, recognition justice ensures that all stakeholders

are represented and protected equitably, particularly acknowledging the distinct rights, identities, and knowledge systems of marginalized groups such as Indigenous peoples. Finally, cosmopolitan justice advocates for assigning equal value and consideration to every individual worldwide, in the allocation of energy resources, transcending national boundaries to address global inequities in energy access and the distribution of climate burdens.

Connecting these justice principles to modern slavery in energy systems reveals how the absence of justice creates structural vulnerabilities to exploitation. To tackle fairness issues in the energy sector across various aspects, there is a growing interest in examining the energy landscape from the perspective of energy justice (see Fig. 2). Energy justice emphasizes the importance of providing fair and accessible energy for everyone. Despite its theoretical robustness, the practical application of energy justice principles, particularly in legal and policy domains, remains uneven [8,75–78]. This gap between theory and practice has significant consequences: where energy justice principles are absent or weakly enforced, modern slavery becomes prevalent in the energy industry. To combat this issue, policy approaches to modern slavery in the energy sector should be informed by energy justice principles. The key question is therefore not whether but how the principles of energy justice can be practically applied to identify, prevent, and remediate modern slavery within energy transitions.

Fig. 2 synthesizes the analytical framework that guides the following subsections. It illustrates how three critical characteristics of contemporary energy markets, transitioning to cleaner energy sources, volatile energy price fluctuations, and land displacement in green energy projects, create distinct pathways to modern slavery when energy justice principles are absent. The figure demonstrates that different energy market characteristics require different configurations of justice principles: the clean energy transition primarily engages distributive and restorative justice; price volatility is fundamentally a distributive justice concern; and displacement demands procedural, recognition, and cosmopolitan justice responses. This framework allows us to diagnose the specific justice failures that enable exploitation in each context and to prescribe targeted policy interventions. The subsequent subsections elaborate these connections in detail, demonstrating both the empirical manifestations of injustice and the theoretical pathways through which justice principles can address them.

4.1. Transitioning to cleaner energy sources

As discussed before in this section, distributive justice addresses the fair allocation of the energy transition’s benefits and burdens across different populations and regions. The decline of legacy fossil fuel industries causes concentrated job losses and economic devastation in dependent communities, eroding local tax bases and funding for public services like schools and infrastructure [79–82]. Concurrently, the advantages of the expanding clean energy economy, including new job opportunities in renewable sectors, are not being distributed equitably [83]. Women and people of color remain significantly underrepresented in these new roles [84,85]. This uneven distribution creates economic desperation and precarity conditions that research consistently demonstrates increase vulnerability to labour exploitation and modern slavery. Distributive justice calls for policies that ensure these communities are not disproportionately burdened and have fair access to the opportunities generated by the new energy economy.

However, distributional justice cannot be achieved without addressing restorative justice concern, which focus on repairing harm and addressing past injustices. Historical evidence from previous economic transitions provides critical lessons for understanding how distributional outcomes emerge and how restorative interventions can shape them. In low- and middle-income countries, past experiences with trade liberalization and technological change from 1960 to 1990 offer valuable insights into the diverse effects on employment. For instance, while Latin American countries faced high unemployment rates and

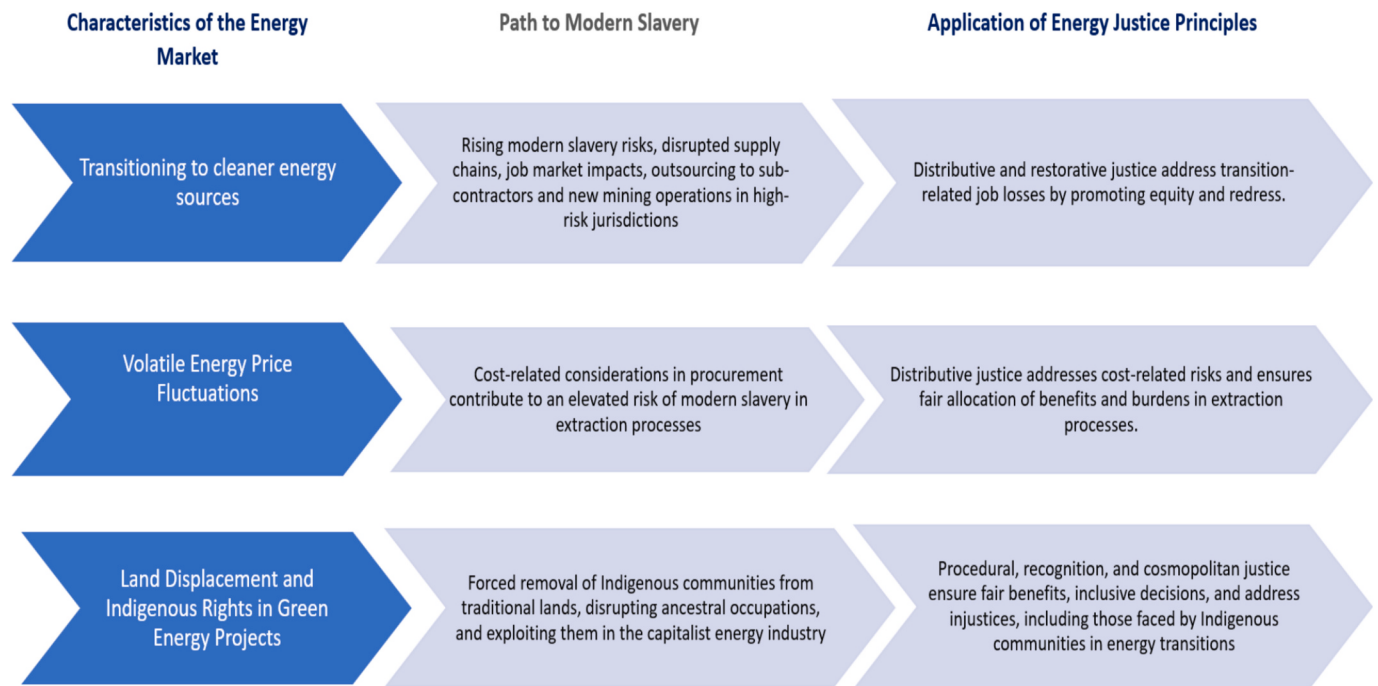


Fig. 2. Modern slavery risks in energy transitions, and energy justice principles as a solution to them.

increased wage inequality, East Asian countries saw a reduction in wage inequality between skilled and unskilled labour [86]. These differences primarily stem from two factors: human capital endowment and the abundance of natural resources [87]. East Asian countries prioritized education and training policies before trade liberalization, while Latin American countries initially struggled with educational disparities, leading to extended periods of adjustment in the supply of skilled labour [88]. Natural resources also played a significant role, with Latin American economies exporting more primary goods. The unequal distribution of these resources among the population likely contributed to significant income inequality [89]. These historical patterns demonstrate that without proactive restorative policies, particularly investments in education, training, and economic diversification, structural transitions reproduce and amplify existing inequalities, creating pools of vulnerable workers susceptible to exploitation. In contrast, high-income countries exhibit considerable heterogeneity, with the socio-economic characteristics of these nations influencing how their labour markets respond to structural changes.

Additionally, understanding how modern slavery manifests across the energy value chain is essential for applying justice principles effectively. When considering the implementation of energy justice within our communities, it can take on various forms. The progress of energy-related activities can be divided into five crucial phases: starting with extraction, advancing to production, transitioning into supply and generation, proceeding to consumption, and culminating in waste management and decommissioning [90]. Modern slavery can occur at different stages of the energy life-cycle, from extraction to waste management and decommissioning. In areas where resources like coal, oil, gas, or minerals are extracted, workers are subjected to forced labour [91]. This entails deceptive recruitment practices, confiscation of identity documents, and harsh working conditions without proper safety measures. Even in sectors considered sustainable, like mining for rare earth metals necessary for solar panels or wind turbines, forced labour occurs, especially in regions where regulations are weak or oversight is inadequate [92,93]. The concentration of exploitation at the extraction phase—whether for fossil fuels or renewable energy minerals—reflects a fundamental distributive injustice: the most hazardous, poorly compensated, and exploitative work in the global energy system is

systematically allocated to the most marginalized populations, often in the Global South, while the benefits accrue to consumers in industrialized nations.

Hence, restorative justice is required to actively remedy the harms inflicted by the transition. This involves providing a robust safety net and direct redress for affected workers and communities. This includes funding for workforce retraining programs, income support during transition periods, pension guarantees, and community-level economic diversification initiatives to help regions recover from industrial decline [80,94–96]. Additionally, expanding technical and vocational training programs through community colleges can help workers in transition acquire new skills relevant to green sectors [83]. These measures can help balance the economic disparities created by the shift to green jobs and ensure that benefits are distributed equitably [83]. Beyond economic repair, restorative justice also acknowledges the profound social and cultural losses, such as the erosion of community identity and sense of place in regions where coal mining was a multi-generational way of life [83,97]. Critically, restorative justice in the context of modern slavery must extend beyond communities in transition from fossil fuels to encompass workers currently exploited in renewable energy supply chains. This requires establishing grievance mechanisms, providing legal remedies and compensation for victims of forced labour, and ensuring that corporations causing harm through their procurement practices are held accountable. Without such restorative measures, the energy transition risks merely shifting exploitation from one population to another from fossil fuel workers in the Global North to mineral extraction workers in the Global South rather than eradicating it.

4.2. Volatile energy price fluctuations

Volatile energy price fluctuations present a profound issue of distributive justice, which concerns the fair allocation of benefits and burdens across populations [98–100]. The recent surge in global oil prices, driven by geopolitical conflict, growing demand, and supply chain constraints, places a heavy and inequitable burden on households and economies [98]. As mentioned in Section 3.2 through the North Sea vessel case, these economic pressures create conditions where corporations systematically externalize costs onto the most vulnerable workers,

directly facilitating modern slavery.

The core distributive injustice lies in the regressive impact of these price hikes. Rising energy costs consume a significantly larger portion of income for low-income households, forcing difficult trade-offs between essential needs like energy, food, and healthcare [101–103]. This exacerbates existing energy insecurity, as these households are more likely to reside in energy-inefficient housing, further increasing their consumption and costs [98]. This economic vulnerability has a dual effect: it creates both potential victims of exploitation (workers desperate for any employment) and conditions that incentivize employers to seek cost reductions through labour exploitation.

Furthermore, oil price volatility has a cascading effect on the cost of essential commodities, disproportionately affecting those already vulnerable. Empirical analysis confirms strong positive correlations between crude oil prices and the prices of staple goods such as corn, wheat, and beef [104–106]. This occurs because energy is a critical input for agricultural production, processing, and transportation. Therefore, an oil price shock functions as a shock to the entire cost of living, with its burdens falling most heavily on those least able to absorb them.

From a distributive justice perspective, the burden of global energy market volatility is not shared equally. The benefits of market dynamics accrue to energy producers and traders, while the burdens—in the form of higher costs for energy, food, and mobility—are disproportionately distributed to lower-income populations. This violates the principle of distributive justice, which demands that such burdens be allocated fairly and that mechanisms be in place to protect the most vulnerable segments of society from bearing an inordinate share of the costs of a volatile global energy system. Moreover, this distributive failure creates a permissive environment for modern slavery: when companies face intense cost pressures from energy price fluctuations, they frequently respond by compressing labour costs through subcontracting to informal operators, replacing unionized workers with precarious migrant labour, or reducing safety and wage standards, all pathways to exploitation documented across both fossil fuel and renewable energy supply chains. Thus, addressing modern slavery in energy systems requires not only labour law enforcement but also distributive justice mechanisms that prevent the systematic displacement of economic shocks onto vulnerable workers.

4.3. Land displacement and indigenous rights in green energy projects

The third configuration of energy justice principles including recognition, procedural, and cosmopolitan justice addresses the nexus between land displacement and modern slavery in renewable energy development. As discussed in Section 3 of this article, the rapid deployment of large-scale green energy projects, while critical for climate goals, often occurs on lands central to the identity and survival of Indigenous peoples, leading to widespread land displacement and human rights violations. The systematic violation of Indigenous rights within green energy value chains creates conditions ripe for modern slavery [107]. When Indigenous communities are forcibly displaced from their ancestral territories to make way for wind farms, solar parks, or hydroelectric dams, they lose not only their land but also their traditional livelihoods, cultural practices, and economic autonomy, forcing many into precarious wage labour where exploitation becomes endemic.

Encountering such a profound injustice highlights the importance of recognition justice. This principle calls for Indigenous communities to be acknowledged as distinct peoples with deep ancestral connections to their lands. It recognizes them as historical victims of injustices related to energy systems, rather than viewing them merely as stakeholders [108,109]. This goes beyond political recognition to require specific energy policies that address their unique needs and vulnerabilities, including high rates of energy poverty [110,111]. Failure to recognize their distinct status and rights is a primary driver of conflict, as 69 % of energy transition mining projects are on or near Indigenous territories,

leading to hundreds of human rights claims [112]. Recognition justice is thus foundational to preventing modern slavery: without acknowledging Indigenous peoples' distinct legal status, knowledge systems, and territorial rights, energy policies inevitably treat them as obstacles to development rather than rights-holders, creating the conditions for their dispossession and subsequent exploitation.

Once we recognize the need for safeguards in the Indigenous territories, the next step is the procedure; this is where procedural justice serves as the mechanism through which recognition is operationalized. The most recurring grievances—the violation of Free, Prior, and Informed Consent (FPIC), lack of meaningful consultation, and denial of access to information—are not merely ethical oversights; they are mechanisms of disenfranchisement that strip communities of autonomy over their land and livelihoods, forcing them into vulnerable positions where exploitation thrives [113–116]. This process of dispossession for energy transition mining is a direct pathway to modern slavery, pushing displaced peoples into precarious labor within the very industries that displaced them. The absence of procedural justice—manifested through sham consultations, information asymmetries, and decisions imposed without consent—not only violates Indigenous rights but also eliminates the protective mechanisms that could prevent their descent into exploitative labour conditions.

Effective procedural justice is therefore a critical anti-slavery mechanism. It requires moving beyond token consultation to structures that genuinely empower Indigenous communities as decision makers and partners, thereby mitigating the vulnerability that leads to exploitation. Concrete mechanisms that operationalize procedural justice in ways that directly prevent modern slavery include:

- a) Community-Based Renewable Energy Systems (CBRES): Supporting indigenous-led projects, like those in the Philippines, Australia, and Malaysia, which combat modern slavery by providing equitable, dignified employment and community ownership, integrating traditional knowledge to ensure sustainable and just development [117–119]. These models prevent exploitation by ensuring that energy development creates local employment under community-determined conditions rather than displacing communities into precarious external labour markets.
- b) Co-ownership and Equity Models: Initiatives like the Kipeto Wind Power project in Kenya, which granted 5 % equity shares to the local community, directly address modern slavery risks by ensuring communities are beneficiaries rather than victims of development, integrating them as shareholders with a stake in the project's success [120,121]. Such equity arrangements transform the power dynamics where communities gain both economic stake and decision-making authority, reducing their vulnerability to exploitation while creating accountability mechanisms for labour standards.
- c) Legal Self-Determination: Policies like the U.S. Tribal Energy Resource Agreements (TERAs), which decentralize energy management and promote tribal self-determination, are essential for preventing exploitation by granting communities the legal authority to control development on their terms and protect their members [122,123]. Self-determination frameworks enable Indigenous communities to establish and enforce their own labour standards, reject projects that pose exploitation risks, and ensure that any development occurring on their territories adheres to culturally appropriate governance structures.

In addition to the recognition and procedural justice, cosmopolitan justice also plays a role in calling for a global anti-slavery framework. It demands robust international governance to hold corporations and states accountable for the extraterritorial impacts of their energy value chains, ensuring that the pursuit of minerals for the green transition does not come at the cost of exploiting indigenous peoples [107]. Cosmopolitan justice recognizes that modern slavery in energy supply chains is fundamentally a transnational issue: minerals extracted under

exploitative conditions in one country power renewable technologies in another, while the corporations orchestrating these supply chains often operate across multiple jurisdictions to evade accountability. This necessitates international legal mechanisms that transcend national borders and assign equal moral weight to workers and communities regardless of their geographic location or nationality. Achieving this requires overcoming the key challenges that enable modern slavery: providing financial and technical support to eliminate the economic desperation that fuels vulnerability, establishing strong legal frameworks that enforce meaningful participation and consent, and mandating that businesses conduct due diligence on indigenous rights. Ultimately, it necessitates a “new social contract”⁹ for energy that prioritizes community well-being over a purely business-centered model to break the historical patterns of marginalization that perpetuate modern slavery and achieve a truly just transition [124].

This analysis through the energy justice framework reveals that modern slavery in energy supply chains is not merely a labour law enforcement problem but a systemic justice failure across multiple dimensions. The three pathways examined—clean energy transitions, price volatility, and land displacement—demonstrate how the absence of distributive, procedural, restorative, recognition, and cosmopolitan justice creates structural conditions where exploitation becomes endemic. Addressing modern slavery effectively, therefore, requires policy interventions that embed these justice principles into the governance of energy systems. Hence, addressing the challenges of modern slavery within the framework of energy justice requires more than simply enacting new laws or relying solely on law enforcement. It is crucial to examine existing modern slavery laws through the lens of energy justice to evaluate their adequacy in addressing these structural vulnerabilities and to identify the specific reforms needed to align legislation with justice principles.

That is why we have chosen to examine the *Modern Slavery Act* of Australia from an energy justice perspective and provide suggestions that would be equally valuable for all other jurisdictions. In doing so, we have also analyzed relevant provisions of the *Dodd-Frank Act of 2010*, the *Modern Slavery Acts of the UK*, and the Canadian, South African, and European efforts toward modern slavery and energy supply chains to compare and contrast with Australia’s *Modern Slavery Act*.

5. Australia’s Modern Slavery Act as a case study in context and a missed opportunity from energy justice perspectives

Having established the energy justice framework and demonstrated how the absence of distributive, procedural, restorative, recognition, and cosmopolitan justice creates structural vulnerabilities to modern slavery in energy supply chains, we now turn to a critical evaluation of Australia’s *Modern Slavery Act 2018*. This section examines whether the Act, as a prominent example of second-generation disclosure legislation, adequately addresses the justice failures identified in [Sections 3 and 4](#), with particular attention to its efficacy in governing the renewable energy sector’s complex and high-risk supply chains. The *Modern Slavery Act 2018* was passed in the Australian parliament in November 2018. Effective from January 2019, this law mandates business entities with an annual turnover above AU\$100 million (USD 69 million) to report annually on modern slavery risks within their business operations and supply chains, along with measures taken to address modern slavery risks. This Act followed extensive consultations, including a parliamentary inquiry report in 2017, a Federal Government Public Consultation Paper and Regulation Impact Statement and a Senate Inquiry in 2018.

It was designed to align with similar laws in the UK, California, and

New South Wales (*NSW Modern Slavery Act 2018*), addressing the global challenge of modern slavery [125]. Notably, it offers a legislative definition of ‘modern slavery’ (already mentioned in the Introduction Section of this article), with the proponents of this Act claiming this as the first time that any legislative Act has defined ‘modern slavery’ [126]. This definition encompasses eight specific forms of exploitation, including human trafficking, slavery, servitude, forced marriage, forced labour, debt bondage, the worst form of child labour, and deceptive recruiting for labour and services. Eligible entities must submit a Modern Slavery Statement to the publicly accessible repository Register, which is maintained by the Australian Border Force. This Register is the first of its kind worldwide where all the eligible entities are legally bound by Section 19(2) of the *Modern Slavery Act 2018* to submit their modern slavery statements.

The Act stipulates seven mandatory criteria for these statements under Section 16; it covers:

“(a) identify the reporting entity; and (b) describe the structure, operations and supply chains of the reporting entity; and (c) describe the risks of modern slavery practices in the operations and supply chains of the reporting entity, and any entities that the reporting entity owns or controls; and (d) describe the actions taken by the reporting entity and any entity that the reporting entity owns or controls, to assess and address those risks, including due diligence and remediation processes; and (e) describe how the reporting entity assesses the effectiveness of such actions; and (f) describe the process of consultation with: (i) any entities that the reporting entity owns or controls; and (ii) in the case of a reporting entity covered by a statement under section 14—the entity giving the statement; and (g) include any other information that the reporting entity, or the entity giving the statement, considers relevant.” [127].

While these seven criteria appear comprehensive on paper, their implementation reveals a fundamental tension between procedural transparency and substantive accountability, a tension that becomes particularly acute when examining the Act through an energy justice lens. While Australia’s *Modern Slavery Act* shares many similarities with the UK’s, such as the reporting threshold and disclosure requirements, it has a broader scope in terms of the industries covered and an emphasis on centralized oversight through the Modern Slavery Register. However, this very breadth becomes a critical weakness from an energy justice perspective. By treating all industries uniformly, the Act fails to target sectors, like renewable energy, that are simultaneously high-risk for modern slavery (due to their mineral-intensive supply chains) and critically important for a just transition. From a distributive justice perspective, this uniformity creates perverse outcomes: the Act captures large retail or financial services firms with relatively lower modern slavery risks while exempting smaller renewable energy developers with direct procurement relationships to high-risk mineral extraction operations. The burden of compliance thus falls disproportionately on sectors based on revenue rather than actual exploitation risk. We believe that a solution is not to create separate modern slavery laws for different industries, but rather to enhance the enforcement of a comprehensive, cross-sectoral law with targeted, industry-specific tools.

First, from a procedural justice standpoint, the government should develop mandatory, detailed guidance for high-risk sectors, such as renewable energy. This guidance would outline common exploitation hotspots (e.g., polysilicon manufacturing for solar, cobalt and lithium mining for batteries), model due diligence practices, and sector-specific risk indicators. This would transform vague reporting requirements into actionable standards without needing industry-specific legislation. Second, addressing distributive justice concerns, the financial threshold should be supplemented with a risk-based criterion. This would mandate reporting not only for large entities but also for smaller companies whose business models are intrinsically high-risk, regardless of their revenue. This would capture specialized renewable energy developers and mining firms currently excluded by the arbitrary AU\$100 million turnover threshold, ensuring the law targets actual risk rather than just

⁹ The term “new social contract” here is not a single legal document but a fundamental reimagining of the relationships, responsibilities, and power dynamics between all actors in the global energy system—states, corporations, communities, and individuals.

corporate size.

This combination of a broad legislative framework with precise, practical tools would make the Act far more effective in compelling meaningful action from companies in the renewable energy sector and other high-risk industries. Critically, most Australian renewable energy companies operate as small-to-medium-sized businesses or project-specific special purpose vehicles established to develop individual wind farms, solar parks, or battery storage facilities. Hence, a more inclusive approach, grounded in risk assessment, could better address distributive justice by ensuring that a broader spectrum of companies, including those in the renewable energy sector, actively engage in mitigating modern slavery risks within their supply chains. The current threshold excludes precisely those entities most directly connected to high-risk mineral supply chains, creating a distributive injustice where scrutiny is inversely related to actual exploitation risk.

One strength of the Australian *Modern Slavery Act* is that, unlike the UK, where businesses may avoid penalties for non-compliance, Australia's enforcement mechanisms are more structured. Although the penalties for non-compliance with reporting requirements are not as severe, the public nature of the register and the legal obligation to submit accurate reports may exert pressure on companies to comply, as reputational damage could ensue from failing to meet reporting standards.

On the other hand, the US *Dodd-Frank Act* focuses more narrowly on conflict minerals, targeting specific sectors (such as electronics and manufacturing) where these minerals are most prevalent. It does not directly address modern slavery, but rather focuses on supply chain transparency regarding minerals sourced from conflict zones. In contrast, Australia's *Modern Slavery Act* applies to a wider range of business operations and supply chains, thus requiring companies to consider broader human rights risks, including forced labour, human trafficking, and other forms of exploitation that may occur in connection with renewable energy companies.

Another positive aspect of the *Modern Slavery Act 2018* is that it imposes reporting obligations on public authorities, potentially bolstering due diligence in government procurement, and establishes a central repository for companies' modern slavery statements (ss 18–20 [127]). The Act's reporting obligations on public authorities, establishment of a central repository for modern slavery statements, and extra-territorial reach demonstrate elements of cosmopolitan and restorative justice principles. These provisions aim to hold entities accountable for their actions and enhance transparency. The legislation also extends its reach beyond national borders, compelling Australian companies operating abroad to disclose risks in their supply chains both domestically and overseas (ss 9–10 [127]). The extra-territorial reach of the *Modern Slavery Act*, requiring Australian companies operating abroad to disclose risks in their supply chains domestically and overseas, aligns with cosmopolitan justice principles by recognizing that exploitation in global energy supply chains demands governance mechanisms that transcend national jurisdictions.

Hence, on its face, the Act stands in a potentially better position than other jurisdictions and aims to strengthen Australia's response to modern slavery, purporting to shine "a light into the shadows of global supply chains where modern slavery thrives... send[ing] a clear message that modern slavery is unacceptable in the supply chains of all of our goods and services." [128] Since 2020, entities mandated to comply with the Act have been publishing their statements in a public repository, drawing scrutiny from civil society and academia alike [129]. However, the actual impact of the Act on industry practices remains under review, with initial research suggesting that many disclosures tend to be symbolic rather than substantive [130,131]. This "tick-box" exercise of compliance directly undermines energy justice and fails to drive meaningful change or provide true supply chain visibility. From a procedural justice perspective, when reporting becomes a compliance ritual rather than a mechanism for genuine stakeholder engagement and risk mitigation, affected communities, including workers in mineral

extraction and Indigenous peoples on displaced lands, are systematically excluded from meaningful participation in decisions affecting their lives. Without robust enforcement, the Act risks legitimizing corporate inaction on labour exploitation within "green" supply chains, thereby perpetuating the very injustices the energy transition aims to overcome.

The Act's procedural and restorative justice failures become particularly acute when examined in detail. There are limited consequences for corporations failing to report adequately, shifting the burden of determining human rights violations from the government to businesses [5]. For the law to effectively combat modern slavery, robust incentives and consequences are imperative to ensure rigorous due diligence and a meaningful response to investigation outcomes. The lack of strong consequences for non-compliance and the weak sanctions undermine the potential for meaningful restorative justice. A victim compensation scheme, as recommended but ignored [132], could have played a crucial role in addressing the harms inflicted on individuals within supply chains, aligning with principles of restorative justice. Without such remedial mechanisms, the Act offers no pathway for workers subjected to forced labour in lithium mines, cobalt extraction sites, or polysilicon processing facilities to obtain redress, constituting a fundamental failure of restorative justice that leaves victims without remedy even when exploitation is identified. Additionally, the government's reluctance to publish a list of entities required to report, despite extensive recommendations from civil society and business [133–136], significantly undermines civil society's role in holding businesses accountable for rights violations, eventually, thereby exemplifying the issues related to recognition justice. This opacity prevents civil society organizations, trade unions, and affected communities from identifying which renewable energy companies should be reporting, monitoring their compliance, and holding them accountable—a recognition justice failure that denies these stakeholders their legitimate role as participants in governance.

In sum, the Australian *Modern Slavery Act's* generic, one-size-fits-all design results in profound inadequacies when applied to the specific injustices endemic to renewable energy supply chains. Analyzed systematically through the five energy justice principles, the Act's failures become clear: Firstly, from a distributive justice perspective, its arbitrary financial threshold (AUD \$100 million annual turnover) exempts a significant portion of the renewable sector, which is populated by small-to-medium-sized developers and special purpose vehicles, despite their procurement of high-risk minerals like cobalt, lithium, and polysilicon. This creates a distributive injustice, where the burden of compliance falls on larger entities while allowing smaller, high-risk operators to evade scrutiny. Secondly, in terms of procedural justice, the Act's focus on procedural reporting over substantive due diligence fails to address the unique procedural injustices in mineral extraction, particularly the lack of enforceable mechanisms to secure the Free, Prior, and Informed Consent (FPIC) of Indigenous communities on whose lands mining often occurs. Thirdly, regarding restorative justice, the lack of strong consequences for non-compliance and the absence of a victim compensation scheme undermine restorative justice by failing to remediate harms inflicted on individuals exploited within energy supply chains. Fourthly, from a recognition justice standpoint, the government's refusal to publish a list of reporting entities cripples civil society oversight, constituting a profound failure of recognition justice by denying affected communities and their advocates the information necessary to participate meaningfully in accountability processes.

Finally, while the Act's extraterritorial reach gestures toward cosmopolitan justice, this potential is undermined by weak enforcement: without mechanisms to hold Australian companies accountable for exploitation occurring in overseas mineral extraction operations, the cosmopolitan principle remains aspirational rather than operational. By treating modern slavery as a generic risk rather than a structurally embedded problem in energy supply chains, the Act permits a form of "bluwashing," where companies can brandish their "clean" energy credentials while overlooking labour abuses in their supply networks.

This comprehensive justice failure demonstrates that disclosure-based transparency regimes, without robust enforcement, risk-based targeting, victim remediation, and genuine stakeholder participation, are fundamentally inadequate to address modern slavery in the complex, transnational, and high-risk supply chains characteristic of the renewable energy sector.

6. Crafting a vision: modern slavery legislation through the lens of energy justice

A modern slavery law must not only tailor to local needs but also consider the labour exploitation in the transnational supply chains [137]. From a distributive justice standpoint, the law must rectify the inequitable burden placed on mineral-rich communities in the Global South who bear the environmental and social costs of extraction for the global energy transition, while the benefits of clean energy are predominantly accrued in the Global North [138]. A robust modern slavery law should therefore incorporate mechanisms that mandate corporate contributions to local development in these source communities, ensuring that the economic benefits derived from the green energy boom are shared more equitably along the entire supply chain. Concretely, this could involve mandatory benefit-sharing agreements that allocate a percentage of renewable energy project revenues to affected communities, or requirements that companies invest in local infrastructure, education, and healthcare as a condition for operating in mineral extraction zones. Such provisions would transform distributive justice from an abstract principle into an enforceable legal obligation.

Procedural justice demands the establishment of fair processes and mechanisms. The modern slavery law should not only raise awareness but also enforce accountability, transparency, and sanctions. It must establish fair and accessible procedures to address non-compliance, ensuring that companies within the energy sector undergo due diligence processes and are held accountable for their actions along the supply chain. On the other hand, recognition justice also emphasizes the need to acknowledge and address specific challenges faced by marginalized groups [138]. Hence, a modern slavery law informed by energy justice should not be limited to narrow definitions of individual exploitation. It must be expanded to encompass systematic practices that destroy cultural identity, erase ancestral connections, and eliminate economic self-determination—all of which are conditions that create profound vulnerability to exploitation and constitute a form of collective bondage. Critically, for Indigenous peoples, this means operationalizing the principle of Free, Prior, and Informed Consent (FPIC) as a fundamental anti-slavery mechanism, moving beyond token consultation to structures that genuinely empower communities as leaders in energy projects on their lands [119]. Legislatively, this requires explicit incorporation of FPIC as a mandatory prerequisite for any energy project affecting Indigenous territories, with non-compliance constituting a breach of the modern slavery law itself and triggering both civil liability and potential criminal sanctions.

Moreover, restorative justice calls for gender and child-sensitive due diligence processes and demands active measures to remedy the harms inflicted by the transition [139]. The law should recognize the unique vulnerabilities faced by women and children within the supply chains and go beyond punitive measures. Hence, it necessitates a robust safety net for affected workers and communities, including funding for workforce retraining programs, income support, pension guarantees, and community-level economic diversification initiatives to help regions recover from industrial decline and address profound social and cultural losses.

The law should also integrate trade regulations and prohibit the import of goods produced through exploitative labour practices. This not only prevents the energy industry, including renewable energy, from benefiting from such practices but also fosters international cooperation [140]. This aligns with the call for cosmopolitan justice, which demands a global anti-slavery framework and robust international governance to

hold corporations and states accountable for the extraterritorial impacts of their energy value chains. Cosmopolitan justice recognizes that modern slavery in energy supply chains is inherently transnational: cobalt mined under forced labour conditions in the DRC, processed in China, and incorporated into batteries manufactured in South Korea for electric vehicles sold in Australia requires governance mechanisms that transcend national boundaries and assign equal moral weight to workers regardless of geographic location. Addressing forced labour concerns and trade restriction principles in a national modern slavery law not only tackles local governance issues but also influences international trade, encouraging a standardized approach to combating modern slavery. Concretely, this requires import bans on goods produced with forced labour (similar to the U.S. Uyghur Forced Labor Prevention Act), coupled with mandatory supply chain mapping that traces critical minerals from extraction to final product, enabling enforcement agencies to identify and interdict tainted goods at the border.

Moving from the application of energy justice principles to the structural architecture of an effective modern slavery law, a central design question emerges: whether a central question is whether a modern slavery law should cater specifically to energy justice. The answer is no. Modern slavery is not confined to the energy sector—it cuts across textiles, agriculture, construction, technology, and countless other supply chains. To carve out energy justice as a separate legal field would risk fragmenting the law and weakening its coherence. What is required instead is a broad, sector-agnostic framework that embeds binding obligations on corporations across all industries. Within such a framework, the energy sector would still be directly addressed: provisions requiring proactive due diligence, enforceable FPIC, and trade restrictions on goods produced with forced labour would naturally extend to renewable energy supply chains, fossil-fuel transitions, and critical mineral mining. However, as argued in Section 5, this cross-sectoral framework must be supplemented with sector-specific guidance and risk-based thresholds to ensure that the unique vulnerabilities of renewable energy supply chains—including their dependence on geographically concentrated critical minerals, complex multi-tier subcontracting, and operations in jurisdictions with weak regulatory oversight—are adequately captured and addressed.

The fundamental inadequacy of the current legislative model demands a paradigm shift from transparency to accountability. The Australian *Modern Slavery Act* rests on the assumption that corporate disclosure and market pressure will suffice to curb exploitation [141]. This narrow, transparency-based approach is inadequate: it neither prevents modern slavery nor addresses the deeper structural injustices embedded in global supply chains [142]. It operates like a diagnostic tool that identifies a disease but offers no cure. It does not prevent modern slavery from happening in the first place, nor does it address the deeper structural injustices that allow exploitation to flourish in global supply chains. Evidence from the first four years of the Act's operation demonstrates that disclosure without enforcement produces symbolic compliance: companies report risks but take minimal action to mitigate them, and no entity has faced meaningful consequences for inadequate reporting or for continued sourcing from high-risk operations. For example, a major solar panel manufacturer might disclose that forced labour is a risk in its polysilicon supply chain from a specific region. But under the current law, it faces no penalty for continuing to source from that region as long as it reports the risk. This allows the “clean energy” brand to be built on potentially tainted labour.

An effective modern slavery law must transcend the limitations of transparency-based models, by establishing a mandatory human rights due diligence (mHRDD) obligation. This shift moves beyond mere corporate disclosure toward a proactive duty to identify, prevent, and mitigate modern slavery risks within global operations and supply chains [143]. mHRDD shifts the legal onus from passive reporting to a proactive, continuous cycle of management [144]. This cycle legally compels companies to first identify and assess human rights risks through supply chain mapping and audits; second, to implement

concrete measures to prevent and mitigate those risks, such as contractually enforcing standards with suppliers; third, to track the effectiveness of these actions through performance indicators; fourth, to communicate outcomes transparently; and finally, and most critically, to provide remediation to victims when harms occur [144]. The French *Corporate Duty of Vigilance Law of 2017* serves as a critical precedent, demonstrating that legislation with legal ramifications for corporate non-compliance is necessary to motivate substantive behavioural change, particularly among laggard firms [143]. Similarly, the German Supply Chain Due Diligence Act (2023) and the EU Corporate Sustainability Due Diligence Directive (2024) represent this global shift toward mandatory, enforceable due diligence with meaningful sanctions for non-compliance. This foundational shift from voluntary reporting to enforceable obligation is the first step in aligning domestic legislation with the unique *jus cogens* status of the prohibition against slavery in international law [145].

To be effective, this mHRDD obligation must be enshrined as a clear, statutory duty of care that pierces the veil of corporate separation and contractual privacy. The legal test established in *Caparo Industries v Dickman* provides a robust framework, requiring that a duty of care exists where harm is reasonably foreseeable, a relationship of proximity exists, and it is fair, just, and reasonable to impose such a duty [146]. This approach directly counters the strategies multinational corporations use to avoid liability, such as relying on separate corporate personality and the territorial nature of law [147,148]. By shifting focus from narrow contract law to broader tort principles, the modern slavery law can create a pathway for victims to seek remedy from the head company that controls the supply chain and benefits from its operations, thereby addressing the fundamental power imbalances inherent in complex, fragmented contractual networks [149,150].

The legislation must further adopt a polycentric governance model that sets clear goals but allows for flexible implementation. Recognizing that traditional command-and-control regulation is ill-suited for complex global supply chains, a modern slavery law should function as meta-regulation [151]. This involves holding companies accountable for designing and implementing their own internal control systems to achieve the state-mandated objective of eradicating modern slavery, thus promoting innovation and flexibility while ensuring accountability [152]. This polycentric system¹⁰ converges civil, corporate, and legal governance into a single platform of action, as envisioned by the UN Guiding Principles, empowering a range of stakeholders—from corporations to civil society—in its enforcement [153]. However, meta-regulation must be paired with robust state oversight and minimum mandatory standards to prevent it from devolving into self-regulation. The state retains responsibility for setting clear benchmarks, conducting periodic audits, and imposing meaningful sanctions for failures—ensuring that corporate flexibility does not become a mechanism for avoiding substantive obligations.

Finally, the law must integrate with international human rights frameworks and ensure robust enforcement mechanisms. This includes providing for extraterritorial application to govern the overseas activities of domestic companies and explicitly incorporating international standards from the ILO and UN as benchmarks for the required standard of conduct [154]. A critical development in global corporate accountability is the embedding of human rights due diligence into national legislation, reflecting the standards articulated in the UN Guiding

Principles on Business and Human Rights (UNGPs). Of particular relevance are Principle 17, which sets out the process of human rights due diligence, and Principle 18, which calls for the assessment of actual and potential adverse human rights impacts in a company's operations and supply chains. These principles are vital to identifying, preventing, and mitigating risks of modern slavery, especially in sectors like renewable energy, where supply chains are complex and global.

Crucially, the definition of due diligence within the modern slavery law must encompass its dual nature: both as a business process for risk management and as a standard of conduct equivalent to the *diligens paterfamilias*¹¹ concept from Roman law, where failure to act with diligence constitutes negligence [155]. Without such robust civil and criminal liability for negligence and non-compliance, the law will lack the necessary deterrent effect and fail to provide meaningful access to remedy for victims, perpetuating the current gap between principle and practice [156]. This dual approach creates complementary incentives: civil liability enables victims and their representatives to seek compensation through private enforcement, while criminal liability for severe cases (such as knowingly sourcing from operations using forced labour) creates state-based deterrence that does not depend on victim action.

In the context of renewable energy, due diligence processes should not only focus on ethical sourcing of materials but also on ensuring sustainable and just energy systems. This includes ensuring that the energy transition does not inadvertently perpetuate exploitation, whether through the sourcing of minerals for renewable energy technologies or through labor practices in the renewable energy sector. This due diligence must be informed by historical lessons; as past experiences with structural economic changes show, outcomes depend heavily on factors like human capital endowment. Therefore, corporate and state due diligence should include supporting education and training policies to build a skilled local workforce, mitigating extended periods of adjustment and inequality.

In synthesizing these elements, an effective modern slavery law for the energy transition would embody three core pillars: (1) mandatory human rights due diligence grounded in a statutory duty of care, with civil and criminal liability for non-compliance; (2) risk-based coverage criteria that supplement financial thresholds to capture high-risk actors regardless of size, particularly in renewable energy mineral supply chains; and (3) embedded energy justice principles operationalized through concrete mechanisms including FPIC requirements, victim compensation funds, trade import restrictions, benefit-sharing mandates, and meaningful stakeholder participation in enforcement. Such legislation would transform modern slavery governance from symbolic disclosure to substantive prevention and remediation, ensuring that the transition to renewable energy is not only clean but just.

7. Conclusion

The transition to a renewable energy future, while environmentally imperative, is critically undermined by the pervasive risk of modern slavery within its global supply chains - and overall there is a wider just labor transition to consider [157]. This article has examined this paradox through the analytical lens of energy justice, demonstrating that the pursuit of “clean” energy risks perpetuating profound injustices if labour exploitation in supply chains remains unaddressed. Using Australia's *Modern Slavery Act 2018* as a case study, our analysis reveals that well-intentioned legislation can fall short if it prioritizes procedural compliance over substantive justice. The Act's primary limitation is its reliance on a transparency-based model, which generates performative

¹⁰ A “polycentric system” is a fancy way of saying “a team effort where everyone plays a part.” Here is how the team works: (a) civil governance (the public watchdogs) - this is NGOs, community groups, activists, journalists, and the consumer, and their job is to investigate, raise the alarm, and hold companies' feet to the fire; (b) corporate governance (the companies themselves) - the law forces them to actively check their own factories and suppliers, fix problems they find, and report honestly on what they are doing; (c) legal governance (the rulemakers and referees) - this is the government, courts, and regulators who sets the clear rules of the game (“thou shalt not use slave labour”), and then they act as referees, handing out penalties to companies that break those rules.

¹¹ *Diligens paterfamilias* is the philosophical foundation for holding companies legally responsible for not being careful enough. It shifts the question from “Did you break a specific rule?” to “Did you act with the care and diligence that society has a right to expect?” This old idea is the direct ancestor of our modern legal concept of “due diligence” and “duty of care.”

corporate reporting but fails to mandate the proactive measures necessary to prevent exploitation or provide remedy to victims. From an energy justice perspective, the Act's high financial reporting threshold perpetuates distributive injustice by exempting numerous small and medium-sized renewable energy firms, despite their high-risk operations. Furthermore, its weak enforcement mechanisms, lack of a victim compensation scheme, and failure to integrate gender-sensitive or Indigenous-led due diligence—particularly the principle of Free, Prior, and Informed Consent (FPIC)—highlight significant gaps in restorative and recognition justice. Finally, the Act's limited extraterritorial enforcement undermines cosmopolitan justice by failing to hold corporations accountable for exploitation occurring across transnational supply chains.

Our analysis through the energy justice framework reveals three critical empirical findings. First, modern slavery in energy supply chains operates through distinct pathways: the material demands of renewable technologies create exploitation risks in mineral extraction; energy price volatility displaces economic pressures onto vulnerable workers; and land displacement for green energy projects forces Indigenous communities into precarious labour conditions. Second, these pathways are not inevitable consequences of energy transitions but result from systematic failures across all five energy justice principles including distributive, procedural, restorative, recognition, and cosmopolitan. Third, existing disclosure-based legislation, exemplified by Australia's Act, is structurally inadequate to address these multidimensional justice failures, requiring fundamental reform rather than incremental adjustment.

Consequently, for any nation seeking to enact effective modern slavery legislation, it is imperative to learn from the loopholes inherent in the Australian approach. Hence, a modern slavery law must:

- (a) Avoid the transparency trap: Replacing the weak “reporting-only” model with mandatory human rights due diligence (mHRDD) that legally compels companies to prevent, mitigate, and remediate harms, creating enforceable obligations backed by civil and criminal liability rather than voluntary disclosure.
- (b) Address the arbitrary threshold: Supplementing or replacing a pure financial turnover threshold with a risk-based criterion to ensure high-risk sectors and companies are covered, regardless of their size, thereby capturing small-to-medium renewable energy developers and special purpose vehicles with direct procurement relationships to exploitation-prone operations.
- (c) Identify and respond to the enforcement gap: Incorporating strong penalties for non-compliance and a public list of reporting entities to enable civil society oversight and create meaningful corporate accountability, transforming enforcement from reputational risk pressure to legal consequences.
- (d) Resolve the remedy vacuum: Legislating a victim compensation scheme and robust grievance mechanisms to provide tangible restorative justice, ensuring that workers subjected to forced labour in energy supply chains have access to remediation regardless of the jurisdictional location of their exploitation.
- (e) Applying energy justice: Explicitly mandating gender-sensitive reporting and upholding Free, Prior, and Informed Consent (FPIC) for Indigenous communities to ensure recognition justice is served, operationalizing FPIC as a mandatory legal prerequisite with sanctions for non-compliance rather than a consultative aspiration.

Our concrete findings point to the necessity of reforming the Australian *Modern Slavery Act* to incorporate mHRDD, a robust legal framework that shifts the obligation from disclosure to continuous risk management. This requires a statutory duty of care that pierces the corporate veil, enabling victims to seek remedy from parent companies, and the adoption of a polycentric enforcement model that empowers civil society, corporations, and governments alike. Effective reform must also include a risk-based reporting threshold to cover high-risk entities

regardless of revenue, alongside sector-specific guidance for renewable energy that targets exploitation hotspots like mineral mining and polysilicon production. Beyond Australia, these findings have implications for all jurisdictions pursuing modern slavery legislation: the shift from transparency to accountability, from voluntary to mandatory due diligence, and from sector-blind to risk-based regulation represents not merely technical adjustments but a fundamental reconceptualization of corporate accountability in global supply chains.

We explicitly acknowledge the limitations of this study, notably its focus on a single national case and the nascent state of empirical research on the Act's real-world impact. These limitations underscore the critical need for future research to conduct comparative analyses of mHRDD laws across jurisdictions and to develop robust empirical metrics to evaluate corporate compliance and victim outcomes. For policymakers, the next steps are clear: first, recalibrate legislation to embed mandatory due diligence, transforming modern slavery governance from disclosure to prevention and creating enforceable legal duties that cannot be satisfied through reporting alone; second, enforce stringent import bans on goods tainted by forced labour, utilizing supply chain mapping and border interdiction to prevent exploitation-derived products from entering markets; third, establish victim compensation funds financed by mandatory corporate contributions from high-risk sectors; fourth, mandate meaningful stakeholder participation in enforcement, including third-party complaint mechanisms and civil society monitoring; and fifth, ensure that the pursuit of a clean energy future is founded upon uncompromising commitments to justice including through ethical sourcing and human rights. These reforms are not aspirational ideals but practical necessities: without them, the renewable energy transition risks becoming another chapter in the long history of extraction-based development that enriches some while exploiting others. Only through such a comprehensive, justice-oriented approach can modern slavery laws truly protect the most vulnerable and ensure that the global energy transition is both sustainable and equitable. The question facing policymakers is not whether such reforms are possible, comparative examples from France, Germany, and the EU demonstrate they are, but whether they possess the political will to prioritize human dignity over corporate convenience in the architecture of our energy future.

CRedit authorship contribution statement

Ridoan Karim: Investigation, Conceptualization, Writing – original draft. **Raphael J Heffron:** Visualization, Supervision, Project administration, Methodology, Writing – review & editing. **Shakoor Ahmed:** Investigation, Conceptualization, Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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