

Just Transition for All:

A Feminist Approach for the Coal Sector



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Just Transition For All:

A Feminist Approach for the Coal Sector

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Executive Summary



Just Transition for All: A Feminist Approach for the Coal Sector

The world is facing a rapid transition away from coal-based energy due to climate change. While many regions and countries are set to benefit economically and environmentally from the transition in the end, coal workers and their communities will experience immediate adverse outcomes economically such as job losses, socially such as disruption of current gender roles and relations, and culturally such as loss of traditional customs and status. Based on both qualitative and quantitative evidence gathered from around the world where coal mines have shut down, this report shows how and why transition will affect men and women differently. It argues that women are particularly vulnerable to the potential negative effects of a transition away from coal. Above all, it offers an intersectionality-informed analytical and assessment framework that governments, civil society organizations, and global development institutions can employ to achieve a just transition to a gender transformed and decarbonized world.

The reasons why women bear a greater share of the impacts of coal mine and thermal power plant closures are rooted in gender roles and relations in coal mining communities. Because the industry has traditionally employed only a handful of women directly, they are unable to access employment and/or development programs that might be extended to male workers who lose their jobs. Because women's roles in the care economy are invisible and unpaid, there is a risk that historic gender imbalances will be perpetuated, preventing opportunities in the

new clean-energy economy to reach women. This report shows that when unemployment increases among men, women experience higher levels of domestic violence, food insecurity, and a decline of customary status.

In some countries, the important role of informal labor in coal-based economies further exaggerates the challenge. Across regions and countries, women are more likely to work in these informal coal economies, yet remain invisible. As a result, women are unable to access much-needed economic assistance designed to provide short-term support. In India, for example, where the road transportation of coal is in the informal sector, women make up a majority of the informal workers who load the trucks with coal. Transition strategies should take the informal labor of women into consideration.

The report also shows the importance of an intersectionality-informed approach in considering the gendered impacts of a transition away from coal. Transition will not affect all women equally. Factors such as ethnicity, race, age, ability, immigration status, and sexuality would cause some women to experience more negative outcomes than others.

Rather than perpetuating existing gender inequalities, a transition away from coal needs to be seen as an opportunity to transform current gender relations, creating more gender equal conditions. Just transition for all should make visible women's caring roles in the households and communities, improve women's livelihood opportunities, and make it feasible for women to participate in the new, clean-energy economy. The report is guided by three principles: participation, intersectionality and transparency.



Based on these principles, this report shows a path forward for such a gender transformative just transition address unequal power relations between companies and communities, within communities, and between women and men. It presents an intersectional Gender Analytical Framework based on four interrelated domains of gender power relations: (1) distribution of labor and economic roles; (2) access to assets and resources; (3) norms and values; and (4) institutions, rules, and decision-making. The framework helps to analyze existing gender imbalances and identify ways in which a transition away from coal could

exacerbate those imbalances. It offers a set of questions and policies that help stakeholders ensure gender plays a central role in the planning process at the very beginning of a transition away from coal. It is designed to be contextual and participatory, taking into account the nuances of each region and each community.

The following section summarizes each part of the report, allowing the reader to examine the topics and tools most relevant to them.

Taken together, the research, insights, and guidance contained within can help ensure a gender transformative transition away from coal.





PART 1

Introducing the Problem



Context: The Shifting End of

the Coal Value Chain

Energy is a value chain in which the extraction of commodities such as fossil fuels is located at one end and the use of electricity at the other. Energy systems along this chain are gendered because women and men are involved differently in the extraction process, in value addition, and as end users. Moreover, any change or shift in a component of this chain impacts them differently because of the different roles they play in society, communities, and households; different levels of access to resources such as education, training, jobs, and credit; and different ownership levels of productive assets such as land and technology.

Currently, the world is experiencing a fundamental shift in global energy systems: an increased awareness of the harmful effects of high-emitting coal-fired power generation has led to the closure of coal mines and thermal power plants, greater use of natural gas, and a rapid increase in the availability and affordability of alternative and renewable energy sources (Johnson and Boyland 2020). Energy transition starts at the extractive end of the energy chain, and coal – which has so far ruled the generation of electricity globally – can thus be expected to experience the greatest impact of the transition. Sartor (2018) observes that coal sector transitions are already occurring due to both climate and non-climate policy factors driven largely by market forces, and the closure of coal-fired power stations (such as Bluewaters in Australia) is evidence of this shift (Mercer 2020).

Coal has been an integral part of the global energy system for over 200 years; even today, millions of women and men around the world are directly or indirectly dependent on coal-based industries, mines, and electricity generation firms for their livelihoods (IEA 2020; Oliver 2018; Pinker 2020; Stanley 2018). Global coal production peaked in 2013. Since then, most countries in the Global North have hastily reduced their consumption and production of coal and moved towards greener energy systems (IRENA 2019; ILO 2018; Strambo et al. 2019). However, it can be expected that the countries in the Global South, especially in Asia, that have increased their production and consumption of coal and coal-based electricity, will encounter global pressure to adopt energy policies to phase out coal (Brown and Spiegel 2019). In this shift and struggle, evidence suggests that while all workers and coal-reliant communities will suffer, women and men will not experience these changes in the same way. In some contexts, protective legislation prevents women in some industries, and it is possible that coal transition might intensify the gendered impacts as men move away from coal to jobs in other sectors.

Gendered vulnerabilities due to climate change have also been brought to the fore. It is now known that a changes or shocks tend to aggravate pre-existing socioeconomic vulnerabilities and risks, and are more intensely experienced by the poor (Field et al. 2014). Increasingly, social scientists are finding evidence linking climate change and energy insecurity with a range of social and cultural factors. For example, abolishing modern slavery may be one of the potentially quickest and cost-effective ways to fight climate change (Bales and

Sovacool 2021). Jerneck (2018) also observes that vulnerabilities caused by climate change are contextual and offer a multidimensional view of climate–society interactions. Barca (2015) has underlined the dire consequences of climate change on the global labour force, and Barrett et al. (2002) have drawn attention to the effects on jobs as the world moves towards cleaner energy systems. Hans et al. (2021) argue that social and economic pressures, including women’s increased work burden both in productive and reproductive labour due to climate change, affects gender relations. Rao et al. (2019) emphasize the importance of moving beyond counting heads to unpacking relations of power, inclusion and exclusion in decision-making, and challenging cultural beliefs that have denied equal opportunities and rights to differently positioned people, especially those at the bottom of economic and social hierarchies.

In considering coal sector transitions as a response to climate change, we therefore need to consider whether relevant policies and practices respond to the gender-differentiated needs of women and men in coal affected communities. The aim is to understand coping mechanisms such as male outmigration and the formation of women’s collectives to create space for agency and change, and to develop an analytical framework that can dig deeper into rigid social relations to ensure women’s wellbeing in the new low-carbon economy.

Research Question

The question that arises within this broad picture is: How do we ensure that women are not impacted negatively, and are not left behind while economies shift away from coal and toward decarbonization? Any economic shock or structural change has significant and often prolonged socioeconomic impacts on affected workers and communities. Both historical and emerging studies of the distributional impacts of coal sector decline reveal that these socioeconomic impacts are gendered and that intersectional factors such as race, ethnicity, class, caste, ability, and age have significant bearing on how these impacts are experienced. Men and women in the Global South experience the added disadvantage of higher levels of poverty and marginalization, and less social welfare support (Aung and Strambo 2020; Strambo et al. 2019).

This report explores the gendered impacts of coal sector transition with a focus on major coal-producing countries in the Global South. It aims to collate evidence of gendered impacts, based on which it attempts to find ways to reduce these impacts in locations where the coal sector is experiencing – or might – experience transition. Wrapping the research around the concepts of energy justice and Just Transition, it further shows why gender considerations are important, and how gender can be mainstreamed in strategies adopted for transitioning the coal sector.



Need for the Study

The need for this research arises from the fact that despite decades of gender mainstreaming, women continue to experience sustained structural and cultural barriers to economic and political participation. Without attention to and transformation of these structural barriers gender equality will continue to be elusive, even in the Global North. Studies suggest that many of these structural barriers are worsening, with more women and men engaged in insecure work with shrinking social welfare support. Economic inequality is widening in many countries and gender inequality remains stubbornly high. The coal and energy sectors are no exception to these trends following the erasure of unionized workforces and consolidation within the mining industry resulting in the transfer of wealth and power from workers to shareholders (Browne et al. 2011; McDonald et al. 2012; Wiseman et al. 2017). Musango et al. (2020) call for a need to reconceptualize gender mainstreaming as a long-term strategy aimed at bridging gender awareness and daily routines and urge policies and research to shift the focus on the gendered aspects of everyday energy use practices. Feminist tools such as gender audits, gender impact assessment, and gender analysis continue to be powerful and indispensable for mainstreaming gender in policies and programs. However, as Clancy and Mohlakoana (2020) note, their transformative potential cannot be realized without political and financial commitment to achieving gender equality on the part of governments and industry.

The need for the study is also embedded in the rapid growth of technology both in the coal sector and in the energy systems that are replacing coal. Generating clean energy such as geothermal energy from coal mines has been suggested as one technological innovation, but it is unclear how far such developments will succeed in places without a natural advantage (Coal International 2020). Brey (2019) considers that new technologies of a socially disruptive nature will change things such as the meaning of “informed consent” as ubiquitous and data-intensive applications utilizing self-learning algorithms interfere with what has so far been seen as a human right.

The wave of rapid automation, often described as the “fourth industrial revolution” (Schwab 2016), is creating a new landscape of employment, fundamentally transforming the ways in which people live and work.

Brussevich et al. (n.d.: 4) find that on average women perform more routine tasks that are prone to automation than men across all sectors and occupations; women face a higher risk of automation compared to male workers, and less-educated, older-female workers (above 40 years), and those in low-skill, clerical, service, and sales positions are disproportionately exposed to automation. They estimate that given the current state of technology, 26 million female jobs in 30 countries are at a high risk of being displaced by technology. According to the IOE (2016: 18), the use of new technologies seems to have opened up labour markets, particularly in economic systems that were originally dominated by men, or in countries of the Global South, because women are more likely to have better developed “soft skills” which makes them an important talent pool. Casey and Nzau (2020) argue that the gender-differentiated impact of automation on men and women’s jobs may vary, but the change will largely depend on the extent of automation

possible in the sector; for example, women may benefit from their over-representation in sectors that have the least potential for automation such as health care and education. In the more specific instance of mining, many innovative techniques are currently in use for data processing and remote-control operating devices. Along with other uses, these technologies are also evolving rapidly in mining from exploration to consumption patterns. Cosbey et al (2016), however, ultimately predict workforce reduction and warn about the impact of automaton on employment in extractive industries.

Already, a host of technological breakthroughs in Artificial Intelligence (AI), robotics, the Internet of Things (IOT), autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing are in use in energy systems.

Opinions differ on their impact on jobs; on the one hand Deloitte's (nd) report on AI is hopeful about the future of mining employment although it predicts changes in the nature of mining work itself as well as changing perceptions of mining as a career choice. Other scholars believe that AI is making visible the limits to the productivist model of work that has so far governed capitalist societies (Macleavy and Lapworth 2020). Srnicek and Williams (2015) agree and argue that complete automation that is divorced from feminist struggles for gender equality will lead to a "misogynist post-work future" in which there is a decrease in waged labour, but women continue to fulfill the majority of unpaid domestic and reproductive work. Wisskirchen et al. (2016) note that one of the outcomes of the use of AI and IOT will be flexible work hours and shorter workdays.

The risks and opportunities arising from these technological changes are not gender neutral. In considering the future of work, Macleavy and Lapworth (2020: 314) further warn that "[t]echnological advancement will not overcome the lower value of feminised labour, the barriers to women's labour market participation, or the wealth gap between men and women", but instead, these innovations "will see a greater share of profits flow to men as business owners and investors." In the extractive industries, Abrahamsson (2019) suggests that women might become negatively impacted by new technologies such as AI that will create new work environments, contexts and tasks, new ways of organizing, new competence demands, and a move from underground extraction to high-tech control rooms above ground. In other words, these account for large changes in mining production and work and new conditions for what constitutes "work" in a coalmine. As the perceptions of mining as a career choice change, it will have implications for the future of work for women and men in coalmines. For example, women who are currently not working would profit from flexible working hours and working places, which could particularly enable them to work part-time from home. Such options would help to bring them back into the workforce.

Approach and Methodology

This report takes up a multi-scalar approach to understand if and why the impacts of coal sector transitions are gendered, to examine these gendered impacts and to design a framework based on this evidence to prevent such impacts on women. In a multi-scalar approach, which is different from multi-level approaches, scale is conceptualized as not only hierarchical and clearly bounded,



but the importance of multiple scales is evident in shaping the outcomes. The same (or similar) question(s) is asked in light of different empirical evidence that pertains to that particular scale. This approach examines the same research question at different geographical scales to understand the problem holistically. It does not start with the belief that there is a certain “value” that can be calculated at a scale that is “correct”; instead, it presents a continuous function with respect to scale and implicates scale in the complex outcomes experienced by women and men in the global coal economy. The adoption of such an approach enables new ways of thinking about and analyzing gender challenges with respect to coal sector transition at different scales, while engaging with the complexities of multi-scalar methods. Since this project is essentially a desk-based research, several tools were applied which differed depending on the scale of analysis.

The scales of this study are global, national, and community/household. At the global scale, both quantitative and qualitative tools were used. A statistical analysis was employed to examine the possible relationship between coal reliance and gender development indicators of individual countries. For this a Coal Reliance Indicator was developed, based on available country statistics on supply and demand, which was in turn correlated with available gender equality indices. At the same time, experts working on various aspects of gender and coal/energy areas were consulted, along with a stakeholder consultation on the gender challenges of a Just Transition.

At the national scale, individual country studies of major coal producing countries – India, Indonesia, Russia, Ukraine, Vietnam, and Australia¹ – were studied to examine how their commitment to the Paris Climate Accord aligns with their commitment to Sustainable Development Goals (SDGs). The study thus rendered an understanding of their coal economies and gender equity contexts².

At the community/household scale the report draws upon case studies of mine-affected communities using participatory and ethnographic fieldwork methods. These case studies illustrate the gendered impacts of mine closure and energy transition on men and women, and the institutional and structural barriers to engendering energy policy, which are based on the work of independent researchers and NGOs working with communities affected by the extractive industries and energy transition.

Different parts of the research were carried out by different researchers based in Australia, Russia, and Vietnam under the supervision of Kuntala Lahiri-Dutt, the lead author, who carried out the stakeholder consultations and Delphi process, supervised researchers, and finally collated the findings. The individual researchers are credited for their contribution towards this report in the title page.

¹ The United States of America and China are two important coal-producing countries that were not considered for intensive study.

² These ‘country snapshots’ are not included in this report.

Structure of the Report

Part I of the report lays out the framework and gives a brief introduction to the theoretical framing of the thematic topic. Part II gives the global scenario of coal reliance, correlating it with gender equality, and also offers a broad concept mapping based on consultations with experts and stakeholders. Part III offers evidence of gender impacts of coal mine closure and summarizes the key findings from extant literature, followed by recommendations for policymakers and planners for a just and gender-equitable transition, and finally offers a framework to prevent negative gender impacts in mine closure contexts.

Linking Energy Justice to Gender

Following Sovacool and Dworkin (2015: 436), energy justice is defined as a system that “fairly disseminates both the benefits and costs of energy services, and one that has representative and impartial energy decision-making”. The word “fair” is crucial because the idea of justice in this context is intimately linked to morality, not simply laws. In considering energy justice, the focus would be on procedural justice (to ensure fairness to all) and distributive justice (to ensure that everyone gets their due and has equal access to key resources) (Jenkins et al. 2016). Addressing gender in energy justice would therefore mean a redistribution of power between women and men, possible by following the five key principles: access (to resources), equity, diversity, participation, and human rights.

Gender inequalities reflect the social inequities and hierarchies between women and men (Kabeer 1999). Gender gaps continue to exist due to differences in power, status, and influence between women and men, and are manifested in lower pay/wages, lower levels of education, skills, access to resources and low asset ownership, experience, time-poverty and limited mobility, and the segregation of roles between men and women (ILO 2016). Energy justice would mean addressing these gender inequalities and the existing socioeconomic and power inequalities that drive them.

Currently, women, particularly rural women from poorer countries, are often disempowered and discriminated against both at the workplace and in households (ILO 2016; IRENA 2019). The global gender gap in workforce participation on average is around 27%, while women earn 23% less wages than men (ILO 2016). Women are also most likely to compromise on the quality of jobs due to their multiple roles, and limited mobility, time, and decision-making capabilities (ILO 2016; IRENA 2019; Mortensen and Boyland 2019). Within this grim scenario, the growing attention towards climate change and approach to mitigate climate change impacts through energy transition can serve to enhance these gender gaps (UNFCCC 2020).

A rich body of literature explains how the impacts of climate change and energy transition are gender differentiated (Clancy and Dutta 2019; Clancy and Roehr 2003; Gay-Antaki 2016; Oparaocha and Dutta 2011; Sovacool 2016). The analysis of gender in energy transition, however, focuses on the user end of energy systems (e.g., Johnson and Boyland 2020; Johnson et al. 2020; Smith 1996). In considering climate change and energy access, scholars have noted the



structural inequalities in the current global political economy that put women at a more disadvantageous place than men (Allwood 2020; Aung and Koski 2020; Johnson and Boyland 2020). Comparatively less is known about the gender impacts of coal sector transition, which brings us to the concept of Just Transition and gender.

Approaching Just Transition

Energy systems are shifting rapidly globally.

According to the Intergovernmental Panel for Climate Change (IPCC 2014) the pace of transition has accelerated in the last two decades with the advent of new, alternative technologies which are low in carbon and more sustainable and economical. The transition is enabling a shift from fossil fuels to non-fossil fuels by state and private actors in production, consumption, and other uses (Bridge et al 2013; Sovacool 2016). This transition will, however, not be easy given the socio-economic and cultural impacts on dependent households and communities, despite paving the way for new employment opportunities within a low-carbon economy (ILO 2018). The concept of Just Transition shifts the conventional climate versus development debate towards the well-being of people whose lives are caught up in the energy transition (Aung and Boyland 2020).

Since 2010, Just Transition has been part of the of the main discourse in climate change dialogues and debates between development agencies, business, governments, advocacy groups, NGOs and academia (Evans and Phelan 2016; Heffron and McCauley 2017 and 2018; ILO 2015, García-García et al. 2020). The 2015 Paris Agreement referred to the process of “[t]aking into account the

imperatives of a just transition of the workforce and the creation of decent work and quality jobs per nationally defined development priorities” (UNFCCC 2015), further legitimizing the importance of the concept in achieving a low-carbon economy.

There is now a broad consensus that the impacts of energy transition transcend economic and political domains and reach every aspect of society (Heffron and McCauley 2017; McCauley et al. 2019; Newell and Mulvaney 2013). Thus, Just Transition warrants a comprehensive, holistic, and inclusive approach through which the “winners” and “losers” can be identified and a framework developed to enhance the adaptive capacity of those adversely impacted in the new economy. This requires long-term planning and commitment, adoption of distributional and procedural justice within the strategies, and creating opportunities to reduce the existing social and economic inequities (Piggot et al. 2019). Clearly, the meaning of Just Transition as a concept is more than job protection but encompasses more radical transformations and the restructuring of market-based economies to reduce existing socioeconomic inequities (Farrell 2012; Swilling et al. 2016). This creates opportunities to consider existing gender inequalities and the transition to a more gender equal society that is also carbon-free.

The Just Transition Research Collaborative report (UNRISD 2018) identifies four overlapping approaches, drawing upon academic and stakeholder classifications (Fraser 2005; Hopwood et al. 2005; Stevis and Felli 2015)

1. **Status quo approach** is associated with corporatist and free-market genres of thought that calls for greening of the economy while focusing on new business opportunities arising in the process (Pinker 2020). In this approach, “old brown/black jobs” are replaced by “new green jobs” as a form of justice. This approach has been extensively used in Ruhr, Germany, where displaced miners received financial compensation and young miners were given training and support in acquiring new green jobs (Abraham 2017; Sheldon et al. 2018).
2. **Managerial reform approach** focuses on creating or modifying standards and rules to put more focus on employment, health, and education without compromising the existing socioeconomic model and power balances. National and international environmental organizations, trade unions, and industries have adopted this approach in public policymaking and investments in public and private sectors (Hubbard and Nunez 2016). The International Trade Union Confederation (ITUC) supports this approach (2009), and the International Labour Organization’s (ILO) Just Transition guidelines are also based on a managerial reform approach (ILO 2017).
3. **Structural reform approach** emphasizes distributional and procedural justice including:
 - a. equitable distribution of resources among workers.
 - b. democratic decision-making framework to navigate the transition; and
 - c. collective ownership of the new energy system developed in the low transition economy with multiple stakeholders (Healy and Barry 2017; McCauley et al. 2013; McCauley et al. 2019; Sweeney and Treat 2018).
4. **Transformative approach** implies that existing socioeconomic and political structures are the root cause of many social, economic, and environmental problems (Healy and Barry 2017; Hopwood et al. 2005) and suggests alternative development pathways and radical changes in the relationship between the economy and the environment. Though the focus is mostly towards the rights of workers, this approach also addresses the issues of racism, gender inequality, north–south divide, etc., prevalent in our current social and economic systems. The New Green Deal in the US (sponsored by Democrat Senator Ed Markey) is an example of this approach (Friedman 2019). The Just Transition Alliance in Oregon (JTA 2018) and the Labour Network for Sustainability (LNS 2016), also based in the US, argue that economic inequities can be addressed by achieving climate justice, but the process should be democratic, inclusive, and community led. There is also a great support for this approach in international organizations (Healy and Barry 2017; Heffron and McCauley 2018; McCauley and Heffron 2018; Stevis and Felli 2015). However, there is no consensus on the pathway to be taken and a transformative approach remains context specific.



A gender lens can be applied to each of the four approaches to a Just Transition. The status quo approach has been adopted by some governments and corporations operating in the EU. In these contexts, the emphasis has been on the provision of a conducive environment for transition, compensating the “losers” and offering opportunities for new green jobs. This approach has also focused on building women’s leadership and entrepreneurship, providing targeted funding to women to start businesses, and training women for new jobs in the green sectors. The managerial reform approach prescribes dialogue between trade unions and employers to ensure that both climate and developmental goals are achieved so that new industries can capture opportunities arising from the low-carbon transition. A modified version of this approach seems to have been taken up by large trade unions in some countries such as South Africa. However, other trade unions have proposed a structural reform approach to move beyond social and political boundaries and revisit the existing inequities in the energy system. They propose that women should be at the centre of consultations, planning and implementation of the transition to a low-carbon economy to ensure energy democracy. Obviously, the structural reform approach creates greater opportunities for women than the managerial reform approach.

However, it is the transformative approach that resonates most strongly with current Gender and Development (GAD) theory and practices. Moving beyond the previously held conception of “women’s empowerment”, GAD experts in recent years have emphasized that any change must be “gender transformative”, i.e., fundamentally change those economic, social, cultural, and political root causes that allow gender inequalities to persist (Cornwall and Rivas 2015; Weber 2020). Towards this

purpose, coal sector transition approaches and intervention programs need to be customized to local needs to address the sources of persistent gender inequalities while enabling transformative change processes that can lead to the empowerment of women and girls. Transition policies and processes should also aim to ensure that women gain a greater awareness of their rights and have access to information and control over productive resources and financial services. In this manner, Just Transition could enhance women’s agency, technical knowledges and skills, enabling them to participate in the new, more democratized, low-carbon economy.

Just Transition and Gender

The term “gender” has been “a wellspring of feminist debates” (Eveline and Bacchi 2005: 497) ever since the second wave of Anglophone feminism differentiated between biological sex, determined by nature, and socially constructed gender, which can be changed. Yet, a strong association between gender and women has remained ever-present in development praxis because in most countries and cultures, women are generally more socioeconomically disadvantaged than men. The need to apply a gender lens to the fossil-fuel dominated energy systems arises because of their lower status, level of employment, and the less importance given to women’s issues despite them bearing a greater burden, compared to men, of the socioeconomic impacts of coal mine and power plant closure (Aragón et al 2018; Aung and Strambo 2020; Pai 2020; World Bank 2018). Studies suggest that the transition towards a low-carbon economy may reduce such disparities

between women and men (IRENA 2019; Pearl-Martinez 2020). However, women who benefit from the existing energy systems tend to be those who are directly or indirectly employed in sectors that are dependent on fossil-fuel-based industries (Kotsadam and Tolonen 2016; Oliver 2018; Stanley 2018).

The poor understanding of the gendered impacts of socioeconomic upheavals such as energy transitions arises because on the surface it appears that women and men are impacted equally.

However, human societies are not homogeneous in economic, social and cultural aspects, and have different historical contexts. Consequently, women and men hold different power in society and thus when there are impacts such as climate change they are not affected equally or in the same ways. Similarly, changes in energy regimes – sourcing and production – can be expected to have serious gendered impacts, which in turn affects the nature and pace of energy transition. In arguing against the assumption that countries where women with important decision-making roles have high levels of gender equality, Magnúsdóttir and Kronsell (2015) reason that such women may support carbon emission abatement as these transitions have the potential to bring along new ideas and perspectives.

That the extractive industries cause gendered impacts is well-established (Jenkins 2014; Keenan et al. 2016; Lahiri-Dutt 2011, 2012; Lahiri-Dutt and Macintyre 2006).

It is also well-known that women gain less of the benefits and experience a disproportionate amount of the adverse impacts of mining, which are most acute during mine closure (Bainton and Holcombe 2018; Owen and

Kemp 2018). To date, governments and the mining industry have predominantly focused on the environmental and technical aspects of mine closure and its impacts on male mine workers. This has obscured other social impacts resulting from mine closure, including negative impacts on women as dependent spouses of retrenched mine workers, workers in supply and secondary goods and service industries, and as members of communities experiencing the often-severe economic decline that follows closure (Aragon et al. 2019; Aung and Strambo 2020; Sesele 2020; Strambo et al. 2019).

Researchers have concluded that the key barriers to managing the social, environmental, and economic impacts of coal sector decline are inadequate regulation and abrupt or unplanned mine closure (Browne et al. 2011; Bainton and Holcombe 2018; Owen and Kemp 2018).

The lack of effective planning and regulation of mine closure that is widely documented in the literature across multiple jurisdictions calls into question the commitment of governments and the extractive industry to sustainable development and livelihoods (Keenan et al. 2016). It has been suggested that governments in all jurisdictions need to legislate robust, legally binding mine closure agreements to ensure that best practice in terms of consultation, communication, and long-term community-driven closure planning takes place (Bainton and Holcombe 2018; Monosky and Keeling 2020; Pini et al. 2010; Sartor 2018; Vivoda et al. 2019).



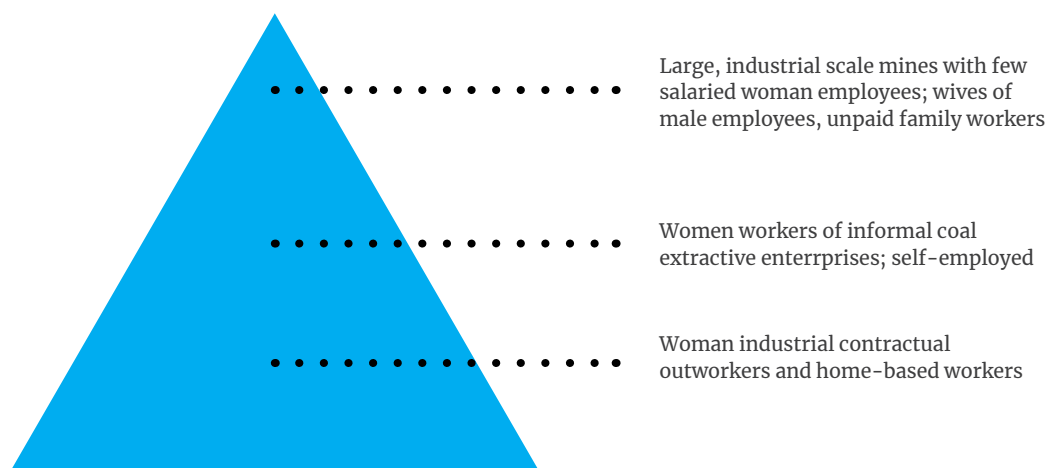
Women in the Coal Sector

A question might arise: why are we concerned about women when we all know that the coal sector is highly dominated by men. Women comprise a small proportion of the formal mining workforce in general, and are fewer in formal, large-scale coal mining industry. However, women are present in large numbers in the informal, artisanal and small-scale mining sectors. Even in large-scale mining, the visibility of women and gender issues has increased to a great extent in the recent years, leading to a feminization of mining (Lahiri-Dutt 2015). Moreover, coal mining is not always large- or industrial-scale; experts suggest that there are informal and smaller-scale coal mining occurring throughout the world, and although it is impossible to provide a correct estimate of the amount of coal produced or numbers of women employed in such mines, an educated guess would be that collectively they offer a significant area in need of greater investigation and intervention (Lahiri-Dutt 2016).

Irrespective of the size or nature of the coal mining operation, women generally are poorly paid and typically engaged by contractors as low-level staff, casual, informal or daily-wage labour within the coal sector. Women also play key roles in coal mining communities and have often been at the forefront of social movements – be it against mining, or mine closure or in support of trade union movements. Still, women are often overlooked as stakeholders and their interests may not be considered or advocated by unions, industry, or government when developing employment and economic transition policies and programs (Aung and Strambo 2020; Strambo et al. 2019). Following Chen’s 2004 illustration of the informal economy, and Kabeer’s 2008 exploration of the gendered dimensions of the informal work of women in the economy, women’s status in the global coal sector can be demonstrated as the following pyramidal structure. Women’s lack of participation in higher-levels, formalized and decision-making spaces at all levels and types of coal communities means that their

Figure 1

Women in the Global Coal Economy



needs, interests, views, and perspectives are not considered in the policies that shape their lives and opportunities (Fraune 2018; Lieu et al. 2020; Mohr et al. 2020). Baran (2018) argues that the spouses and partners of male mineworkers are more likely to have less financial independence as coal communities are generally male dominated (Allwood 2020; Aung and Strambo 2020; Clancy and Dutta 2019). Therefore, when these male workers lose their jobs, their wives are in many ways more adversely affected.

Although there is ample evidence of the gendered impacts of mining projects, there has been a lack of attention to energy systems, even though they too are marked by gender disparities. While the Just Transition movement has led to studies that emphasize the importance of minimizing the socioeconomic losses of communities dependent on the coal sector (Mortensen and Boyland 2019), only a few have focused on the gender impacts of coal transition. Research to date has tended to focus on gender and the social equity challenges of enhancing affordable and clean energy access – goals which can help in achieving SDGs on gender equality, health and well-being (Johnson and Boyland 2020; Pearl-Martinez 2020; Bell et al 2020; Smith 1996). One of the critical research findings in this field is by Johnson et al. (2020), who suggest that changes in energy systems do not automatically tackle the structural impediments that are embedded in social, economic, and cultural contexts. Based on a study of renewable energy projects, they argue that if existing power asymmetries in resource access and distribution are not addressed early on, the same structural inequalities will be replicated and transferred over to new energy systems.

Impacts of Coal Mine Closure on Women

Data on the impacts of coal sector transition on women is sparse and limited to countries in the Global North. The Latrobe Valley in Australia, Silesia region in Poland, and Bottrop in Germany's Rhine Valley are examples of coal regions where the entire socioeconomic fabric is based on coal mining and/or coal-fired power plants (Skoczkowski 2020; Taylor 2015). Aragón et al. (2018) argue that coal mine closure affects the genders differently, that they are not perfect substitutes for each other in terms of employment in other non-mining sectors. Using a 20-year gender-disaggregated employment dataset from coal mines regions in the UK, they show that when mines close the number of men in manufacturing and services increases, but the participation rate for women decreases.

Kotsadam and Tolonen's (2016) temporal study using quantitative tools to determine the impact on women's employment during the resource boom in Africa found that structural reallocation during a resource boom forces women to shift from agriculture to manufacturing and services sectors for better incomes. However, when mines are closed, women are forced to shift to agriculture on much lower incomes.

The World Bank and ILO have undertaken qualitative analysis of the socioeconomic impacts of coal mine closures on women. They argue that although women are not always directly employed in the coal sector, they are indirectly affected by coal transitions because most of them are employed in sectors or supply chains that are dependent on coal sector revenues (ILO 2017; Stanley 2018; World Bank 2018). The case studies of mine closure in this report confirm, among other things, an increase in domestic and other

forms of violence against women and burden of household responsibilities, and high levels of anxiety and mental stress for women who must find alternative employment to support their families. An example is the Polish coal sector layoffs and policies to reduce the workforce in the Silesia region that resulted in an increase in men's alcoholism, substance abuse, and violence against women (World Bank 2018).

However, not all women are negatively impacted by the transition towards low-carbon technologies. In their report, Johnson and Boyland (2020) suggest that energy transitions can have positive impacts on women's labour and living conditions. Mortensen and Boyland (2019) also suggest that new technologies such as solar cooking stoves and solar lanterns will improve women's health and reduce the burden of manual tasks, such as collecting fuelwood for household use. However, women's labour participation in the renewable energy sector and in accessing the benefits accrued from new energy technologies remain highly contingent on prevailing gender norms and constraints (Bell et al. 2020).

Frameworks and Policies for a Just

Transition to Low-Carbon Energy

A survey conducted by the International Renewable Energy Agency (IRENA 2019) suggests that the transition to low-carbon technologies has improved both the level and quality of women's labour participation when compared to jobs in fossil fuel industries.

Women comprise 32% of the total workforce in renewable-based industries globally compared to 22% in the global fossil fuel industry. However, there are significant barriers to

entry for women in comparison to men for securing employment in the renewable-based industries, which arise from pre-existing cultural and social norms, limited mobility, poor training, lack of skills and awareness, low asset ownership, and, most important, lack of gender awareness and gender sensitivity. The report further suggests that there is a need for gender mainstreaming at the level of policymaking and project implementation to achieve the three key, interconnected, and mutually reinforcing SDGs: gender equality (SDG 5); affordable and clean energy (SDG 7); and decent work and economic growth (SDG 8).

Two key observations have emerged in the literature on the gendered impacts of mine closure and energy transition. The first is that context matters. Regions where the coal sector is declining are widely divergent and so is the pace and significance of that decline (Clancy and Dutta 2019). Secondly, all policy solutions must be based on careful analysis of local conditions and developed in close and constant consultation with the affected local communities or risk being ineffective (Clancy and Mohlakoana 2020; 2019; Gambhir et al. 2018; Hill et al. 2017a, 2017b; Kooijman-van Dijk 2020). Other critical factors include effective consultation and collaboration between stakeholders and different levels and agencies of government. A recurring finding is that local levels of government that are the most severely impacted in terms of revenue by mine closure and are also charged with implementing transition programs must have the resources, capacity, technical skills, and support to implement gender-responsive transition policies and programs (Mohr et al. 2020; Sesele 2020).

Mainstreaming gender into a Just Transition policy framework would therefore require the institutionalization of gender equality by embedding gender-sensitive practices and norms in the structures, processes, and overall environment of policies adopted to implement coal mine closure and energy transition. It would involve a two-pronged approach: analysis of existing evidence to understand how gender inequality is perpetuated or exacerbated by mine closure and the development of a range of activities and/or tools to ensure new gender inequalities are not produced in coal sector transition. According to Walby (2005), traditional gender equality policies and politics have focused on areas where it is possible to compare the disadvantaged position of women from the privileged position of men. Gender mainstreaming goes beyond this, with the ambition of subjecting all policy areas to gender equality practices. The aim of gender mainstreaming is transformation, in which there are new standards for everyone, replacing the segregated institutions and rules associated with masculinity and femininity. Transformative gender mainstreaming has the potential to deliver gender justice because this is the only strategy that involves the transformation of institutions and standards necessary for effective equality (Walby 2005: 456).

Addressing gender challenges in energy transition and mainstreaming gender in Just Transition frameworks and initiatives is gaining traction. Yet despite the growing discourse on Just Transition and global trend of reducing dependency on fossil fuels, data and evidence-based analysis on the gender and social equity impacts of energy transition for countries of the Global South is still largely missing.

Intersectional Approach to Gender

The concept of “intersectionality” has no common definition; it is based on feminist arguments that single and discrete categories of difference (race, gender, or sexuality) are limited, and that these categories are multidimensional, interdependent, and mutually constitutive and cannot be simply added together or ranked (Bilge 2009). For the purposes of this report, we broadly follow Davis’ (2008) definition of intersectionality as “the interaction between gender, race, and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies and the outcomes of these interactions in terms of power” (Davis 2008: 68). In general, intersectionality promotes:

"[A]n understanding of human beings as shaped by the interaction of different social locations (e.g., race/ethnicity, indigeneity, gender, class, sexuality, geography, age, disability/ability, migration status, religion). These interactions occur within a context of connected systems and structures of power (e.g., law, policies, state governments and other political and economic unions, religious institutions, media). Through such processes, interdependent forms of privilege and oppression shaped by colonialism, imperialism, racism, homophobia, ableism and patriarchy are created." (Hankivsky 2014: 2)

According to Hankivsky (2014: 4), intersectional approaches to policy analysis and research are oriented towards “transformation, building coalitions among different groups, and working towards social justice”. Researchers can use intersectional principles to expand the scope and analytical lens of gender analysis frameworks to help achieve these goals.

Embedding Intersectional Principles in Gender-Based Policy and Social Research

Reflexivity: Researchers and policymakers must consider their own social positions, identities, and relationships, and how these might shape our perspectives and outcome of our analyses.

Diverse knowledge: Valuing and recognizing the diversity of forms of knowledge as well as how power influences which forms of knowledge are considered legitimate.

Multilevel analysis: Understanding effects between and across various levels in society, including macro (global and national-level institutions and policies), meso or intermediate (provincial and regional-level institutions and policies), and micro levels (community and household).

Resistance and resilience: These can disrupt power and oppressions, and collective action can destabilize dominant ideologies.

Key Questions to Bring an Intersectional Lens to Social and Policy Research:

- What forms of identity are critical organizing principles for this community/region (gender, race, ethnicity, religion, citizenship, sexual orientation, and gender identity, age, caste, ability)?
- Which women, girls, men, and boys are most at risk of marginalization and why?
- What social and economic programs are available to different groups in the community, and do they promote or advance a transformative agenda for women's rights?
- Who does and does not have access or control over productive resources and why?
- Who has the lowest and highest levels of public representation and why?
- What laws, policies, and organizations limit the opportunities of different groups?
- What opportunities facilitate the advancement of different groups?
- What initiatives would address the needs of marginalized or discriminated groups in society?
- What are the expressed needs and priorities of these marginalized groups?

Sources: Hankivsky (2012, 2014); Colfer et al. (2018); GADN (2017).

PART 2

Global Scale Studies



Section A: Qualitative Stakeholder Consultation: What are the Gender Challenges in Coal Sector Transition?

Introduction

A large-scale, global, stakeholder consultation was carried out to understand how those who are involved deeply in coal sector transition view gender issues.

This was a qualitative-inductive study, and this section reports the findings of this consultative process.

Individuals were identified through a sampling method called "snowballing" used widely in sociological and anthropological research. In snowballing, the enrolment of one participant in the study leads to other participants; this way, the participant numbers are "snowballed" or increased gradually. Snowball sampling is also described as a convenience sampling or a "chain method" and is efficient and cost-effective. This method is used when it is difficult to access research participants, and one participant can help identify others from among their acquaintances. The technique was selected to address the sampling challenges that arise when undertaking a qualitative global survey to generate a "thick description" of how people are currently considering gender in their work on energy transition. It addressed the need for a multi-country stakeholder survey that is also representative of the broader ideas existing amongst all stakeholders on gender challenges.

The participants in this survey were drawn from a wide variety of fields and areas of expertise, including: academics, researchers, policymakers, administrators, mining company professionals, trade unionists, civil society activists, environmental activists, development donors and development banking staff.

The study allowed us to examine micro-level experiences, patterns of thoughts and attitudes, and the actions of myriad individuals and groups that are involved in energy/coal sector transition.

We asked each participant to respond to several questions. Instead of presenting the individual responses to each of these questions, we have condensed and summarized the key findings below under five broad thematic headings.

Awareness of Gender Challenges in

Energy Transition: Gender and Climate

as the Two Pillars

The survey responses revealed that overall, general awareness of gender challenges in energy transition seemed to be minimal, even for those survey participants that were directly engaged with gender issues in their work. The common trend was for survey participants to link the issues of gender with energy (in)security and energy use, rather than energy production. For example, awareness of the need for clean cooking energy (for women based in the Global South), or smart technologies at home were noted. Clearly, women/gender remain in the peripheral vision of those engaged with coal/energy/electricity production. Coal sector jobs are still considered

to be "non-traditional" for women, and coal and male identities remain inextricably linked. This enduring view of coal as a "masculine domain" remains the first hurdle in making the case for a "gender just" Just Transition of the coal sector. When specifically asked, the survey participants expressed the view that as women comprise only a tiny proportion of the workforce, and since Just Transition as a concept is focused on securing post-mine closure livelihoods for workers, the gender question was not uppermost in their minds. Gender-based vulnerabilities caused by climate change and environmental degradation were well recognised, and many European activists pointed out that gender inequalities are being exacerbated and a Just Transition to more sustainable production and consumption is thus needed to ensure that the transition is gender just. Gender and climate activists from Germany for example, noted that the context of gender equality is not similar in western and eastern parts of the country, and the impacts of coal mine closure will be deeper on women in the east. So far, economic subsidies have been a key policy instrument in Germany's phasing out of coal, but they note that any subsidy program should have a Gender Impact Assessment carried out to assess both the intended and unintended impacts on gender equality.

Yet, most participants noted that women throughout the Global South rely on agriculture for subsistence or employment, bear great responsibility for unpaid provisioning of water and fuel for households, and have fewer resources to buffer the impacts arising out of land degradation, deforestation, water scarcity, pollution and changing water regimes that intensify their labour burdens and increase

their risks of poverty and hunger. A researcher who has been studying the outcomes of a coal mine closure in the Western Coal Fields in India noted that the policy implementation gap and the lack of basic facilities such as schools, hospitals and other social security measures, particularly for the large number of people in the informal coal extraction economy, services and allied industries, has had a profound impact in the surrounding areas. Farming had changed during mining towards the production of more cash-crops, but now the local communities are at a loss as local trade and commerce has decreased. Reduced consumption and spending has affected petty traders such as local shopkeepers, and moreover has crushed the dreams of young people about the future and led to the outmigration of men, leaving much of the burden of household level livelihood responsibilities on women. The number of de facto Women-Headed Households has increased in the area. Crime rates have also significantly increased.

Global South Countries Do Not Always

Have an "Elite Development Coal Economy"

It was suggested that as some Asian countries and emerging economies become more reliant on coal, a new mining elite that controls the "commanding heights" of these economies seems to have come into existence. In Post-Apartheid South Africa for example, this took the shape of a class project whereas in India and Indonesia, the idea of "national development" took precedence. For example, ESKOM, a state-owned utility, is the largest coal user in



South Africa; SASOL is the largest taxpayer and employer with their own mines. The equivalent in India is Coal India Limited (CIL) that hire over 250,000 people and is the largest state-owned coal producer in the country.

However, both countries are characterized by the presence of an informal coal mining sector that is largely unaccounted for, ill-understood, tolerated by the States for the sake of law-and-order maintenance, and sometimes a major source of livelihoods for the poor.

The wider context of the existence of this informal coal extraction sector is rampant unemployment or underemployment, combined with low skills development, a decaying farm sector and lack of alternative job opportunities. Informal mining takes diverse forms and the numbers eking out a livelihood from informal coal extraction varies considerably, but notably employs many women. For example, in South Africa's Mpumalanga region women (and sometimes children) pick coal for household use, whereas in Soweto coal is scavenged for sales. A respondent from South Africa noted that scavenging that takes place close to residential areas is usually carried out by women whereas in abandoned underground mines it requires a higher degree of organization and is led by men. In India's northeast, a legal loophole allows informal coal mining by indigenous landowners with the permission of only district level authorities, whereas in the eastern state of Jharkhand, dispossessed indigenous and local poor extract coal for a livelihood.

In addition, in almost all Asian countries, a large, poorly recorded, informal sector piggybacks on the formal sector: contractual

coal extraction. Most coal mining companies outsource much of their work to avoid hiring more direct employees. They outsource jobs such as land preparation, overburden removal and sometimes coal extraction itself to companies or local entrepreneurs acting as "contractors". Most often, the contractors hire local people on a daily wage basis on very low and uncertain incomes. Whilst the formal companies report the total coal production figures as theirs, they do not count the contractors' labour force in their lists of employees. These large numbers of people are dependent on coal extraction for a living. In the Mpumalanga region of South Africa, around 30% of the GDP comes from informal coal, and 12-15% of the informal workers are women. One of the respondents from a civil society organization noted that the median age of coal miners in Mpumalanga is 37, and they are generally very poorly educated and do not have the necessary skills to take up new job opportunities. There also are no other jobs available as agriculture, horticulture and dairy farming activities have largely ceased with the expansion of mining, leaving few other avenues for employment.

Most local community members have become sick with respiratory illnesses due to poor environmental management.

Outsiders, better-trained migrants from other areas, have taken the formal sector mining jobs, and the local communities are gradually getting fewer jobs due to their inability to get "medical clearance" for even low-paying positions which formerly were claimed by them. The burden of ill-health falls on women to a great extent as they provide the care work at home. The high death rates, domestic violence and wife-desertion mean that

there are a large number of Women-Headed Households in almost all coal communities and these households are at the bottom of the priorities of the local government, the coal mining companies and the trade unions. The numbers of people on a pension includes those employees who have had to stop working due to poor health or were given Voluntary Retirement. These retired workers or pensioners are enormously important to maintaining the local economies of coal regions and need to be considered in the transition away from coal, as will the “sending communities” that provide migrant workers as coal mines close when the remittance incomes they have received will cease as coal jobs are lost.

According to one interviewee, besides informal livelihoods, there is a category of “indirect” jobs that include those hired casually by the coal transport companies.

Historically coal was moved on conveyors, but now-a-days almost everywhere in Asia an army of trucking companies manage coal movement on a contractual basis. These transport companies’ staff includes thousands of truck drivers and their attendants, who are not listed as direct employees of either the coal companies or the coal contractors.

Besides the indirect jobs, there is an additional category of “induced jobs”; those jobs that are not in the value chain of coal extraction but are part of what can be described as the “extended value chain”.

These include the “next layer of jobs” – ancillary activities such as the provision of services to coal-dependent communities. Much of this sector is feminized but is once again poorly accounted for within the official “jobs figures” debated as part of

Just Transition. The impact of coal transition on these indirect workers can be enormous, and for women whose labours are already undercounted, these impacts can be serious.

Specifically in the context of India, one researcher noted the potential impact of coal transition on the state-owned Railways. Apparently, the Indian Railways (IR) undercharges passengers and overcharges coal (along with petroleum, oil and lubricants) movement. About 45% of the IR’s income is derived from the transportation of coal, therefore, the shift away from coal would be significant on the employees as well as passenger traffic of the Railways. This highlights that not only does the purpose of coal usage need to be considered, but in developing policies for Just Transition, we need to consider where the coal is used. These are areas where women have interests, not only as jobholders but as community members.

Also, the Just Transition debate has so far been focused on coal fired or thermal power plants in the Global North, but in some countries like India, non-power plant coal usage is significant and a major emitter. Brick kilns consume 5% of coal in India but they use low technology and have very low or no pollution control equipment. Most brick kilns are located close to urban centers and impact communities with carbon emissions. Small and Medium Enterprises (SMEs) such as sponge iron plants are also important coal consumers and polluters, thereby necessitating a demand-side monitoring. Women as part of the local communities are affected as they will lose their direct and indirect livelihoods from the closure of the entire smaller-scale industrial infrastructure that relies on coal.



Therefore, in discussing a fair transition away from coal in the Global South, to avoid a “chaotic transition”, several interviewees noted the importance of both formal and informal employment, and direct and indirect impacts (such as the multiplier effects on the economy and impacts of agriculture-based livelihoods) and suggested the need for a holistic view of coal and its relationship with not only the local economy but also politics and society.

Several respondents observed that in policy debates of Just Transition, primacy is given to renewables, but the first point should be to understand the ways coal employs people. Women who live in coal communities need to be recognized and their contributions across multiple sectors, even if as sex workers, or in garment-making, need to be understood. Deep and contextual research and early assessments of the social and employment/livelihood impacts on women would be required as a first step.

Economic Transition Begins at Home

Some survey participants observed that Just Transition is a broad umbrella term, and to put gender at the heart of it, one needs to expand the idea of what constitutes "work". An expanded definition of "work" would extricate our simplistic attention on formal sector employment to consider the much broader informal sector and encourage us to account for and value the relentless paid and unpaid work that women perform in this sector. Much of this work remains invisible and comprises the "care economy"; which is not just limited to person-to-person care but also involves securing food and water resources to ensure the well-being of households and the safeguarding of livelihoods. To make coal

sector transition just, we need to understand the diverse work and livelihood activities that women (and men) undertake beyond formal employment within the fossil fuel industry. One of our participants argued that the coal industry has created an artificial division of gender roles between women and men, naturalising men as the "worker". This must change. Why? Because:

"While we focus on the workplace, in this case the site of economic transition, any transition that occurs will necessitate a re-evaluation of the care economy in the home and the broader communities. . . Because of the gender division of labour as well as the network of gender relations in any economy, women often bear the brunt of what takes place in the fossil fuel workplace. This is especially true for countries of the Global South."

Other survey participants pointed out that in countries such as the US where gas is displacing coal, the dire consequences that are remaining as embodied legacies – such as Black Lung Disease – need to be seen in a temporal perspective and do not just impact the individual miner but the entire family.

Because of the US medical insurance system, when a retired male miner contracts an acute form of the disease, he has to meet his own medical costs. Similarly, when a company goes bankrupt, the old or young miners with disabilities will fall out of the safety nets provided by the now-defunct company, leaving the burden of care with female relatives.

An expert with wide experience in countries such as Poland observed that mine closures caused social unrest which permeated into the household as retrenched husbands brought the anger into the home, leading to increased suffering by women from aggravated domestic violence. Women's not-

for-profit organizations can provide support in such situations and offer a safe place for women where they can seek refuge. The pensions that were provided to the employees largely went into the hands of men who had worked underground, and not to women who were mostly surface workers. Other anecdotal evidence of the secondary impacts on women comes from Romania where women comprised around 16% of the workforce in 1991, but only 7% in 2004. The closures were led by the World Bank because many of the mines were uneconomic, but redundancy packages were offered to men. The cash finished within a few months therefore leading to widespread political unrest.

A Contextual Gender Approach

is Necessary

In making transition policies more gender sensitive, the approach must be context specific. This is because although coal as a commodity has similar chemical properties and is used for similar purposes irrespective of where they occur, fossil fuel extraction also has a social dimension, and the social-cultural-political contexts within which coal is mined, processed, transported and sold vary widely from place to place. All these factors influence the role of coal in that country or regional context, how decisions about coal are taken and by whom, and how these decisions are received. To be gender-transformative, coal sector transition policies must be “place-based” to understand how far physically the effects of coal mining incomes travel, and the diversification of the economies need to look beyond the possibility of jobs in renewables sector. In this way, a social dialogue can be established to lead to

a democratic consultation of all social actors, and women must be placed at the forefront of the consultative processes to ensure that their interests are not marginalized.

For example, coal mining has a long history in South Africa and India, dating back to colonial times. Both countries still use more labour-intensive production and extraction methods than those in more affluent countries. Consequently, they have vast numbers of people depending on formal and informal jobs within the coal sector. The size of this coal-dependent population, and the skills and education levels of these workers are such that they cannot be easily employed in other jobs, particularly in the new, smart technology-oriented renewables sector. The circumstances of these workers cannot be equated with the coal workers of West European countries such as Germany, where highly qualified and well-paid coal workers could be trained and transitioned into equivalent jobs in other sectors. In contrast, the thousands of people labouring in India’s coal tracts as “coal collector” or “zama zamas” (illegal miners) in South Africa’s Mpumalanga region are poorly educated or have no education at all, and thus have no other or severely limited livelihood options. They do not have any access to important government-funded services such as health care, education and so on. From our wider understanding of the political economy, we know that women comprise a large proportion of informal sector workers in various capacities, and can expect the coal sector to reflect this gendered reality. Yet, since current laws in many countries criminalize informal and small-scale mining, we do not have accurate data on the possible extent of women’s labour contributions to the informal coal mining sector. The first task, therefore, would be to decriminalize informal coal mining, and then offer women targeted Social



Protection Programs, along with considering the provision and expansion of a basic minimum income for all. In most Global South countries, a mineworker and an agricultural labourer cannot be differentiated clearly; many work casually and/or on a seasonal basis. Therefore, as one interviewee noted, the concept of Just Transition has to be redefined by using a lens that sees beyond employment to check "what are we leaving behind?"

What Can Be Done?

Responses to this question, as expected were varied and depended on the subjective position of the survey participant. One participant from the European Bank of Reconstruction and Development noted that development finance corporations, multilateral banks as well as the international energy agencies, are currently taking up policies to empower women to drive change. The steps they are taking include creation of sex-disaggregated data and matrices, putting women in management or leadership positions, investing in them to develop women's entrepreneurial capacity, increase women's presence in the workforce, and enhance women's roles as consumers. This is clearly, the "status quo approach" to Just Transition. Independent researchers sometimes voiced similar opinions and suggested that wider integration of a gender lens in business models and innovation might be the key to countries transitioning to low-carbon economic futures.

Wider suggestions, such as the need for decentralized production of renewable energy that can be used by micro-entrepreneurs, were also made by survey participants. Yet other researchers argued that the positioning of women as economic

entrepreneurs in the technical value chain of new energy economy is in fact a type of extraction, in this instance the extraction of women's labour, often by undervaluing it. Without gendering policy design and a deep understanding of women's roles in livelihoods through their paid and unpaid contributions, the integration of a gender lens in new energy business models and innovation might not be truly beneficial.

One trade union activist from South Africa summed up her views as:

Just Transition has become a sexy term but not all its principles are closely followed when developing transition policies. To ensure that transition is truly democratic, inclusive and socially just, and creates communities that are gender equitable, women's interests need to be put at the heart of Just Transition frameworks and policies. Only trade unions cannot push the gender agenda; they are also often patriarchal organizations themselves. However, the key principle is "democratization of Low-Carbon Future", and the aim is to manage the diverse changes to bring about sustainability, social equity and economic development. All these can only be achieved if women and their interests are not left behind.

As different groups make conscious choices about how to respond to the unavoidable economic and social shocks brought about by climate change, shocks that are highly uneven and have different manifestations for different locations, communities and individuals, the moral responsibility is to apply a gender lens to ensure that benefits are equitably distributed and risks are evenly shared.

Section B: Qualitative Coal Reliance and Gender Equality: Is There a Connection?

This part of the report addresses the research question: Is there a relationship between coal and gender equality at the global scale? Quantitative data and tools are used to examine the negative impacts of coal sector transition on women and to ensure that women are not left behind as economies shift away from coal and toward decarbonization. It further attempts to correlate the relationships between coal extraction and consumption and gender equality and human development. Thus, the focus of the study is on the social and gender implications of coal reliance at the country level.

There have been few recent quantitative studies correlating commodity production and gender equality. An exception is the work by Ross (2008) which argues that the low representation of women in the workforce is due to the Dutch disease effect on the economy, where an increase in one resource-specific sector causes a decline in other sectors. Ross further argues that the resource curse leads to a decrease in employment opportunities for women and thus they lose economic and political influence in both the household and community. Indeed, a higher reliance on coal may be a source of concern through the so-called “natural resource curse” – the negative effects of a country relying on natural resources for long-term economic growth (Sachs and Warner 2001). Studies show that higher reliance on natural resources is associated with higher corruption levels (Brückner 2010), lower education outcomes (Gylfason 2001; Papyrakis and Gerlagh 2007), barriers to democracy by encouraging dictatorial or authoritarian rule (Tsui 2011),

escalated armed conflicts (Dube and Vargas 2013), and higher gender inequality (Ross 2008). Some studies argue that the impacts of resource reliance are not uniform and depend on how concentrated the resources are and if the rent from resources can be collected easily (Alexeev and Conrad 2011; Dube and Vargas 2013; Isham et al. 2005). It is important to note that these studies usually refer to oil or mineral wealth, not coal. There have been studies on the impacts of transitions away from coal, especially in developed countries such as the US (Carley et al. 2018), Australia (Della Bosca and Gillespie 2018), and Germany (Harrahill and Douglas 2019). While the employment and social impacts of mine closures may be concentrated in certain coal-producing regions, the economy-wide effects cannot be ignored.

Reliance on Coal

Individual countries rely on coal in different ways. Some countries are reliant on production for employment and economic output. For others, coal export revenues allow them to import other essential goods and services. In terms of consumption, coal is still a comparatively cheap source of energy. Consequently, developing countries in particular have relied on coal as their main energy source. To measure the varying dimensions of the economic role of coal in a number of coal-producing countries, we developed a Coal Reliance Index (CRI), which combined measurements of production, consumption, and external reliance to create an index that is comparable between countries. The index was then tested for correlation with the Human Development Index (HDI) and Gender Development Index (GDI) in coal-producing countries. We found that lack of sex-disaggregated data was a hindrance to correlation with social and gender indicators.



Table 1

Coal Production by Country (Million tons)

Source: Lahiri-Dutt and Pasaribu (2021) based on BP (2020).

Country	2000	2010	2019	% change 2000–19
China	1384.2	3428.4	3846.0	178%
India	334.8	572.3	756.4	126%
US	974.0	983.7	639.8	-34%
Indonesia	77.0	275.2	610.0	692%
Australia	313.9	434.4	506.7	61%
Russia	262.2	322.9	440.4	68%
South Africa	224.2	254.5	254.3	13%
Germany	201.6	182.3	133.9	-34%
Kazakhstan	74.9	110.9	115.4	54%
Poland	162.8	133.2	112.4	-31%
Turkey	63.3	73.4	84.0	33%
Colombia	38.2	74.4	82.4	115%
Mongolia	5.2	25.2	57.1	1002%
Canada	69.1	68.0	50.5	-27%
Vietnam	11.6	44.8	46.3	299%
Czech Republic	65.2	55.4	41.0	-37%
Greece	63.9	56.5	27.3	-57%
Ukraine	62.9	55.4	26.2	-58%
Romania	29.3	31.1	21.7	-26%
Bulgaria	26.4	29.4	15.4	-42%
Thailand	17.8	18.3	14.1	-21%
Mexico	11.3	15.3	11.2	-1%
Brazil	6.7	7.7	7.8	17%
Hungary	14.3	9.1	6.9	-52%
Pakistan	3.2	3.4	6.4	97%
Uzbekistan	2.5	3.6	4.1	62%
New Zealand	3.5	5.3	3.0	-12%
Zimbabwe	4.4	2.7	2.3	-47%
UK	31.2	18.3	2.2	-93%
South Korea	4.2	2.1	1.1	-74%
Japan	3.1	0.9	0.8	-76%
Venezuela	7.9	2.6	0.3	-96%
Spain	23.5	8.4	0.1	-100%

Finally, although at the macro-scale we did not find any relationship between CRI and gender equality (or inequality), the exercise is valuable in that it points us to explore the possibility of such relationship at the national and community/household scales.

This by itself is an important outcome of the quantitative exercise as gender impacts need to be dealt at the micro-level where each context varied from the other.

Components of Coal Reliance

Coal Production and Employment

Table 1 shows the changes in coal production in the last 20 years in 33 major coal-producing countries, where the three biggest producers have remained the same: China, India, and the US.

Indonesia stood 4th in 2019 after recording a nearly sevenfold increase in production since 2000. The period saw a rapid shift in coal production from developed countries, especially in Europe, to developing countries, especially in Asia. While coal production in China, India, and Indonesia more than doubled; Spain, the UK, and Japan have virtually eliminated it. Australia stands out as the only affluent country whose coal production increased during this period.

The rapid increase in coal production since 2000 was driven by China's rapid economic growth, and, to a lesser extent, India's.

In China, this resource-intensive growth (Radetzki 2006) triggered a commodity boom that started in 2003 in which the price of commodities, including coal, reached a record high. It attracted investments in coal mining all over the world, especially in China, Indonesia, and Australia, and the latter two countries have subsequently become the two main coal exporters in the global market.

This commodity boom lasted for nearly 10 years, barely interrupted by the global financial crisis of 2008–09. This turned out to be a boon for commodity producers like Indonesia and Australia, which came out of the crisis relatively unscathed. Throughout this period, most commodity exporters experienced rapid economic growth, stronger currencies, higher government revenues, and an employment boom, albeit at different levels (Garnaut 2015). Commodity prices started to decline and stabilize from 2013 onward.

The number of people employed in coal mining corresponds to levels of coal production. Figures 2, 3, and 4 show coal employment as a proportion of the total labour force. The data is based on the International Labour Organization (ILO) database and, when not available, complemented by ILO estimates and national data, compiled by CEIC database. However, data is not available in some countries and some data points are missing. Coal employment data availability varies between countries, for example, while coal employment data for Indonesia are available from 2000, Pakistani data are only available from 2009, and Vietnamese data are available from 2007.



Figure 2

Coal Employment as a Proportion of

Total Labour Force: Asia and the Pacific

Sources: ILO (2019); CEIC (2020).

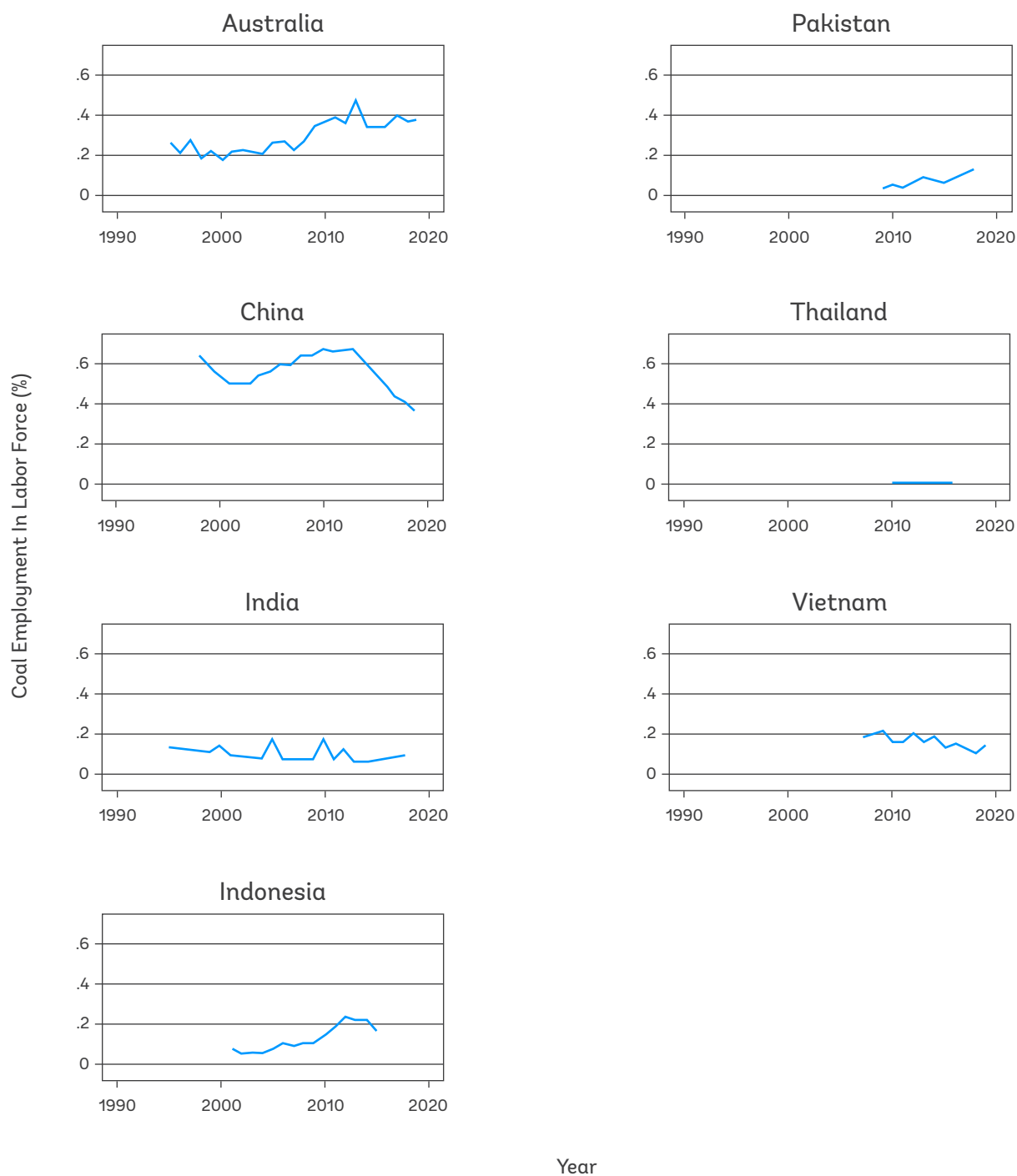
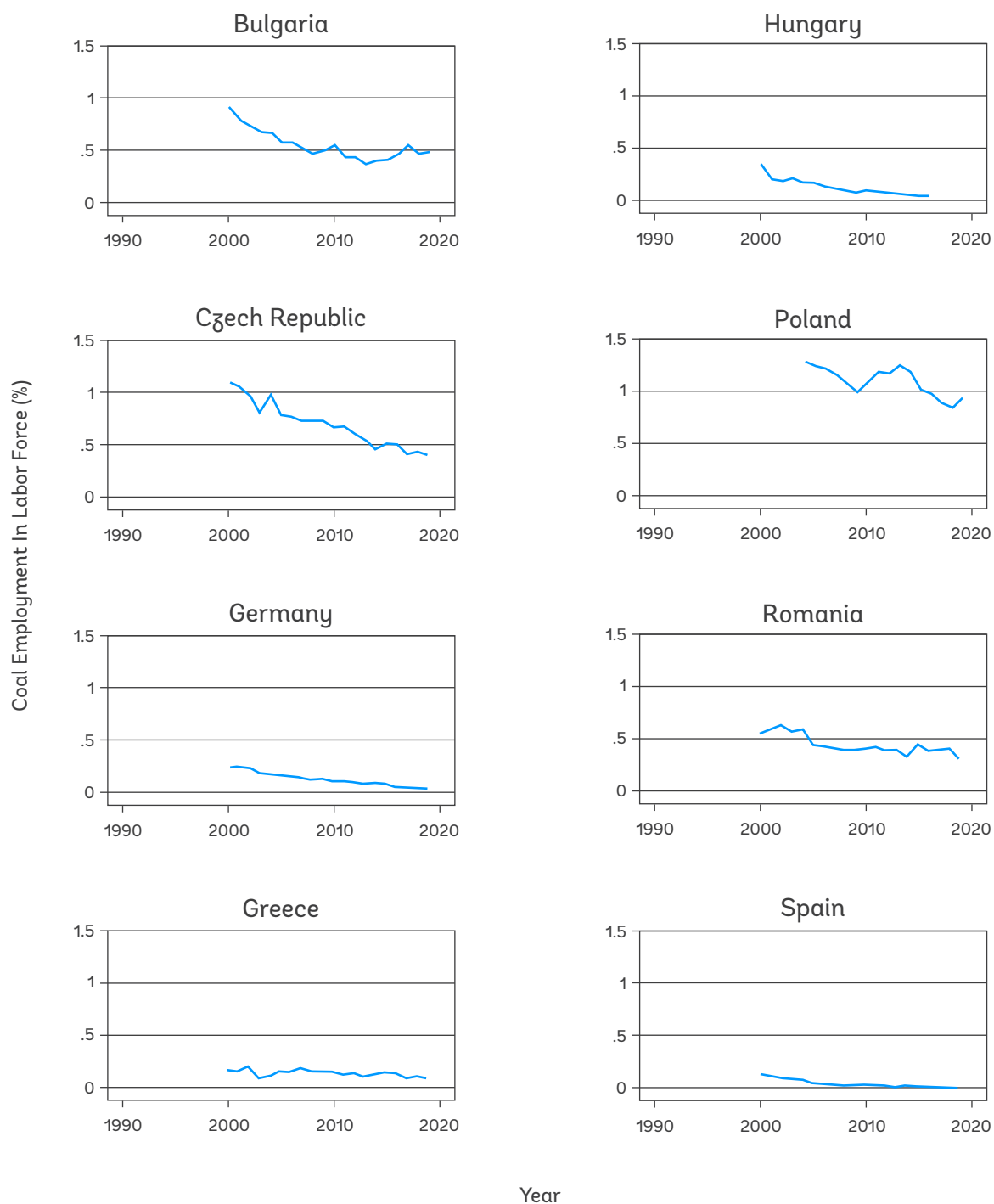


Figure 3

Coal Employment as a Proportion of Total

Labour Force: Europe and Central Asia

Sources: ILO (2019); CEIC (2020).



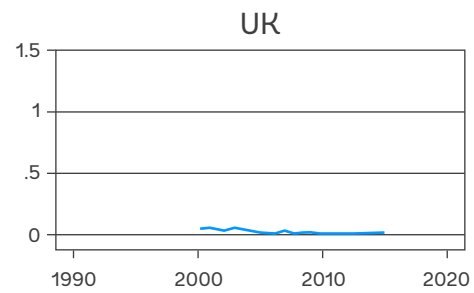
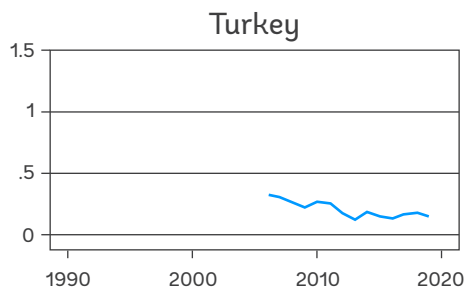
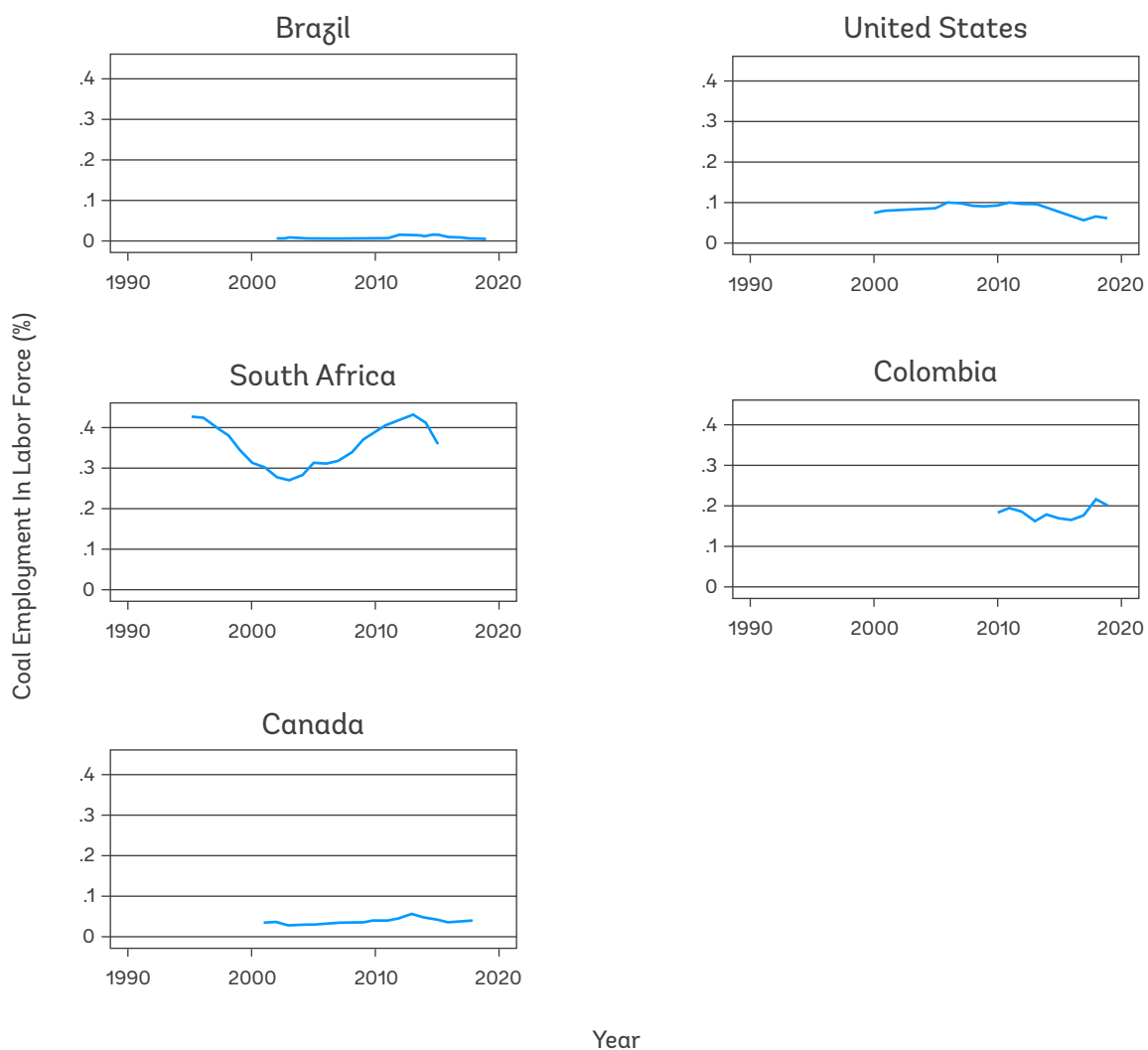


Figure 4

Coal Employment as a Proportion of Total

Labour Force: The Americas and South Africa

Sources: ILO (2019); CEIC (2020).



While the proportion of coal employment has been fast declining in Europe, the same cannot be said about countries in Asia, which exhibit relatively mixed trends. The substantial production effects of the China-driven commodity boom in the Asian countries only modestly increased the share of coal employment. Coal production in China still increased after 2010 despite the declining share of coal employment in the labour force. This may have been the result of mechanization and capital deepening in the sector, but further study is required to substantiate these claims.

In Australia, China, Indonesia, Poland, Canada, South Africa, and the US, coal employment as a share of the labour force peaked in the early to mid-2010s, signifying the end of the global commodity boom.

Since then, there have been signs of a rebound in coal employment in Australia, but recent

employment data in other countries are not available to confirm this. The figures do not capture the entirety of the employment effects because a mining boom may be followed by a Dutch disease effect, which increases employment in resource-related sectors and non-traded services sector and decreases employment in the traded manufacturing sector (Corden and Neary 1982).

Countries in Europe, in contrast, decreased their coal production throughout the same period. Mirroring this trend, coal employment shares also declined to near zero in some of the European countries. This may have been a result of the combination of physical distance from China, stricter environmental regulation, and social and political pressure to decarbonize.



Electricity Mix

Another aspect of reliance on coal is its consumption. Since it is mostly used to produce electricity, observing the changes in a country's electricity mix reveals a combination of policy and preferences toward renewable energy sources and the phasing out (or in) of fossil fuel extraction. Figures 5, 6, and 7 show the changes in the share of coal in electricity generation in sample countries. While the share may have declined in most countries, total coal consumption might still increase in some, as shown in Figures 8, 9, and 10 ahead.

Figure 5

Share of Coal in Electricity Generation: Asia and the Pacific

Source: Lahiri-Dutt and Pasaribu (2021) based on BP (2020).

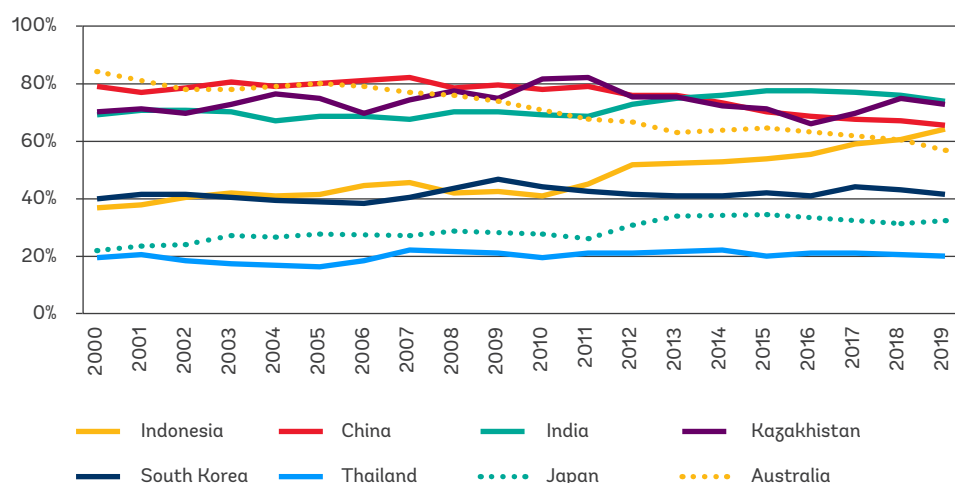


Figure 6

Share of Coal in Electricity Generation: Europe

Source: Lahiri-Dutt and Pasaribu (2021) based on BP (2020).

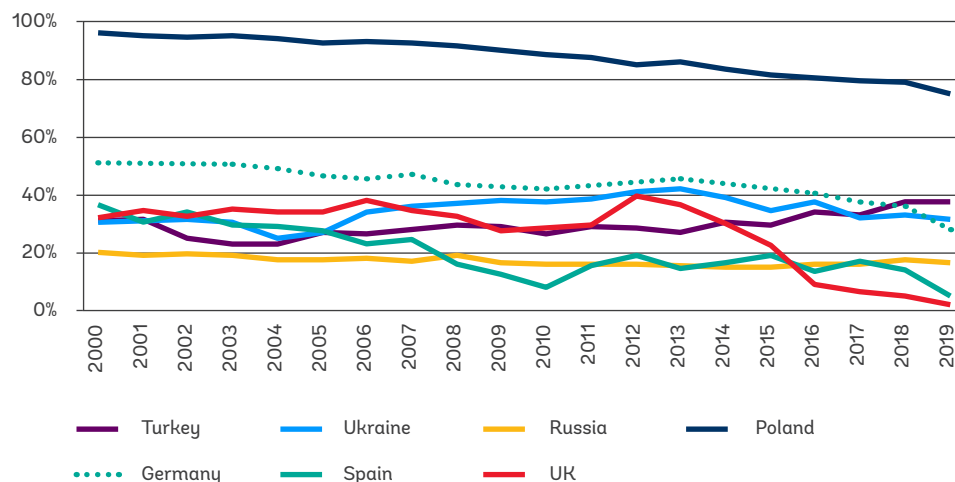
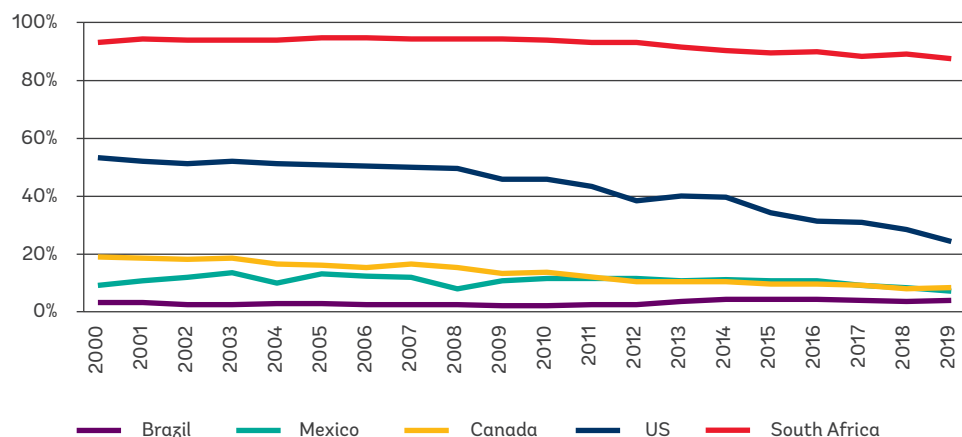


Figure 7

Share of Coal in Electricity Generation: The Americas and South Africa

Source: Lahiri-Dutt and Pasaribu (2021) based on BP (2020).



The share of coal declined or stagnated in most countries between 2000 and 2010 except in Indonesia, which is not unique in having increased its level of coal production but is in terms of its increasing reliance on coal as compared to other sources of electricity. While China's increased use of coal was the reason behind the commodity boom, Indonesia's astounding increase in coal usage is primarily a response to the increasing availability of coal from domestic mines and its consistently declining oil and gas production. Coal became Indonesia's primary source of electricity in 2000 and surpassed oil-based and gas-based electricity combined

in 2006. In contrast, Australia saw a decline in its coal-generated electricity despite an increase in coal production during the same period. While the difference in coal-based electricity growth between these two countries may be caused by their contrasting energy and environmental policies, the reason may also be due to Australia's longer history of coal reliance than Indonesia. India and Japan also had a modest increase in coal reliance as compared to other sources of electricity. In the case of Japan, coal-generated electricity increased between 2011 and 2013 due to the 2011 Fukushima Daiichi nuclear disaster that shut its nuclear power generation.

It is important to note that Figures 5, 6, and 7 do not represent these countries' total coal consumption for electricity. It is possible for them to have higher coal consumption even with a decreased share of coal production.³ Seen in absolute terms, coal-based electricity was higher in 2019 than 2000 in all Asia-Pacific countries except Australia, where the decrease is still relatively modest. Of the seven sample countries in Europe (Figure 5), only Turkey shows a higher reliance on coal-based electricity generation in 2019 compared to 2000. This contrasts with the UK and Spain which have nearly eliminated coal from their electricity generation process since 2019. This may also be related to the declining share of manufacturing in most of Europe, except for Germany⁴, which may have led to a lower electricity demand including demand from coal. Some of these countries, such as Russia, have never been overly dependent on coal for their electricity generation and thus have not shown noticeable changes between 2000 and 2019.

Canada and the US have also managed to halve their dependence on coal-based electricity generation during the same period (Figure 6). Middle-income countries in the Americas like Brazil and Mexico have never been dependent on coal and their coal-based electricity generation has declined in absolute terms since the mid-2010s. South Africa, an important coal producer, saw a relative decline in the share of coal-based electricity as compared to other sources of electricity despite having one of the highest shares of coal in electricity generation in the world.

Figures 8 and 9 show a break-down of the sources of electricity generation growth in the sample countries for 2000–10 and for 2010–19, respectively; the total electricity generation is denoted by yellow dots. The figures combine all non-renewable sources other than coal and oil and gas into the “other” category. This category includes hydroelectric, nuclear, and geothermal electricity. Electricity generation in India grew by 64% from 2000 to 2010, of which 44% comes from coal, 8% from oil and gas, 5% from renewables, and 7% from other non-renewable sources. In Spain, electricity generation grew by 34%, with 2% from renewables, 32% from oil and gas, 6% from other non-renewable sources, with the share of coal declining by 25%. China tripled its hydroelectric generation capacity between 2000 and 2010.

³ See Figures 21, 22, and 23 in the Appendix.

⁴ While the share of manufacturing in GDP in the European Union has declined from 17.4% in 2000 to 14.4% in 2019, the share in Germany only changed from 20.5% to 19.1% during the same period (World Bank 2020).

Figure 8

Contribution to Growth in Electricity Generation Between 2000 and 2010:

Coal and Renewables (%)

Source: Lahiri-Dutt and Pasaribu (2021) based on BP (2020).

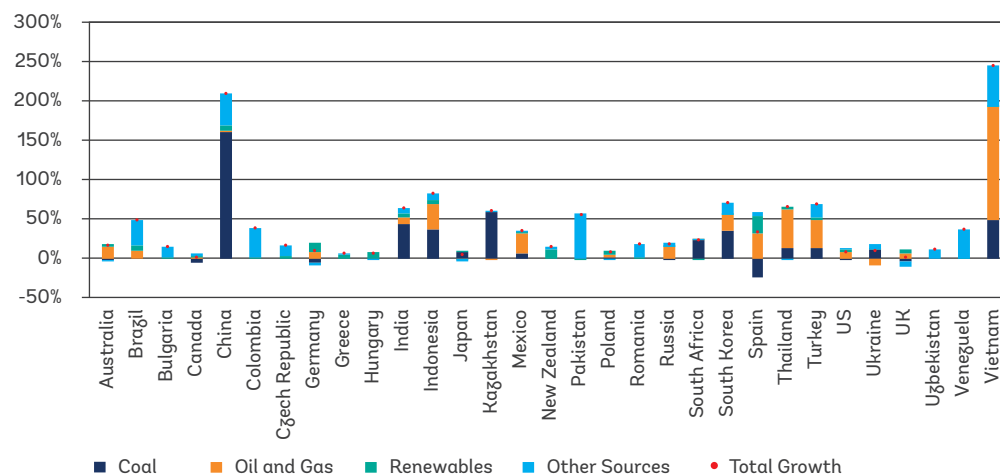
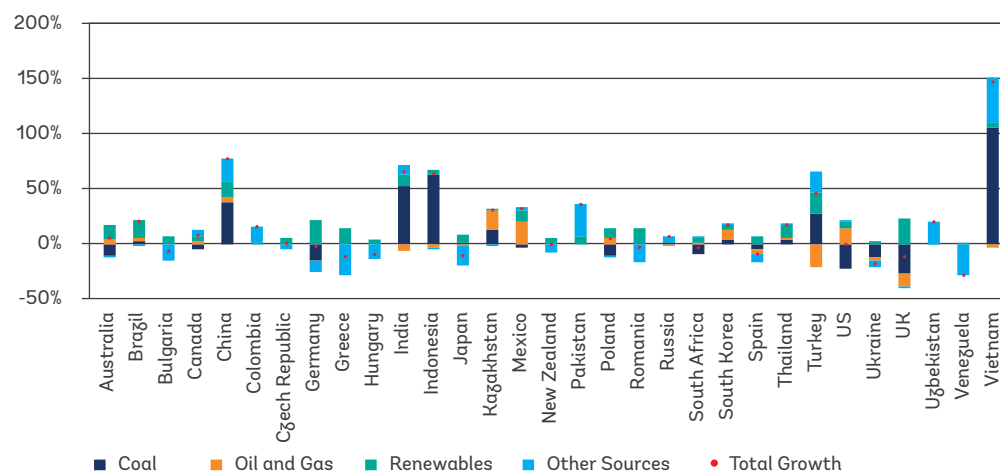


Figure 9

Contribution to Growth in Electricity Generation Between 2010 and 2019:

Coal and Renewables (%)

Source: Lahiri-Dutt and Pasaribu (2021) based on BP (2020).



From Figure 9 it is evident that while total electricity generation in several countries declined, the contribution of renewables in new electricity generation was larger in the decade of 2010–19. Developing countries in Asia, including China, India, Indonesia, and Vietnam, lead the sample countries in the growth of electricity generation, a large proportion of which is still sourced from coal. The countries that reduced their total electricity generation (e.g., Bulgaria, Germany, Japan, Romania, Ukraine, and the UK) were also successful in replacing coal-based and non-renewable electricity with renewables.

A comparison of these two figures shows that the decade of 2010–19 witnessed substantial changes in global energy and environmental policy. Electricity demand peaked and then started to decline, or at least slowed down, in most developed countries. This was mostly caused by slower global economic growth compared to the previous decade and the development of energy-saving technology. Even in developing countries, the growth in new electricity generation was comparatively lower in this decade, suggesting lower electricity demand growth. In terms of the supply side, the contrast between developed and developing countries is stark. By the early 2000s, most developed countries had already stopped building coal-powered power plants and by 2010 had replaced some of them with renewable energy infrastructure. In contrast, the share of coal in new electricity generation in India, Indonesia, and Vietnam increased from 2010 suggesting a need for affordable electricity generation and less stringent environmental standards.

Exports and Imports

Since it is an internationally traded commodity, a countries' reliance on coal is also demonstrated by the ratio between coal exports or imports as compared to the size of the economy, i.e., Gross Domestic Product (GDP). We use GDP, and not total trade value, as the measure of reliance because it provides a broader assessment of the economy than total trade, and countries have varying levels of involvement in international trade. As a mining commodity, coal extraction and export are concentrated in some countries while its consumption and import are more dispersed. Figures 10 and 11 show the different composition of coal exporters and importers in the sample countries.

Figure 10

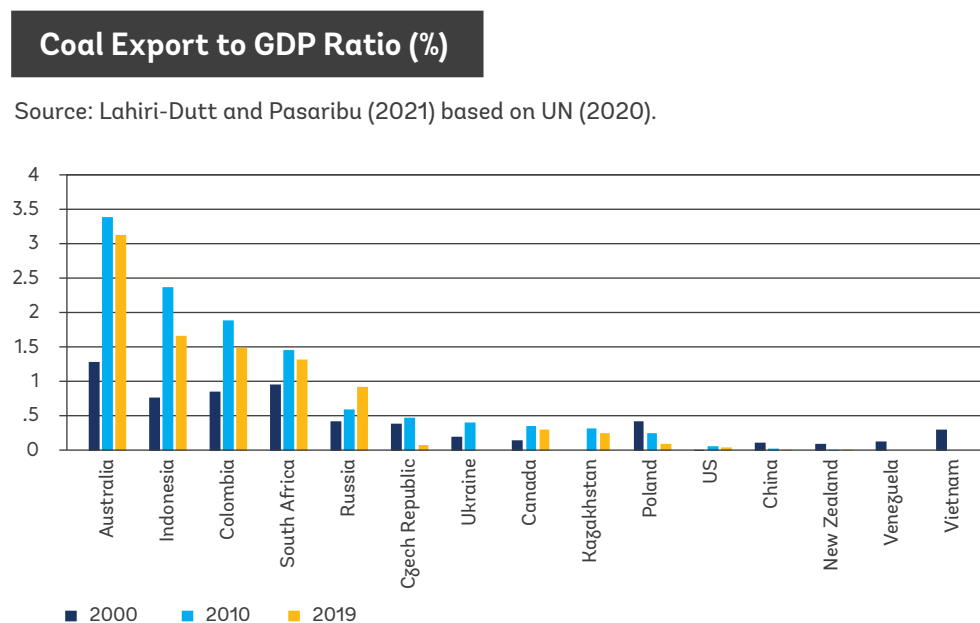
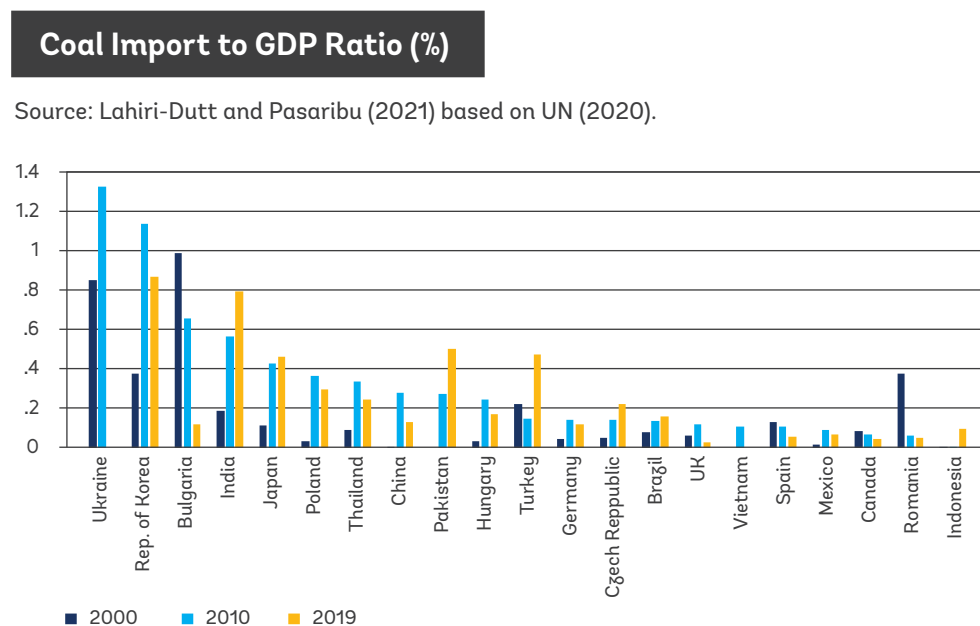


Figure 11



Australia, Indonesia, Colombia, and South Africa have remained the four biggest coal exporters in the last 20 years. Similar to coal production, in most countries exports also peaked in the mid-2010s and lowered in 2019. Even among the biggest exporters during the commodity boom exports never exceeded 3.5% of GDP. This low percentage shows that the economy of coal exporters as a whole has never been too reliant on this commodity, even though coal may constitute a large part of their total exports. The four biggest coal exporters have a diversified economy in which coal has relatively low importance.

As expected, coal importers outnumber exporters. The share of imports in their GDP is less than 2% throughout the period. This is unsurprising considering coal is primarily used for electricity. However, given the reputation of coal as a cheap source of energy, it is interesting to note that the biggest coal importers are generally middle- to high-income countries, except India.

Human Development and

Gender Measures

Since the purpose of this study is to see if a country's reliance on coal is associated with human development and gender outcomes, we will discuss the HDI, GDI, and Gender Inequality Index (GII) as the preferred measurement of these factors.

Human Development Index

The HDI is a composite index measuring average achievement in three basic dimensions of human development: long and healthy life (measured using life expectancy at birth); knowledge (measured using expected years and mean years of schooling); and standard of living (calculated using Gross National Income or GNI per capita, measured at purchasing power parity) (UNDP 2020). It is the geometric mean of the three-dimensional index. A higher HDI value represents a higher human development level. Figures 12, 13, and 14 depict the HDI level in the sample countries in 2000, 2010, and 2018.

Figure 12

HDI 2000, 2010, and 2018: Asia and the Pacific

Source: Lahiri-Dutt and Pasaribu (2021) based on UNDP (2020).

Note: Numbers in the callouts denote the % change between 2000 and 2018.

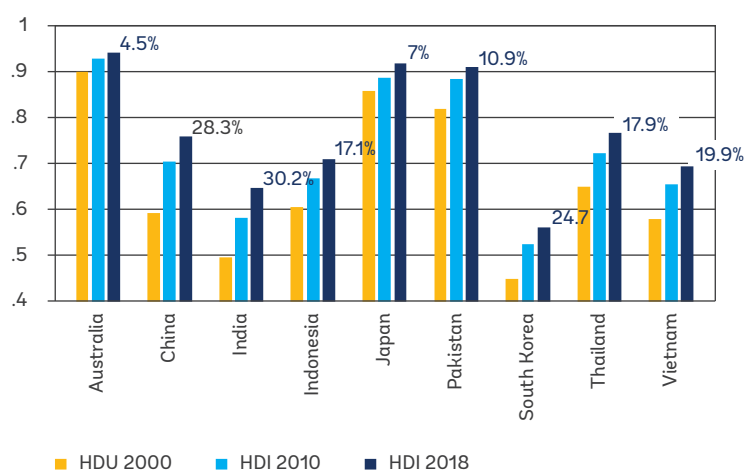


Figure 13

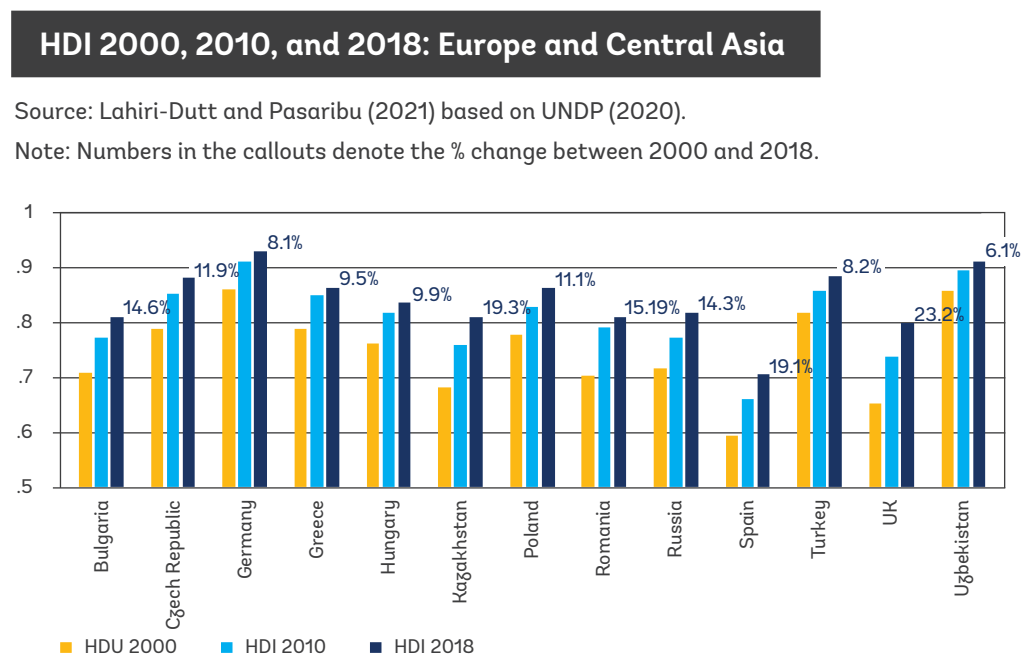
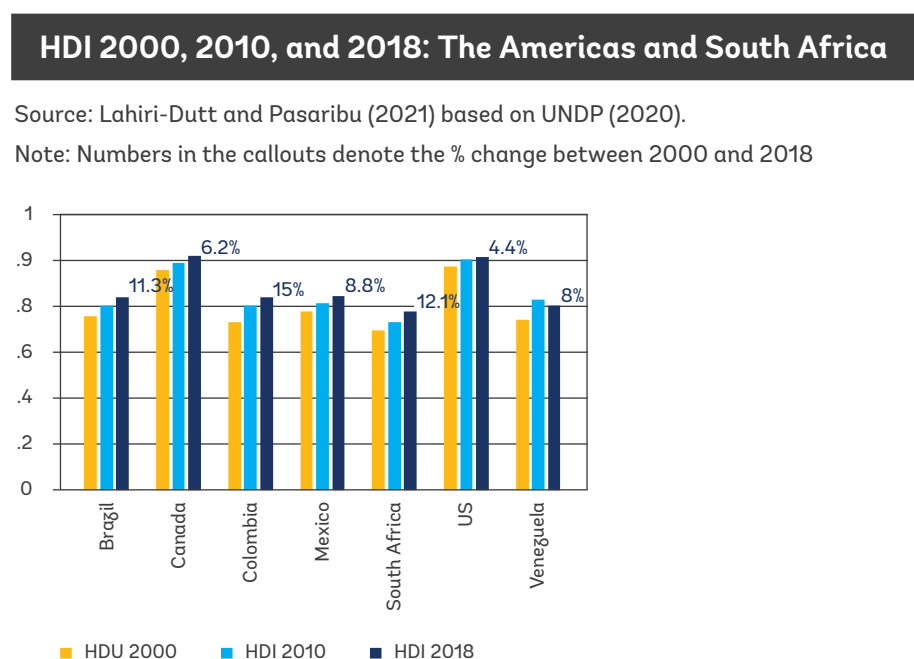


Figure 14



In the last 20 years, the HDI has improved in all of the sample countries, particularly in developing countries where it grew by more than 10%. Whether the size of the changes is affected by reliance on coal remains to be tested, perhaps by other researchers, in the future.

Gender Development Index

The GDI measures gender inequalities by comparing the difference in achievement in the three dimensions of human development: health (measured by female and male life expectancy at birth); education (measured by

female and male expected years of schooling for children and female and male mean years of schooling for adults); and command over economic resources (measured by female and male estimated earned income) (UNDP 2020). The GDI is simply the ratio of female HDI value to male HDI value. As such a value of 1 represents gender parity. Figures 15, 16, and 17 show the GDI level in sample countries in 2000, 2010, and 2018.

Figure 15

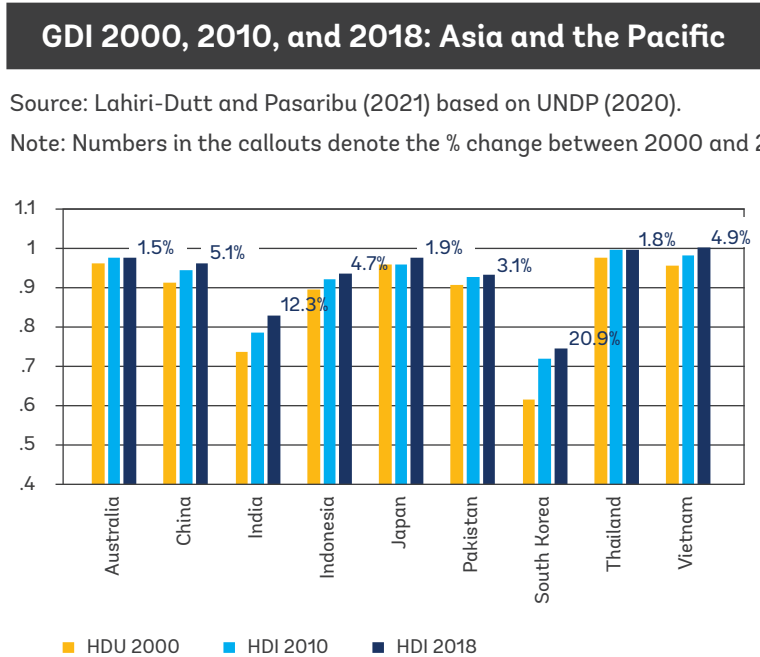


Figure 16

GDI 2000, 2010, and 2018: Europe and Central Asia

Source: Lahiri-Dutt and Pasaribu (2021) based on UNDP (2020).

Note: Numbers in the callouts denote the % change between 2000 and 2018.

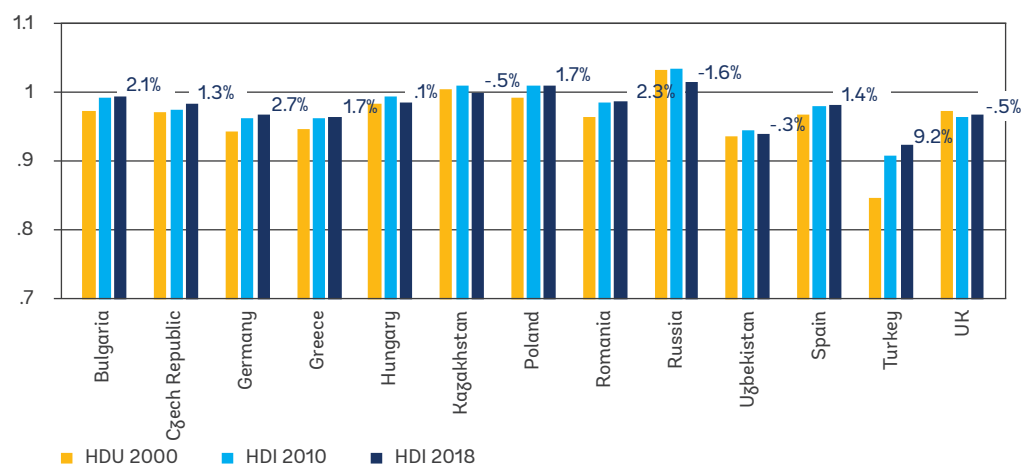
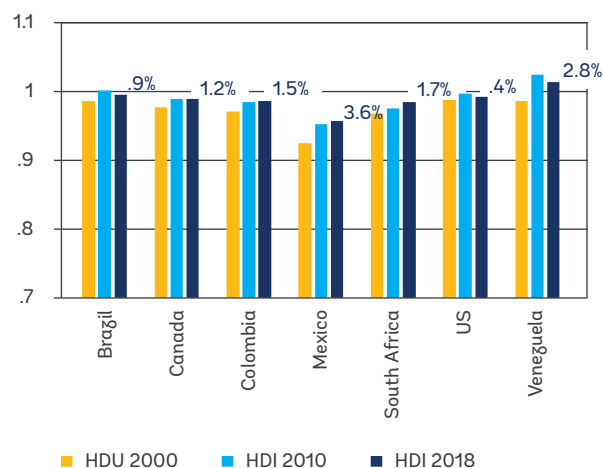


Figure 17

GDI 2000, 2010, and 2018: The Americas and South Africa

Source: Lahiri-Dutt and Pasaribu (2021) based on UNDP (2020).

Note: Numbers in the callouts denote the % change between 2000 and 2018.



Figures 15, 16 and 17 show that the GDI has moved closer to 1 in most countries, suggesting better gender equality in the last two decades, noticeably in Pakistan, India, China, Vietnam, and Indonesia. Because the ideal level is 1, a decline from a value higher than 1 (i.e., women having better achievement than men) can also be seen as a positive sign, such as the case in Russia and Venezuela between 2010 and 2019. However, there are worrying trends where the GDI had reversed, albeit slightly, in some countries since 2010, such as in Hungary, Brazil, Canada, and the US.

Gender Inequality Index

The GII reflects gender-based disadvantage by showing the loss in potential human development due to inequality between the genders. It includes the three dimensions of reproductive health (for women measured

using the maternal mortality rate and for children using the adolescent birth rate), empowerment (measured using the share of parliamentary seats held by each gender and population with at least some secondary education), and labour market (measured using labour force participation for each gender). Like the GDI, the GII also compares the score between genders. It ranges from 0, where women and men fare equally, to 1, where one gender fares as poorly as possible in all measured dimensions. Unfortunately, data for 2000 and 2010 are not available in some countries (such as India, Pakistan, Czech Republic, Uzbekistan, the US, and Canada). Figures 18, 19, and 20 show the GII in 2000, 2010, and 2018 in the sample countries.

Figure 18

GII 2000, 2010, and 2018: Asia and the Pacific

Source: Lahiri-Dutt and Pasaribu (2021) based on UNDP (2020).

Note: Numbers in the callouts denote the % change between 2000 and 2018.

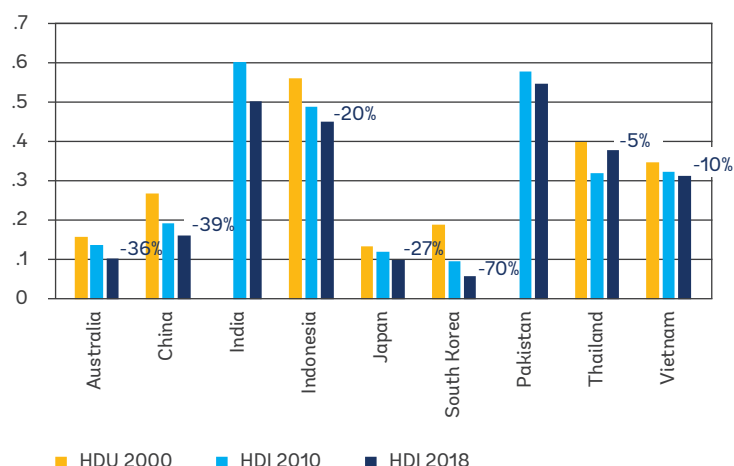


Figure 19

GII 2000, 2010, and 2018: Europe and Central Asia

Source: Lahiri-Dutt and Pasaribu (2021) based on UNDP (2020).

Note: Numbers in the callouts denote the % change between 2000 and 2018.

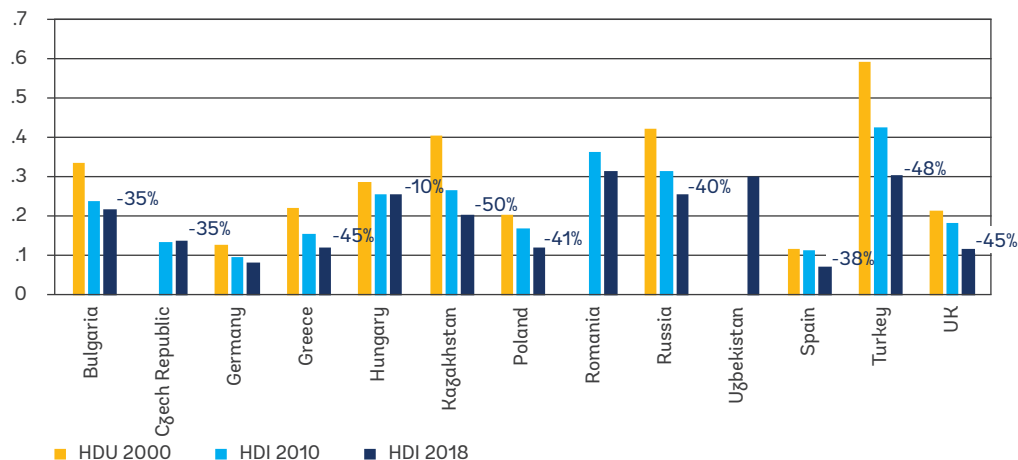
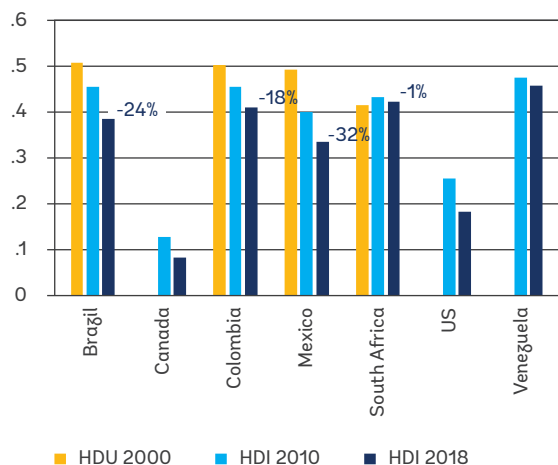


Figure 20

GII 2000, 2010, and 2018: The Americas and South Africa

Source: Lahiri-Dutt and Pasaribu (2021) based on UNDP (2020).

Note: Numbers in the callouts denote the % change between 2000 and 2018.



The GII in most countries declined between 2000 and 2018, suggesting a lowering of gender-based disadvantages globally. There are a few notable exceptions, such as Thailand and South Africa, where the GII rebounded between 2010 and 2018. It is interesting to observe that the same did not happen to their GDI, which improved (reached closer to 1) during this period. In contrast, countries where the GDI worsened between these years (i.e., Hungary, Brazil, Canada, and the US) saw an improvement in their GII.

These differences show the importance of how the indices are calculated and what they are focused on. While the GII examines specific aspects that are suspected to contribute to (or hamper) gender equality, the GDI simply compares the outcomes: the HDI ratio between women and men. Therefore, the GII can improve while the GDI does not if the aspects that are measured in the GII (e.g., reproductive health, women's presence in parliament, secondary education, and labour participation) do not significantly contribute to improvements in women's HDI.

Coal Reliance Index (CRI)

There are several dimensions by which a country can be reliant on coal: supply, demand, and external factors. To accurately test if a country's reliance on coal is associated with human development and gender outcomes, these three dimensions need to be factored in. To assess this, we developed the coal reliance index (CRI) that summarizes the three dimensions. It is a weighted average of normalized indices for the three dimensions.

The supply dimension captures the production side of coal extraction. Coal-producing countries tend to be highly dependent on this natural resource both as a source of income and employment. To measure this, the supply dimension combines two indicators: contribution of coal revenue to the economy (i.e., coal rent as a percentage of GDP) (World Bank 2020) and coal production per capita (in million tons) (BP 2019).⁵

The demand dimension captures the consumption side of coal usage. Coal is primarily used to generate electricity. Since it can be transported over long distances, its usage is not limited only to coal-producing countries. To measure a country's reliance on coal consumption, the demand dimension combines two indicators: total coal consumption per capita (in million tons) (BP 2019) and the proportion of coal in electricity mix (in %) (BP 2019).

The external dimension captures the role of coal as a globally traded commodity. Some countries rely on coal as their main export commodity; others import it for electricity generation. While this dimension is already partly captured by both supply and demand dimensions, it tends to be perceived differently because it can affect a country's trade balance, exchange rate, and energy sovereignty. This dimension combines two indicators: the ratio of coal exports to GDP (in %) (UN 2020) and the ratio of coal imports to GDP (in %) (UN 2020).

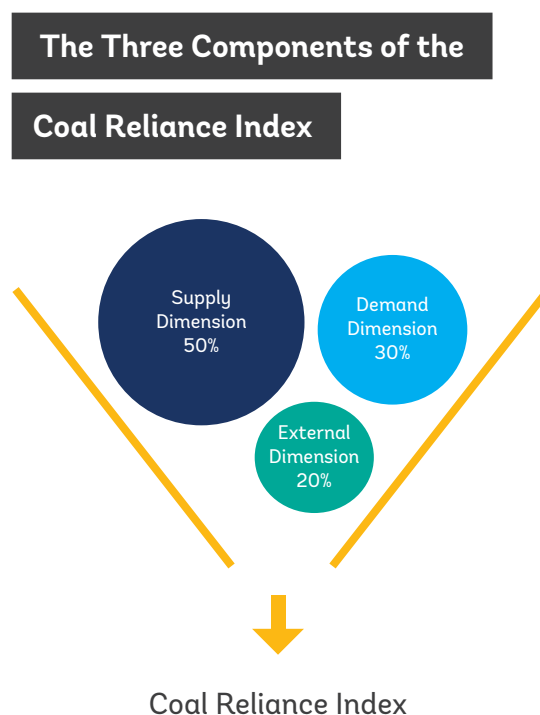
⁵ Percentage of the proportion of coal sector employment in the total labour force was also considered as a component of the dimension, but coal sector employment data are not available for several countries in the sample.

The three dimensions are weighted differently in the CRI to show individual importance: supply dimension (50%), demand dimension (30%), and external dimension (20%). The supply dimension receives the largest share because coal's direct economic contribution is arguably the most important aspect of coal reliance. Coal mining creates a distinct level of reliance that encompasses employment, backward and forward linkages with other economic activities, and government revenue. This dimension is also tied to the presence of coal deposits in a given country, because any country can buy it from the global market regardless of its source. The two indicators in the supply dimension are weighted equally (25% each).

The demand dimension receives a comparatively lesser importance (weight) because coal as a source of energy can be substituted with other sources of energy in the long term. Coal's primary advantage for consumers is its low cost in generating electricity. The two indicators in the dimension are also weighted equally (15% each). It is important to note that the supply and demand dimensions are not mutually exclusive. In fact, countries that produce coal tend to use it more heavily in their energy mix than those which import it.

The external dimension is of least importance because it is already partly captured by the other two dimensions. Unlike the other dimensions, the two indicators for this are not weighted equally. The ratio of coal exports to GDP (at 15%) is arguably more important than the ratio of coal imports to GDP (5%) for the same reason that the supply dimension is more important than the demand dimension. While an exporter may be highly reliant on coal as a source of export revenue, an importing country can find other import sources relatively easily. Moreover, if other energy sources are available domestically, some importing countries would be glad to switch to it to reduce their reliance on imported energy.

Figure 21



Methodology and Data

To investigate if coal reliance is associated with human development and gender development outcomes, we analyzed the CRI data for coal-producing countries and their HDI, GDI, and GII data between 1995 and 2019. Similar to Ross (2008), a first difference model, which assesses whether changes in the explanatory variable are associated with those in the dependent variable, was used. We thus tested the impact of a change in the CRI on changes in the HDI, GDI, and GII. The focus on these changes also controls for underlying differences between countries. This also helps to correct for the possible estimation error due to the consistent positive trend in the dependent variable: the steady increase in human development and gender equality.

Since data for the GDI and GII are not available every year, we used a five-year difference (1995, 2000, 2005, 2010, 2015, and 2019) in the regression, except for the final period (2015–19). While using only six years in our regression considerably limited our observation numbers, the overall 24-year period helped in covering an important dual transition in global coal usage: increased consumption and production in developing Asia, as well as the phasing out of coal production and consumption in developed countries.

It is also important to note that since 2019 there has been a global acceleration in the shift to renewable energy and low carbon technology. This trend is likely to accelerate further with the 2015 Paris Agreement that is entering its first round of submission for countries' intended greenhouse gas

emissions reductions in 2021. Some countries, such as Sweden, the UK, France, Denmark, New Zealand, Hungary, China, and Japan, have recently adopted net zero emission targets for the next few decades.

We controlled the initial level of the HDI, GDI, and GII for each country in the given time periods to account for the differences in early human development and gender equality. Some countries may already have a good initial level of human development, such that any further improvements in human development and gender equality may be incremental.

Effects in the Africa, Asia Pacific, Commonwealth of Independent States (CIS)⁶, Europe, Middle East, North America, and South and Central America were studied to account for any variation of the HDI, GDI, and GII. Time-fixed effects to control for time trend were also included in the study. The first difference model is as follows:

Equation 1

$$y_{i,t} - y_{i,t-1} = \alpha + \beta_1 (CRI_{i,t} - CRI_{i,t-1}) + \beta_2 y_{i,t-1} + \delta_r + \lambda_t + (\epsilon_{i,t} - \epsilon_{i,t-1})$$

where $y_{i,t} - y_{i,t-1}$ is the five-year interval change of either the HDI, GDI, or GII in country i between 2000 and 2019, $(CRI_{i,t} - CRI_{i,t-1})$ is the five-year interval change in the CRI in country i . $y_{i,t-1}$ is the lagged value of the dependent variable in the previous period in the same country. δ_r is the country-fixed effect and λ_t is the time-fixed effect. The coefficient β_1 will show the estimated relationship between the CRI and human development or gender development outcomes. Other control variables, such as income growth, were not included because the objective of this study was to test the effect of the CRI, not to explain

⁶ CIS countries include Azerbaijan, Belarus, Kazakhstan, Russia, Turkmenistan, and Uzbekistan.

Table 2

Summary Statistics of the Variables in 1995, 2000, 2005, 2010, 2015, and 2019

Source: Lahiri-Dutt and Pasaribu (2021) based on various sources.

Variable	Observation	Mean	Std. Dev.	Min	Max
Coal Reliance Index	357	15.70	37.41	0.00	571.38
HDI	357	0.80	0.11	0.43	0.95
GDI	344	0.96	0.06	0.62	1.04
GII	313	0.25	0.17	0.04	0.71
Components of CRI:					
Production index	357	13.66	38.23	0.00	440.91
Consumption index	357	11.74	21.33	0.00	175.19
Export index	357	26.02	133.53	0.00	2339.36
Import index	357	28.84	42.79	0.01	395.11

the HDI, GDI, or GII. Data for the regression were gathered from various sources, while the HDI, GDI, and GII from UNDP (2020). The GDP per capita at a constant 2010 US dollar value were sourced from the World Bank's World Development Indicator (2020). Table 2 summarizes statistics of the variables in the model.

The table includes observations in the six-year period under study, where the CRI has only 357 observations (78 countries). This limitation is mainly due to the lack of data for the consumption index, especially coal consumption data, for many countries.

As a robustness test, the model was also tested using each component of the CRI, i.e., the model was tested using the same specifications as in Equation 1 but replacing $(CRI_{i,t} - CRI_{i,t-1})$ with components of the CRI: production, consumption, and export and import index. This test will show if each component has different effects on human development or gender equality outcomes. It

can also show if the differences in the number of observations between indices have an effect on the results, as discussed in the following section.

Results

The results for each dependent variable are reported separately, each with four different specifications to check for the sensitivity of coefficients. Table 3 reports the results for the HDI, Table 4 for GDI, and Table 5 for GII. In these tables, Column 1 shows the results of the main specification (Equation 1), with the change in HDI as the dependent variable and the change in the CRI and HDI in the previous period as independent variables. Columns 2 to 5 test the components of the CRI individually, where Column 2 tests the change in the production index, Column 3 in the consumption index, Column 4 in the export index, and Column 5 in the import index. The results of these tables suggest that changes in coal reliance are not associated with changes in the HDI, GDI, nor GII.



Table 3

HDI and CRI, First Difference and Fixed Effects

Source: Lahiri-Dutt and Pasaribu (2021)

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1, D denotes the change from previous period

Variables	Dependent variable: Change in HDI (1995–2019)				
	1	2	3	4	5
D. CRI	-1.49e-05				
	(2.17e-05)				
D. Production index		-2.29e-05			
		(2.56e-05)			
D. Consumption index			0.000168		
			(0.000144)		
D. Export index				-4.18e-06	
				(5.29e-06)	
D. Import index					5.12e-05
					(3.18e-05)
HDI in previous period	-0.405***	-0.406***	-0.411***	-0.405***	-0.414***
	(0.0595)	(0.0589)	(0.0599)	(0.0601)	(0.0594)
Constant	0.321***	0.322***	0.326***	0.321***	0.328***
	(0.0426)	(0.0422)	(0.0429)	(0.0430)	(0.0425)
Observations	357	357	357	357	357
Countries	78	78	78	78	78
R-squared	0.540	0.541	0.542	0.540	0.544
Country FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

The coefficients of the CRI and its components are not statistically significant in any of the specifications in Table 3.

Interestingly, the signs of the coefficient of the CRI and production and export indices are negative, while the consumption and import indices show positive signs. This suggests a possible difference between the effects of the production side and the consumption side of coal reliance.

The results in Table 4 show that changes in the CRI and its components also have no statistically significant relationship with the GDI. This is similar to the results in Table 3, but the signs of all specifications are positive. Since the GDI is the ratio of female to male HDI, a positive coefficient means increased coal reliance increases women's human development measures as compared to men's.

Table 4

GDI and CRI, First Difference and Fixed Effects

Source: Lahiri-Dutt and Pasaribu (2021)

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Variables	Dependent variable: Change in GDI (1995–2019)				
	1	2	3	4	5
D. CRI	2.25e-05				
	(1.89e-05)				
D. Production index		3.37e-05			
		(2.41e-05)			
D. Consumption index			6.43e-06		
			(0.000155)		
D. Export index				2.81e-06	
				(2.44e-06)	
D. Import index					2.02e-05
					(3.25e-05)
GDI in previous period	-0.359***	-0.359***	-0.359***	-0.359***	-0.361***
	(0.0625)	(0.0624)	(0.0626)	(0.0627)	(0.0628)
Constant	0.345***	0.346***	0.346***	0.345***	0.348***
	(0.0590)	(0.0589)	(0.0591)	(0.0591)	(0.0593)
Observations	344	344	344	344	344
Countries	78	78	78	78	78
R-squared	0.270	0.271	0.269	0.269	0.270
Country FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

Like Tables 3 and 4, Table 5 also shows that the CRI and its components do not have any statistically significant effect on the

GII. The signs of the consumption and import indices are negative (Columns 4 and 5), while the signs of production and export indices are positive (Columns 2 and 3). These once again suggest that the gender inequality effects of the production and consumption side of coal reliance are different. However, this cannot be

said for certain because the coefficients are not statistically significant. It is important to remember that for the GII, a higher number implies a greater inequality between male and female. Therefore, the results suggest that higher reliance on coal, especially in terms of production and export aspects, may worsen gender inequality.



Table 5

GII and CRI, First Difference and Fixed Effects

Source: Lahiri-Dutt and Pasaribu (2021)

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Dependent variable: Change in GDI (1995–2019)					
Variables	(1)	(2)	(3)	(4)	(5)
D. CRI	4.07e-05				
	(3.85e-05)				
D. Production index		6.58e-05			
		(5.30e-05)			
D. Consumption index			-9.03e-05		
			(0.000171)		
D. Export index				6.13e-06	
				(5.66e-06)	
D. Import index					-2.53e-05
					(6.64e-05)
GII in previous period	-0.400***	-0.400***	-0.402***	-0.401***	-0.402***
	(0.0453)	(0.0451)	(0.0451)	(0.0450)	(0.0448)
Constant	0.106***	0.106***	0.106***	0.106***	0.106***
	(0.0154)	(0.0153)	(0.0153)	(0.0153)	(0.0151)
Observations	313	313	313	313	313
Countries	77	77	77	77	77
R-squared	0.240	0.241	0.240	0.240	0.240
Country FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

This contrasts with previous findings in oil wealth, such as those projected by Ross (2008), where it is seen that oil wealth has a negative correlation with female labour force participation. That coal reliance does not statistically affect human development and gender equality measures at the country level is not entirely surprising. It is important to note that these results do not imply that coal reliance has no impact on human development or gender

equality. The focus of this study has been at the cross-country level, which requires a high level of aggregation that must ignore specific details within each country. There may be important implications of coal reliance at the subnational level, especially in coal mining regions. Moreover, the importance of coal in a national economy rarely reaches the importance of oil in many oil-producing countries.

CRI and Gender Equality: Is

There a Relationship?

The statistical exercise explained the various dimensions of coal reliance of countries across the world and how these dimensions compare to their human development and gender equality outcomes, which are measured by the HDI, GDI, and GII. To achieve the desired results, indicators such as a country's level of coal production and total employment and the proportion of coal in the electricity mix, were considered and then compared with their respective HDI, GDI, and GII.

This exercise revealed a dual global trend in coal reliance over the last two decades.

While developed countries in Europe have made great progress in transitioning away from coal production and consumption, many developing countries in Asia have become increasingly reliant on coal, mainly driven by the rapid economic growth of China in the past few decades, which triggered a global commodity boom. As a result, important coal exporters such as Australia and Indonesia have become increasingly 'reliant' on coal, which in turn makes it more difficult for them to phase out their coal consumption. Moreover, better-off countries in Asia, such as South Korea and Japan, still maintain a high level of reliance on (imported) coal-fired electricity to power their economies. At the same time, human development and gender equality outcomes have been steadily improving in most parts of the world, and the biggest increase has occurred in developing countries in Asia.

Secondly, a CRI was constructed combining the supply, demand, and external dimensions of a country's reliance on coal relative to its size. This index tracks a country's coal production, coal rent, coal consumption, the proportion of coal in the electricity mix, as well as coal exports and imports, and standardizes them into an index. It reflects annual changes in these dimensions as compared to a reference value that is comparable between countries. The CRI confirms our earlier findings of the dualistic global trend in coal reliance.

Using the CRI, we then tested if changes in countries' coal reliance are associated with changes in human development and gender equality outcomes during the period of 1995–2019.

A first difference method with fixed effects regression with five-year intervals was used and controlled for each country's initial condition, regional time trend, and income growth. Based on data from 78 countries during the period, it was found that changes in the CRI are not statistically significant in affecting changes in the HDI, GDI, and GII. These findings are robust even when different specifications and only the supply (production) dimension of coal reliance were used.

It is thus argued that although statistically significant evidence for an association between changes in coal reliance and HDI and GDI at the country level was not found, it does not mean that coal reliance is not associated with these outcomes at other levels of analysis. The effect of coal reliance may be concentrated in only those regions that produce coal. However, this is not within the scope of this study and should be the subject of future research.



Table 6 shows the rank of countries based on CRI dimensions in 2000, 2010, and 2019.⁷ Countries that are big producers and consumers of coal relative to their economic and population size, such as Australia, South Africa, Kazakhstan, Indonesia, and Colombia, topped this index in 2019.

This reflects the general pattern that coal producers and exporters also consume their coal domestically. The table also confirms the pattern that developed countries, especially in Europe, have been phasing coal out over the last two decades, while developing countries in Asia have become increasingly reliant on coal during the same period. The CRI ranks are color-coded to show whether a country has gone up or down in their rank between periods. Red denotes an increase in rank, while green denotes a decrease in rank.

⁷ CRI scores (not ranks) are presented in Table 7 in the Technical Notes.

Table 6

Country Ranks of CRI and its Dimensions: 2000, 2010, and 2019

Country	CRI			Supply			Demand			Export			Import		
	Rank 2000	Rank 2010	Rank 2019	Rank 2000	Rank 2010	Rank 2019	Rank 2000	Rank 2010	Rank 2019	Rank 2000	Rank 2010	Rank 2019	Rank 2000	Rank 2010	Rank 2019
Australia	2	1	1	4	1	1	1	3	3	1	1	1	26	29	26
Brazil	29	29	25	31	29	26	21	21	20	25	28	23	11	14	10
Bulgaria	16	14	19	11	12	13	26.5	26.5	26.5	18	13	18	1	3	14
Canada	10	13	14	8	14	15	11	15	17	10	8	6	10	19	20
China	8	6	7	9	5	7	7	5	5	12	12	13	21	8	11
Colombia	15	8	5	20	8	5	26.5	26.5	26.5	3	3	3	27	30	28
Czech Republic	7	10	17	5	6	11	26.5	26.5	26.5	7	6	9	13	13	8
Germany	11	16	18	17	19	19	6	8	13	17	19	16	15	12	13
Greece	26	23	24	15	16	17	26.5	26.5	26.5	21	24	19	19	21	24
Hungary	27	26	26	19	22	21	26.5	26.5	26.5	26	21	21	18	10	9
India	14	11	9	10	13	9	16	12	9	15	16	15	6	4	2
Indonesia	9	5	4	13	7	4	18	16	11	4	2	2	23	28	15
Japan	20	19	16	30	31	30	13	9	7	28	27	24	8	5	5
Kazakhstan	4	3	3	3	3	3	4	2	1	-	9	7	-	26	18
Mexico	28	25	22	28	25	24	20	19	18	24	20	26	20	18	16
New Zealand	25	21	23	14	15	16	26.5	26.5	26.5	13	18	11	25	23	25
Pakistan	31	28	21	27	28	25	26.5	26.5	26.5	-	25	22	-	9	3
Poland	5	7	8	6	9	8	3	4	4	6	10	8	17	6	6
Romania	22	24	27	16	18	20	26.5	26.5	26.5	22	17	27	4	20	19
Russia	6	9	6	7	10	6	14	14	15	5	5	5	14	24	23
South Africa	1	2	2	1	2	2	2	1	2	2	4	4	16	22	12
Korea	13	12	10	29	30	28	8	6	6	23	26	25	3	2	1
Spain	18	27	28	25	26	31	12	20	19	20	14	12	7	17	17
Thailand	23	22	20	22	23	23	17	17	16	27	23	17	9	7	7
Turkey	19	20	15	21	20	18	15	13	14	19	22	20	5	11	4
US	12	17	11	12	17	10	9	11	10	14	11	10	24	25	27
Ukraine	3	4	13	2	4	12	5	7	12	9	7	-	2	1	-
UK	17	18	30	24	21	27	10	10	21	16	15	14	12	15	22
Uzbekistan	30	30	29	26	24	22	26.5	26.5	26.5	-	-	28	-	-	21
Venezuela	24	31	31	18	27	29	26.5	26.5	26.5	11	-	-	22	27	-
Vietnam	21	15	12	23	11	14	19	18	8	8	-	-	-	16	-

Australia's reliance on coal is high across all dimensions except imports. Its supply dimension rank rose from 4th place in 2000 to 1st place in 2010, reflecting its expanding coal sector during the global commodity boom of the 2000s. Australia also stands out as a developed country with the highest coal reliance in the world. Similarly, South Africa has sizeable levels of coal production, consumption and exports, however, its export reliance has been surpassed by Indonesia and Colombia in recent decades.

It is important to note the case of Indonesia because of its steady increase in coal reliance, mainly driven by export growth. Indonesia's rank as a coal exporter increased from 9th place in 2000 to 5th in 2010 and 4th in 2019. Despite having increased its coal-based electricity generation fivefold in the last 20 years, Indonesia ranks only 11th in the demand dimension, but 2nd in the export dimension. In contrast, Kazakhstan's consistently high CRI rank is driven by its domestic demand, with the country ranked 1st on this dimension in 2019.

India and Korea, ranked 9th and 10th in the CRI respectively, are the two biggest importers of coal relative to their size. Both countries have large and steadily increasing domestic demand which need to be fulfilled with imports. However, only India has a relatively large domestic coal production. Interestingly, China, whose domestic demand was the driver of the commodity boom, ranked only 11th in its coal import reliance. This suggests that the country's demand has been largely satisfied by its domestic production.

In contrast, countries in Europe, such as the Czech Republic, Germany, Poland, Romania, Spain, Ukraine, and the UK, have managed to consistently reduce their reliance on coal. Germany and the UK recorded the biggest drop in the last 20 years mainly due to their declining coal consumption.

Technical Notes

Step 1. Creating dimension indices

Indicators that are used to create the indices are expressed in different units. For example, coal production per capita is expressed in million ton of oil equivalent (Mtoe) per person, while coal rent is expressed as a proportion of GDP. A standardization of these is required before creating them. Because there is no maximum achievable value for most of the indicators, two standard deviations to the mean in the year 2000 have been used as a reference value (100) for each indicator. All indicators are therefore always compared to a reference value in the year 2000. This means, there is no maximum score for each indicator, and a higher score reflects a higher reliance on coal in its corresponding dimension. The justification for using 2000 as a reference year is that it was essential for the reference value to be consistent throughout the study period, and this year was selected because it precedes the year before the beginning of the decade-long commodity boom.

Supply dimension

Coal rents (% of GDP) are the difference between the value of both hard and soft coal production at world price and their total costs of production (World Bank 2011). This is done by estimating the world price of units of specific commodities and subtracting estimates of average unit costs of extraction or harvesting costs (including a normal return on capital). These unit rents are then multiplied by the physical quantity of coal extracted or harvested by countries to determine the rents for each commodity as a share of GDP. Data for this indicator was collected from the World Bank (2020). The reference value for this indicator is 0.81 or 81% of the country's GDP.

Coal production per capita is the amount of hard and soft coal produced in a country at Mtoe divided by the country's total population. Data for this indicator was calculated based on the Statistical Review of World Energy report (BP 2020). The reference value for this indicator is 4.3 Mtoe per capita per year.

Demand dimension

Coal consumption per capita is the amount of hard and soft coal consumed by a country at Mtoe divided by the country's total population. Data for this indicator was calculated based on BP (2020). The reference value for this indicator is 2 Mtoe per capita per year.

Proportion of coal in the electricity mix is the share of coal-sourced electricity in a country's total energy mix. Data for this indicator was calculated based on World Bank (2020) and BP (2020). The reference value for this indicator is 90%.

External dimension

Ratio of coal exports to GDP is the ratio between the value of coal exports and the country's GDP, both measured in nominal US dollar. Data for this indicator was calculated based on UN (2020) and World Bank (2020). The reference value for this indicator is 0.9%.

Ratio of coal imports to GDP is the ratio between the value of coal imports and the country's GDP, both measured in nominal US dollar. Data for this indicator was calculated based on UN (2020) and World Bank (2020). The reference value for this indicator is 0.6%.

Step 2. Aggregating indicators and calculating dimensional indices

The supply and demand dimensional indices were calculated as the geometric mean of the standardized indicators in each dimension. All indicators were weighted equally in this process, except for the external indicator. The formulas are:

Supply dimension index
 $= (\text{Coal rents} \times \text{Coal production per capita})^{1/2}$

Demand dimension index
 $= (\text{Coal consumption per capita} \times \text{Coal in electricity mix})^{1/2}$

In the absence of one of the two standardized indicators to calculate the dimensional index, the index will use the only available indicators without using geometric averaging. This is done to maximize the number of countries that have the CRI. The justification for this is that the indicators in each dimension measure similar aspects of the dimension and are highly correlated to each other.



The external dimension indicators were not aggregated as a distinct external dimension index and were aggregated directly in the CRI. This is because the indicators measure opposite trade directions (export and import) that do not correlate with each other. Therefore, they should not be averaged.

Step 3. Constructing the CRI

Finally, the CRI is a simple weighted average of the dimensional indices which follows this schedule:

Supply dimension	50%
Coal rents	25%
Coal production per capita	25%
Demand dimension	30%
Coal consumption per capita	15%
Coal in electricity mix	15%
External dimension	20%
Ratio of coal export to GDP	15%
Ratio of coal imports to GDP	5%
Total	100%

The supply dimension receives the largest weight because coal's direct economic contribution is arguably the most important aspect of coal reliance. The demand dimension receives a comparatively smaller weight because coal is consumed as a source of energy

that can be substituted with other sources of energy in the long term. It is important to note that the demand and supply dimensions are not opposed to each other.

The external dimension receives the smallest weight because it is already partly captured by the other two dimensions. Unlike the other dimensions, the two indicators for this dimension are not weighted equally. The ratio of coal exports to GDP (15%) is arguably more important than coal imports to GDP (5%) for the same reason that the supply dimension is more important than the demand dimension.

Example: Australia in 2019

Australia's coal rent in 2019 was 0.78 or 78% of GDP. This measure was divided by 0.81, the indicator's reference value:

$$0.78/0.81 \times 100 = 96.7$$

Its coal production per capita in 2019 was 12.5 Mtoe and the reference value 4.3:

$$12.5/4.3 \times 100 = 291.8$$

Australia's supply dimension index is, thus, the geometric mean of the two indices:

$$(96.7 \times 291.8)^{1/2} = 168.0$$

The country's coal consumption per capita in 2019 was 1.7 million tons, and coal made up 56% of its electricity mix in this year.

These indicators are also divided by their respective reference values:

$$1.7/2 \times 100 = 83.1$$

$$56.4/90 \times 100 = 63.2$$

Thus, the demand dimension index is:

$$(83.1 \times 63.2)^{1/2} = 72.5$$

The coal export of Australia in 2019 was 3.2% of its GDP, and its coal import close to zero. Therefore, its import dimension index is zero and its export dimension index is:

$$3.2/0.9 \times 100 = 346.9$$

The CRI is then calculated using a simple weighted average based on the schedule:

$$(0.5 \times 168.0) + (0.3 \times 72.5) + (0.15 \times 346.9) + (0.05 \times 0) = 157.8$$

Table 7

CRI Score and its Dimensions

Country	CRI			Supply			Demand			Export			Import		
	Score 2000	Score 2010	Score 2019	Score 2000	Score 2010	Score 2019	Score 2000	Score 2010	Score 2019	Score 2000	Score 2010	Score 2019	Score 2000	Score 2010	Rank 2019
Australia	88.9	209.1	157.8	68.6	247.9	168.0	110.8	95.5	72.5	142.0	376.6	346.9	0.1	0.2	26
Brazil	1.7	2.3	2.8	0.0	0.6	0.5	3.6	3.0	4.1	0.0	0.0	0.0	12.8	21.4	10
Bulgaria	14.1	22.3	9.3	12.5	33.5	16.7	0.0	0.0	0.0	0.1	1.8	0.2	157.4	104.8	14
Canada	20.9	26.7	15.8	15.8	26.5	13.2	32.4	23.5	12.8	17.0	39.4	33.6	13.8	10.4	20
China	24.1	71.1	45.4	14.9	92.3	46.6	48.6	73.6	69.7	13.2	4.0	0.7	0.9	44.8	11
Colombia	16.0	60.2	49.4	3.3	57.3	49.4	0.0	0.0	0.0	95.5	210.4	164.7	0.0	0.0	28
Czech Republic	25.9	40.7	14.3	38.0	63.0	22.4	0.0	0.0	0.0	43.1	53.8	9.2	8.6	22.9	8
Germany	19.5	21.2	12.8	5.8	12.1	4.4	54.0	46.7	31.9	0.2	0.2	0.2	6.9	22.9	13
Greece	3.5	8.6	3.0	6.5	16.8	5.7	0.0	0.0	0.0	0.0	0.0	0.1	4.2	3.2	24
Hungary	2.4	4.9	2.6	4.2	5.8	2.6	0.0	0.0	0.0	0.0	0.1	0.1	5.3	39.4	9
India	16.0	28.5	30.9	14.2	29.8	27.2	24.2	29.8	36.2	0.8	0.7	0.3	30.4	90.2	2
Indonesia	20.9	74.2	70.1	9.3	58.0	63.7	11.2	19.1	32.4	85.8	262.8	185.0	0.6	0.3	15
Japan	9.8	14.5	15.7	0.0	0.1	0.1	29.6	36.7	40.0	0.0	0.0	0.0	17.8	68.2	5
Kazakhstan	54.7	101.2	76.0	68.8	134.5	87.6	67.7	95.6	92.5	-	35.1	27.3	-	1.0	18
Mexico	2.1	5.2	3.4	0.4	3.7	2.0	5.8	8.5	6.2	0.0	0.2	0.0	2.6	14.8	16
New Zealand	4.9	10.6	3.3	6.6	20.8	6.1	0.0	0.0	0.0	10.5	0.5	1.1	0.2	2.0	25
Pakistan	0.5	2.9	4.8	0.9	1.4	1.5	0.0	0.0	0.0	-	0.0	0.0	-	44.0	3
Poland	49.2	60.4	40.4	31.2	56.8	30.4	87.4	83.4	70.3	47.0	27.1	11.5	5.3	58.0	6
Romania	5.9	7.2	2.5	5.8	13.3	4.2	0.0	0.0	0.0	47.0	27.1	11.5	5.3	58.0	19
Russia	28.6	41.7	46.4	25.2	49.3	47.8	28.2	23.6	23.1	0.0	0.6	0.0	60.3	9.8	23
South Africa	98.0	135.7	114.1	108.5	165.1	130.5	91.6	96.2	85.9	47.9	65.7	102.7	7.0	1.8	12
Korea	16.5	27.7	25.0	0.3	0.6	0.2	44.2	61.1	60.1	106.2	161.1	146.8	6.3	3.2	1
Spain	11.4	4.3	2.2	1.5	1.7	0.0	31.9	8.1	5.3	0.0	1.1	1.0	21.0	17.1	17
Thailand	5.7	9.8	7.8	3.0	4.9	2.0	11.5	15.5	16.1	0.0	0.1	0.2	14.9	53.8	7
Turkey	10.7	13.5	15.8	3.0	9.7	5.1	24.5	25.0	31.5	0.1	0.1	0.1	35.9	24.0	4
US	18.9	19.1	22.8	11.6	14.9	24.2	42.5	35.0	33.0	2.2	7.2	5.0	0.6	1.7	27
Ukraine	62.4	82.3	19.3	70.5	95.6	19.4	56.4	57.3	32.1	23.0	45.2	-	135.2	211.1	-
UK	13.0	15.5	1.5	2.6	7.3	0.3	37.2	36.0	3.3	0.5	0.7	0.5	10.0	19.4	22
Uzbekistan	0.6	2.0	1.5	1.3	4.1	2.3	0.0	0.0	0.0	-	-	0.0	-	-	21
Venezuela	5.0	0.8	0.1	5.6	1.6	0.2	0.0	0.0	0.0	14.4	-	-	0.8	0.4	-
Vietnam	8.2	22.0	19.5	2.7	34.8	16.6	6.2	12.6	37.4	32.9	-	-	-	17.7	-

Appendix

Figure 22

Percentage Change of Electricity Generation From Coal, as Compared to the Year 2000: Asia and the Pacific

Source: Lahiri-Dutt and Pasaribu (2021) based on BP (2020).

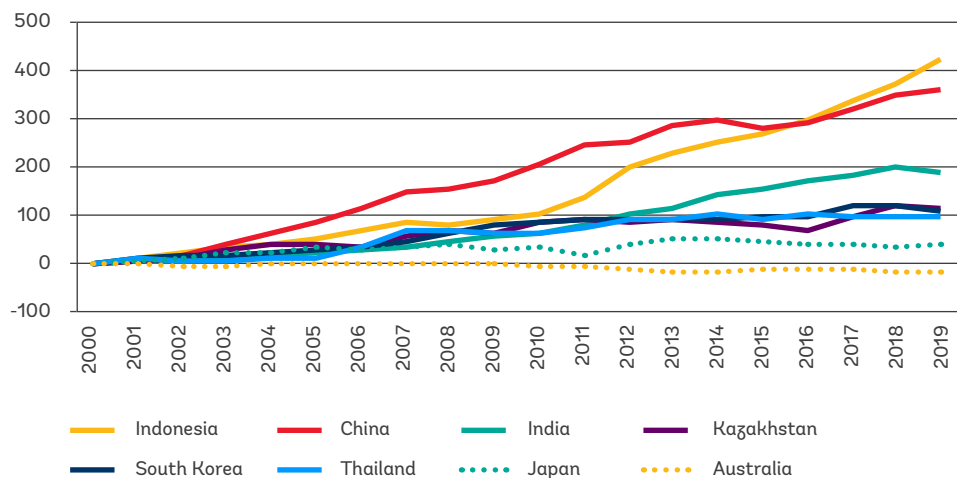


Figure 23

Percentage Change of Electricity Generation From Coal, as Compared to the Year 2000: Europe

Source: Lahiri-Dutt and Pasaribu (2021) based on BP (2020).

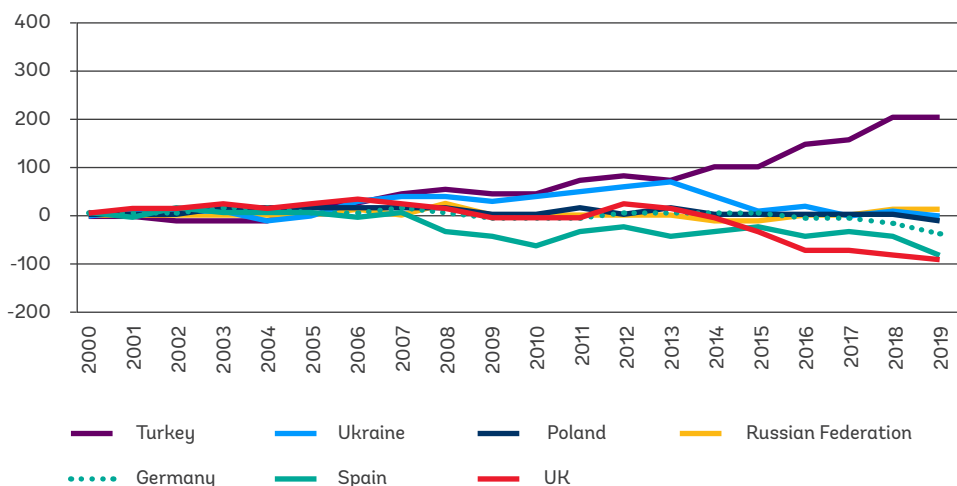
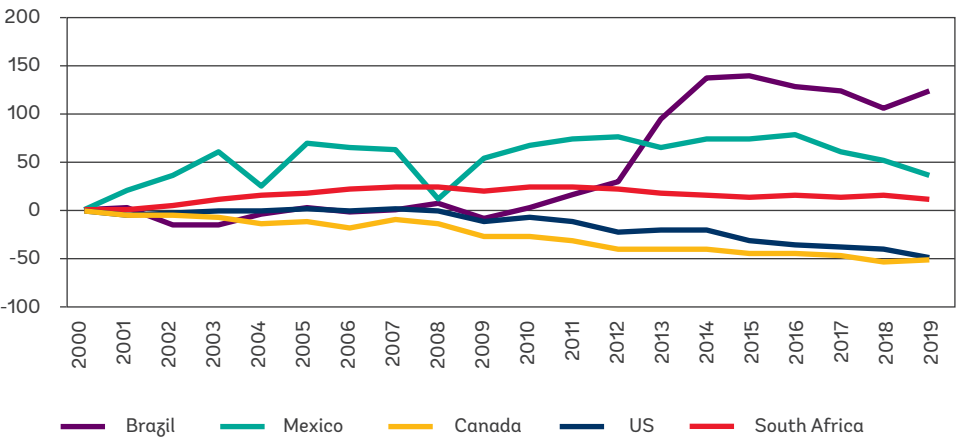


Figure 24

Percentage Change of Electricity Generation From Coal, as Compared to the Year 2000: The Americas and South Africa

Source: Lahiri-Dutt and Pasaribu (2021) based on BP (2020).



PART 3

Addressing Gendered Impacts Future Prospects



Section A: Gendered Impacts of Unplanned and Unregulated Closure

The social impacts of mine closure are both highly diverse and extremely similar across the Global North and South. It has been found across multiple jurisdictions that continued lack of attention to social impacts, inadequate closure planning and regulation, and abrupt closure compound the negative impacts of mine closure (Bainton and Holcombe 2018; Owen and Kemp 2018). Almost all independent research on mine closure refers to insufficient, inconsistent, or the absence of regulatory processes and frameworks for mine closure in the Global South (Ackerman et al. 2018; Evers 2020; Watson and Olalde 2019) as well as in developed countries (McCullough 2016; Monosky and Keeling 2020; Owen and Kemp 2018; Vivoda et al. 2019). Bainton and Holcombe (2018) call for a comprehensive global survey to assist jurisdictions to identify and implement the best policies and procedures.

Despite several decades of research and industry guidelines on best-practice approaches to mine closure (Anglo American 2013; IBRAM 2014; ICM 2008, 2019; World Bank 2000; World Bank and IFC 2002), planning for closure remains inadequate, ad-hoc, and typically occurs at the “eleventh hour” (Bainton and Holcombe 2018; Lamb and Coakes 2012; McCullough 2016). Based on research by Laurence (2006, 2009, 2011), Browne et al. (2011: 709) show that during 1981–2009 up to 75% of mines closed either prematurely or without any planning. It is thus suggested that despite best-practice guidelines, abrupt mine closure is in fact the norm.

Poor, or no communication with stakeholders and affected communities about unplanned or premature closure processes is a common thread in the literature on mine closure impacts in the Global North and South (Ackerman et al. 2018; Browne et al. 2011; Evers 2020; McCullough 2016; McDonald et al. 2012; Monosky and Keeling 2020; Siyongwana and Shabala 2019; Strambo et al. 2019; Vivoda et al. 2019). This compounds the shock, grief, and sense of helplessness experienced by many workers and communities following closure, further impacting their ability to recover (Ackerman et al. 2018; Browne et al. 2011; Pini et al. 2010; Siyongwana and Shabala 2019). The loss of trust generated by poor mine closure practices can jeopardize the collaboration needed between diverse stakeholders for a Just Transition to be realized (Sartor 2018).

Lax standards and regulation of closure can lead to serious ongoing environmental liabilities for both communities and governments. Following closure, access to productive land increases the diversity of livelihood options for both men and women. When access is diminished or removed by the mining company, it causes grave consequences for men, women, households, and communities. The shift away from agriculture to a cash-based economy that accompanies resource extraction causes acute food security crises in the event of the collapse of the mining economy following closure (Ackerman et al. 2018; Hill et al. 2017a; Siyongwana and Shabala 2019). Pollution legacies also produce harmful gendered impacts, particularly for women who shoulder primary caring responsibilities for household members along with carrying out agricultural and subsistence activities.

Overview of Mine Closure Impacts

Bainton and Holcombe (2018) describe mine closure as a complex, context-specific, and long process, with potentially intergenerational consequences. This finding is shared by numerous other researchers who confirm that without adequate transition planning and investment for economic diversification, many former coal mining regions remain socioeconomically depressed for an extended time. In less-developed countries with poor governance structures, negative legacies of mismanaged mine closure are predictably deeper and more protracted (Ackerman et al. 2018; Sesele 2020; Siyongwana and Shabala 2019). Factors that influence the nature and extent of social impacts of mine closure include:

- Geographical location of the mine site and surrounding communities.
- Level and extent of economic dependence on mining.
- Capacity of communities/individuals to respond to the impacts of closure.
- Closure processes and policies of the mining company.
- Closure policies and capacity of regulatory authorities.
- Involvement of local government.
- Coordinated financial investment from different levels of government.

Case studies suggest that many of these impacts are compounded by underlying vulnerabilities. In the Global North and South coal mining often takes place in remote locations with poor transport and

communication infrastructure, lack of access to government and private services, low levels of state presence, and lack of political representation. In many parts, coal mining takes place on or near indigenous lands or communities and indigenous disadvantage is therefore another important intersectional variable that influences the impact of closure.

The level of economic dependency on resource extraction (or lack of economic diversity) within a community or region has the greatest bearing on the social impacts of mine closure (Bainton and Holcombe 2018; Browne et al. 2011; ICM 2008; World Bank 2020). Mining typically makes a major, transformational impact on every aspect of local economies, but according to Owen and Kemp (2018: 20) these impacts – and therefore their gendered dimensions – continue to be poorly documented and understood. Larger revenue flows between mining companies and governments are usually well documented, unlike economic impacts at regional and local scales (Owen and Kemp 2018: 20).

All case studies of mine closure document significant, prolonged detrimental impacts on local economies, including downstream employment impacts for supply chain partners and secondary industries, retail, hospitality, and other commercial services. Another noted local economic impact is the rapid decline in the value of housing and land. Studies also suggest links between the physical environment and social, economic, cultural, and emotional life and activities of people, especially for indigenous people, compound the negative impacts of resource extraction, including mine closure (Hill et al. 2017b; McCullough 2016; Owen and Kemp 2018; UNDP 2018). Such cumulative economic impacts can severely depress former mining regions for decades and have a wide range of serious social



Table 8

Environmental, Social, and Economic Impacts of Mine Closure

Sources: Aung and Strambo (2020), Owen and Kemp (2018).

Environmental/physical impacts	Economic impacts	Social/psychological impacts
Ongoing environmental impacts due to lack of/poor remediation	Direct employment impacts (mine workers and contractors)	Stress, anxiety, depression, and grief
Ongoing safety hazards due to poor/incomplete closure	Secondary employment (supply chain industries)	Loss of identity through unemployment
Future land use/viability	Local businesses (retail and other services)	Loss of connection to place, workplace, home, and community
Future landownership	Loss of local government revenue (reduction in rates and taxation)	Substance abuse
Water quality, access, and use	Loss of government-funded services	Domestic, family, and gender-based violence
Infrastructure (ownership, ongoing maintenance, and repairs)	Outmigration/demographic changes (loss of youth and skilled professionals)	Marital breakdown

and gender impacts, including entrenched poverty and food insecurity in less developed countries (Ackerman et al. 2018; Browne et al. 2011; Edwards and Maritz 2019; Siyongwana and Shabala 2019; Wiseman et al. 2017).

Table 7 captures the key social, economic, and environmental impacts of mine closure, many of which are interrelated and can be considered gendered, i.e., they are felt and experienced differently by women and men, emphasizing that an intersectional approach is required to both understand and mitigate these impacts.

Gendered Impacts of Mine Closure:

Past and Present

There are few independent studies and little publicly available data on the gendered impacts of mine closure and the success or otherwise of impact mitigation programs and policies, both in the past and present. Those that do exist focus mostly on the UK, US, and Europe. Bainton and Holcombe (2018: 476) note that the “socioeconomic and political impacts that arise during operations are nearly always present in a more acute form towards the end of the project life-cycle.” In their study of the distributional impacts of mine closure,

Aung and Strambo (2020) clarify that closure impacts on employment, livelihoods, and wellbeing, and these impacts are felt differently by different women and men, challenging and changing gender roles, relations, and identities. The distributional impacts of coal mine closure by age and gender are summarized in Table 8.

Recent research suggests that mine closure impacts for women have remained broadly the same across ages (Evers 2020; Ey 2018; Pini et al. 2010; Sesele 2020). This is largely due to the obstruction to women’s participation in mining employment, continued neglect and marginalization

of social and gender impacts of mining by industry and government, and structural barriers to their participation in negotiations with mining companies and other community forums to advocate for their needs and interests (Keenan et al. 2016; Lahiri-Dutt 2012).

Table 9

Distributional Impacts of Mine Closure.

Source: Aung and Strambo (2020: 6).

Social impacts	Economic impacts	Political impacts
Double burden of care, domestic and paid work for women.	Unemployment for men; unskilled work for women.	Increased activism of women in mining households.
Increased domestic violence and abuse against women in former mining households.	Surplus male labour displacing female employment.	Disenchantment and anti-authoritarian culture among youth.
Mental health effects for former male miners..	Few/no employment opportunities for youth and older people.	
Stigma against seeking assistance for men.	Outmigration/brain drain of youth/skilled workers.	

While insightful, some researchers have observed that historical studies of the impacts of mine closure do not necessarily reflect the current practice of mining in terms of the rise of Fly-In-Fly-Out (or FIFO) and Drive-In-Drive-Out (or DIDO) employment models and individual work contracts (including short-term international work visas) which reflect the “dynamic, unstable” nature of contemporary mining communities (McDonald et al. 2012: 26). The rise of privatization and industry consolidation and the demise of residential mining and unionization have changed both workplaces and surrounding communities significantly from earlier eras (McDonald et al. 2012). For men, who continue to make up the majority of the (formal) mining workforce, this includes a reduction in the advocacy and collective bargaining power of unions to negotiate redundancy packages and re-training programs on behalf of all workers, including women.

These shifting power relations between corporations, governments, workers, and communities, along with the continued lack of explicit regulatory frameworks for the social impacts of closure mean that communities are largely reliant on the voluntary CSR initiatives of individual companies to mitigate closure impacts. The global trend of unplanned closure is attributed by some to a corporate shift in priorities away from workers and communities and toward shareholders (McDonald et al. 2012; Wiseman et al. 2017).

Social research on the decline of coal mining in the UK and US has found that trust in both governments and industry is a long-term casualty of abrupt or mismanaged mine closure, with political disaffection and anti-authoritarianism being a noted impact lasting for generations. For women in former coal mining communities this has led to them adopting new roles as activists and community advocates (Aung and Strambo 2020; Strambo et al. 2019).

Although there are areas of overlap in the gendered impacts of mine closure in the Global North and South, recent ethnographic case studies (such as Evers 2020; Mohr et al. 2020; Sesele 2020) show that women in the Global South are distinctly disadvantaged by a range of intersectional, institutional, structural, and cultural factors, which exacerbates the impacts of mine closure. Mining here frequently takes place in contexts of uneven economic development, where communities may rely on subsistence agriculture pre and post mining, government structures, services, and infrastructure are weak and gender relations are characterized by inequality. The emerging evidence confirms that the negative impacts of mine closure in this region may therefore be more severe and protracted and further increase economic and gender inequality (Evers 2020; Sesele 2020; Siyongwana and Shabala 2019; UNDP 2018).

Key Areas of Gendered Impact

The key impacts of mine closure, such as employment and livelihoods, land use, water, infrastructure, and outmigration are intrinsically linked. For instance, impacts on land use and water access following closure can have a range of different impacts on the sustainable livelihoods of many women and men living in and around mining communities. Loss of employment for men results in a range of impacts on women, households, and the local economy. Unemployment and the deterioration of local economic conditions can trigger serious impacts that are differentially experienced by the two genders, such as escalating poverty, crime, domestic, and sexual violence.

Employment and Livelihoods

Despite decades of automation dramatically reducing labour requirements of mining operations, sudden large-scale unemployment is the most notable gendered impact of mine closure. Given their over-representation in the mining workforce, male workers are the most visibly affected by unemployment. The gendered impacts of unemployment resulting from mine closure include:

- financial stress and insecurity;
- increased mental health problems and substance abuse amongst former mine workers;
- increased rates of domestic violence, sexual assault, and abuse (of women and children)

- increased rates of marriage breakdown;
- women becoming breadwinners, but often in insecure, low paid, or exploitative work;
- increase in women's "triple burden" of paid and unpaid domestic and caring work; and
- loss of identity, feelings of stigma, and social isolation for men.

An intersectional approach reveals that these impacts are not uniformly experienced by all women or men. For instance, research into mobility and outmigration following mine closure has demonstrated that younger, skilled male workers are better able to find new employment or outmigrate for the same. Older, unskilled, manual workers and those with less transferable skills – both male and female – are less mobile and in a situation of broad sectoral decline may be unable or see no point in outmigrating for work (Aung and Strambo 2020; Sesele 2020; Siyongwana and Shabala 2019).

Given women's low numbers of (formal) employment in the mining sector in the Global South the impacts of mine closure on them are often invisible (Lahiri-Dutt 2012a; Lahiri-Dutt and Macintyre 2006).

Consequently, their needs and interests may be overlooked by unions or other worker advocacy organizations in closure and transition planning. It also obscures the employment impacts on the many secondary industries and small businesses that depend on the coal sector, which often employ or are run by women. A broader focus on coal sector decline, which includes regional supply chain impacts, rather than coal mine closure, is therefore needed to capture the gendered impacts on supply chains (Wiseman et al. 2017).



Compensation and severance payments have been found to exacerbate gender inequality within the household, increase women's economic dependence on men, and decrease women's power over household assets and resources (Hill et al. 2017a, 2017b).

While male mine workers may receive such compensation, research shows that these are not always shared with women or other household members. Men often use such funds for immediate personal consumption, unlike women who are more inclined to invest for the long-term benefit of other family members, such as in education and training.

In the Global South and rural areas mining often shifts local economies away from land-based livelihoods and towards cash-based economies (Hill et al. 2017a). This impacts women and men differently according to a range of variables, particularly access to finance and socioeconomic status. Men are better equipped to capitalize on this economic transition, while women continue to engage in subsistence farming and undertake caring responsibilities. In South Africa, this has contributed to acute poverty and food insecurity following mine closure, with women and men unable to undertake subsistence agriculture due to pollution impacts and gradual loss of farming skills for men due to their participation in mining-related employment in the intervening years (Ackerman et al. 2018; Siyongwana and Shabala 2019). The impacts of this reliance on a cash-based economy are most acute following closure, when a wide range of secondary industries and alternate sources of employment may also collapse. In some former mining communities, workers have been forced to turn to illegal mining, crime, and sex work in order to survive (Siyongwana and Shabala 2019; Sesele 2020).

Case Study 1.

Coal sector decline in the UK: Changing gender-based identities and livelihoods

Coal mining communities in the northern regions of the UK were among the first to experience rapid decline when a significant proportion of mines were closed in the early 1980s. The gendered division of labour largely reflected broader societal norms of the time, with men employed in a variety of mining roles and women in pit canteens, manufacturing, or unpaid reproductive and domestic work (Bennett 2015). While the identity of male coal mine workers was challenged by the mass industry closure, many women became involved in activism through protesting the impacts on their families and communities – an extension of the important role women played in building social networks. Further changes to gender-based roles followed mine closure in the UK, as the economy shifted from an industrial to a service-based model. Women – whose labour was cheaper than men's – became breadwinners in a variety of roles but faced an increasing double burden of paid and unpaid labour. As many former male miners struggled to find alternate employment or suffered lasting health issues as a result of coal mining, women increasingly had to provide and care for their unemployed husbands and experienced increased levels of domestic violence. Masculine cultural ideals of strength and self-sufficiency prevented men from accessing help, while women struggled to support their families in less secure and well-paid work (Aung and Strambo 2020).

These gendered impacts were long lasting in northern England. Bennett (2015) finds that a decade after pit closure in Nottinghamshire, women reported ongoing closure-related stress impacts, including high levels of unemployment, domestic violence, marriage breakdown, and sexual assault. Aragón et al. (2019) also find that women were displaced from better-paid jobs in manufacturing by the surplus availability of male mine workers – a phenomenon which also reduced the cost of labour. Based on census data this impact on women's employment in manufacturing had a prolonged effect in former coal mining areas in northern England.

Sources: Aung and Strambo (2020); Bennett (2015); Aragón et al. (2019).

Land Use, Ownership, and Resettlement

The return and re-use of former mining land is a key gendered impact that is also intrinsically tied to environmental impacts of closure and sustainable livelihoods. Former mining land is often returned to the state or to other private or communal landholders. The rehabilitation of land for future use as well as clear legal frameworks or systems of landownership are critical to minimize social impacts following mine closure, particularly where land has been previously held or used by indigenous peoples under customary tenure arrangements (Owen and Kemp 2018: 16).

Involuntary resettlement results in negative gendered impacts, including exacerbating poverty, access to land and water, food insecurity, and loss of livelihood options (Hill et al. 2017b). Particularly for indigenous people, it can permanently alter deeply held connections to place and cultural identity – including customary gender roles – as well as significantly increasing underlying structural disadvantage and vulnerability. In some cultures, women and men may have different obligations, responsibilities, and rights in terms of landownership, use, and access; cases where land is customarily owned by women post-closure land distribution or withholding of customary land by the state can snatch these rights from women, thereby diminishing their economic, social, and cultural status.

The “feminization of agriculture” is an emerging trend especially in South Asia.

Men have increasingly been forced to migrate seasonally or long term for work opportunities, leaving women to farm on family plots (Pattnaik et al. 2018). The International Labour Organization (ILO 2017: 3) estimates that over 60% of all working women in southern Asia and sub-Saharan Africa are engaged in unpaid and labour-intensive agricultural activities. Despite them being responsible for close to 50% of food production in these regions just 10–15% of women are legal landholders (USAID 2016). Keenan et al. (2016: 613) confirm that women may be excluded from company–community agreement negotiations due to their lack of rights or ability to own land. Land use and ownership is thus a significant gendered impact of closure, with multiple dimensions and intersectional factors, particularly in contexts where women do not have rights to hold land and are dependent on male relatives for land use and access (Evers 2020; UNDP 2018). McCullough (2016: 331) finds that in terms of the remediation and future use of land, separating environmental and social or cultural impacts is deeply problematic for indigenous stakeholders, who “represent a very tangible nexus between social and environmental assessments of end-land use and post-mining considerations.”



Case Study 2.

Hazelwood Power Plant, Australia: Secondary employment and supply chain impacts

When the Hazelwood coal-fired power plant closed in regional Victoria in 2017, unemployment in the La Trobe Valley was already 11.2%. Earlier analysis had found that mining jobs are relatively well paid, with up to four other local jobs in retail and services sustained by the multiplier effect of one well-remunerated coal sector job. Modelling provided for the Committee of Gippsland by GHD consultants found that the loss of 1,400 jobs in the coal power sector would result in the loss of 1,771 non-mining jobs. This had significant gender impacts given that women were primarily employed in retail, tourism, and services sectors, many of them in insecure and low-paid positions. Concerns about surplus labour were heightened with the closure of a nearby timber mill resulting in a further loss of 160 jobs. The “hidden” impacts on women’s employment that accompanies coal sector decline as well as the ripple effects on secondary and supply chain industries are clear from this study.

Source: (Wiseman et al. 2017).

Infrastructure and Social Services

The ownership, ongoing delivery, and maintenance of infrastructure and services that has been developed and funded either directly by mining companies or via tax transfers to local governments is a key area of impact for women and men in mining communities following closure. In remote regions in particular these infrastructure and services – which can include education and childcare, medical and transport services, waste management, water, and power – are considered a positive economic benefit of mining-led development (Owen and Kemp 2018).

Case Study 3.

Kwale County, Kenya: Gendered impacts of land re-distribution and resettlement

In her ethnographic study of the impacts of mine closure on local communities in Kwale county, Kenya, Evers (2020) concludes that despite several projects and plans to assist with economic and environmental regeneration following closure, the mining company was largely focused on exploring options to extend the life of the mine as the closure date loomed. While it could be argued that extending the life of the mine would provide the largest possible livelihood benefits to local communities, this came at the cost of effective mine closure planning and transitioning local economies toward sustainable activities.

Interviews with women revealed that despite locally led committees participating in decisions regarding company-sponsored development projects, there was both a lack of gender balance on these local committees, with low levels of female participants, and a lack of information and knowledge about the company’s closure plans and procedures. Research participants were particularly anxious about the lack of knowledge about receiving land back following closure, as per the Kenyan government policy. Evers (2020: 63) also finds barriers and complexities related to customary tenure arrangements and lack of formal land tenure documentation. This was particularly problematic for women, who are not recognized as landowners or holders in Kenya. As a result, women were disadvantaged twice in resettlement schemes – through a general lack of consultation and participation in the design process and through being unable to own land.

Source: Evers (2020).

While governments are responsible for these services and infrastructure, mining companies often contribute to their costs as part of community development and land use agreements. Several regions in the Global North and South demonstrate that the demise of infrastructure and social services following mine closure has a gendered impact. Loss of access to health, education, and child-care services disproportionately impact women and may have potential long-term intergenerational socioeconomic impacts.

Water

Water quality and security have significant health and livelihood impacts for communities. Despite attempts at mitigation, mining activities may permanently alter or contaminate water resources, leading to potential long-term liabilities for communities and governments following mine closure. According to Owen and Kemp (2018: 19), whether mining companies need to consider hydrogeological impacts as part of mine closure varies across jurisdictions, including the need to engage with affected water users and rights holders during the project cycle.

Case studies of mine closure in countries in sub-Saharan Africa show that many former mine workers and community members turn to farming, fishing, and subsistence agriculture following mine closure and that some mining companies also sponsor farming initiatives as part of sustainable community development programs, all of which are dependent on access to clean water (DFAT 2016; Edwards and Maritz 2019; Evers 2020; Siyongwana and Shabala 2019).

Long-term issues impacting on water resources following closure include the management of polluted groundwater, pit lakes, tailings, spoil piles, and the safety of dams. As per land-based closure impacts, the health impacts of pollution have been found to burden women more than men as the primary carers for immediate and extended family members.

Outmigration

Outmigration is a widely documented gendered impact of mine closure that is closely tied to employment and livelihoods.

Given that mining companies and governments may build social assets such as housing during the project cycle, the choice to leave both a home and a community is a difficult one, particularly for poor and less mobile women and men, despite the severe socioeconomic impacts following closure. Research in Canada and Australia finds that indigenous peoples and women are less likely to out-migrate due to a strong sense of attachment to place. For women this may also be due to their reproductive role and contribution to building and maintaining social networks within mining communities (Aung and Strambo 2020; Pini et al. 2010).

The “feminization of agriculture” is an emerging trend especially in South Asia.

Men have increasingly been forced to migrate seasonally or long term for work opportunities, leaving women to farm on family plots (Pattnaik et al. 2018). The International Labour Organization (ILO 2017: 3) estimates that over 60% of all working women in southern Asia and sub-Saharan Africa are engaged in unpaid and labour-intensive agricultural activities. Despite them being responsible for close to 50% of food production in these regions just 10–15% of women are legal landholders (USAID 2016). Keenan et al. (2016: 613) confirm that women may be excluded from company–community agreement negotiations due to their lack of rights or ability to own land. Land use and ownership is thus a significant gendered impact of closure, with multiple dimensions and intersectional factors, particularly in contexts where women do not have rights to hold land and are dependent on male relatives for land use and access (Evers 2020; UNDP



2018). McCullough (2016: 331) finds that in terms of the remediation and future use of land, separating environmental and social or cultural impacts is deeply problematic for indigenous stakeholders, who “represent a very tangible nexus between social and environmental assessments of end-land use and post-mining considerations.”

Case Study 4.

Free State Goldfields, South Africa: Intergenerational rifts in female-headed households

If the severe economic impacts of mine closure are not effectively mediated, they can result in complex, gendered, and intergenerational impacts at the household level. Loss of trust in governments

that may be unwilling or unable to assist, rising unemployment, and deepening poverty can lead to lawlessness and anti-authoritarian attitudes in young people, as adult male and female breadwinners struggle to provide for their families in a deteriorating economic landscape.

In South Africa, women have been historically excluded from the mining workplace and have thus not reaped its potential benefits. Women’s unpaid agricultural labour assisted men to transition into mining work. Now women must deal with an accelerating situation of mining decline which also disproportionately impacts them.

Sesele’s (2020: 196) research in the Free State Goldfields in South Africa shows that the economic and social breakdown that accompanies mining decline further impacts and erodes the authority of and respect for women within households and the broader community. While male heads of households often migrated in search of work, women typically stayed behind. Some female household heads even pushed daughters and sons into sex work and crime to alleviate poverty – a situation that further undermined their status and authority.

Sources: Sesele (2020); Sesele et al. (forthcoming).

In their assessment of the distributional impacts of mine closure, Aung and Strambo (2020: 9) find that outmigration following mine closure is governed by age, gender, home ownership, skills and work type, as well as social networks and support. Some studies conclude that mine workers who only have industry-specific skills are reluctant to learn a new professional skill and often prefer to seek re-employment elsewhere in the mining industry. However, in the case of a sector-wide decline workers may see little point in relocating, despite the risk of long-term unemployment (Ackerman et al. 2018; Siyongwana and Shabala 2019).

Loss of Identity, Social Capital,

Cohesion, and Connection

Mine workers and mining townships, particularly “fenceline” communities, which often have a strong sense of shared identity, face a sense of alienation, grief, loss of pride, lack of purpose, social disruption and isolation following mine closure as they grapple with unemployment, economic decline, and uncertain futures (Bennett 2015; McDonald et al. 2012; Pini et al. 2010: 564; Strambo et al. 2019: 10). In mining communities in the Global South, the decline and cessation of mining has often induced severe social breakdown due to acute poverty and food insecurity (Ackerman et al. 2018; Sesele 2020; Siyongwana and Shabala 2019). These impacts are also highly gendered, resulting in mental health disorders, substance abuse, domestic violence and abuse, and marital breakdown (Ackerman et al. 2018; Aung and Strambo 2020; Sesele 2020; Siyongwana and Shabala 2019; Strambo et al. 2019).

Case Study 5.

Pilgrims Rest, South Africa: Impacts of infrastructure and service decline

For their investigation into the social impacts of mine closure at Pilgrim's Rest in Mpumalanga Province, South Africa, Siyongwana and Shabala (2019) interviewed workers, residents, teachers, and police officers. Given the community's sole economic reliance on mining the negative impacts following mine closure were acute, including a dramatic increase in crime, outward migration, mental health problems, drug and alcohol abuse, illegal mining, and rapidly deteriorating infrastructure. Children were negatively impacted by their parents' unemployment and poverty: there was a rise in the number of dropouts in the event of not being able to afford the fees, while some children even turned to substance abuse. Teachers feared that the mining company would eventually withdraw its residual support for the school, which would impact future generations and lead to the outmigration of skilled, educated professionals.

The deterioration of infrastructure following closure, such as low-cost housing, illustrates the complex, interconnected social and economic impacts of mine closure, as one resident revealed:

When a toilet pipe burst in my rental house 2 months ago, I did not report the matter to the Department of Public Works; because I had not paid rent for the last 9 months. How could I expect the government to fix the pipe; when I have not been paying my rent for such a long period of time? That is why my family uses a pit toilet, which explains the bad smell around this place . . . I have discovered that the undrained water, which had leaked out of one of the water pipes had become the comfort area for the mosquitos.

Private businesses that provided important community goods and services were also affected by the attendant social and economic decline. One business owner revealed the knock-on impacts of his decision to leave:

I have closed my fuel garage; because it is useless to open the business if you are not making money. Now people are suffering; and to get the fuel they need, they have to travel to the neighbouring small urban centre located twenty-five kilometres from Pilgrim's Rest.

This case study reveals the negative spiral of economic and social decline that can severely impact communities following mine closure without substantial planning, support and intervention.

Source: Siyongwana and Shabala (2019)

The cessation of royalties, uneven distribution of compensation payments, and living with the realities of ongoing environmental and social liabilities can become a source of social and household tensions within these communities. This may create intergenerational rifts when the younger population feels it is left with the negative legacies of mining. Given that mining-led development, which tends to bring an uneven distribution of risks and benefits, is often a contested issue within communities, this underscores the potential for mine closure to create deeper social rifts and conflicts as the negative impacts of closure are unevenly felt (Browne et al. 2011; Pini et al. 2010).



Section B: Steps to Take to Address Gendered Impacts of Mine Closure

There is little evaluative evidence about the success or otherwise of state-sponsored mine closure mitigation strategies. The lack of evidence suggests that many mitigation and transition programs have been either poorly designed or implemented or have failed to include women and men from impacted communities as active participants in the planning process. In terms of the role of industry, while best-practice examples remain hard to find, in recent years some corporations have taken steps toward integrated, participatory mine closure planning and mitigation programs (Edwards and Maritz 2019; Grant and Lacy 2016) that have largely focused on re-training, employment, economic diversification, and resettlement. More recent iterations of industry closure guides focus on the social impacts of closure; however, consideration of gender continues to be a notable omission from most of them, indicating a continued inability to understand and mitigate the complex gendered impacts of closure.

Closure Planning and Regulation

As demonstrated in Section A, how mining companies and governments approach and regulate mine closure ultimately affects addressing impacts, with a wealth of literature demonstrating that deficits in mine closure planning – including the current trend of abrupt or unplanned closure – exacerbates the adverse impacts on workers in mining communities. At a minimum, effective mine closure involves:

- clear, regular, and up-to-date communication and dialogue with impacted workers and communities regarding closure timelines prior to project commencement and throughout the project life cycle;
- active participation of diverse local women and men in closure planning;
- preparing workers and communities for life after closure by embedding closure considerations in gender-sensitive economic diversification programs, education, sustainable livelihoods, and transferable skills training throughout the project life cycle; and
- environmental management and rehabilitation of mine sites to minimize impacts on surrounding and host communities.

To reverse the trend and impacts of unplanned closure, several researchers have called for strengthening closure planning and regulation (Bainton and Holcombe 2018; Monosky and Keeling 2020; Vivoda et al. 2019). To effectively manage the social impacts of coal sector decline, Sartor (2018: 29) recommends governments enter binding transition contracts with mining companies based on detailed asset closure plans that incorporate obligations as to public disclosure of closure dates, ongoing community consultation, and worker adjustment support.

Change of mine ownership – a strategy that many mining companies employ to evade closure planning and liabilities toward the end of the project cycle – must not affect obligations under the transition plan. Other key components of a comprehensive asset closure plan and transition contract should

include iterative, integrated, and participative gender and environmental impact assessment throughout the project life cycle, including for closure; and establishment of Just Transition/closure funds to ensure transition and closure programs and liabilities are adequately funded.

Early planning for closure enables governments to prepare communities and workers, assess the potential for economic diversification of a mining region, and, if possible, attract alternate industries and investment before closure impacts take hold.

This closely relates to the regulation and effectiveness of mine closure planning, as economic diversification may be contingent on the effective environmental rehabilitation and remediation of a mine site and its surrounding areas.

Economic Diversity, Employment, and Training Schemes

Governments in the EU, UK, and North America have instituted compensation and worker re-training and relocation programs in response to coal sector decline with limited long-term success. In these regions post-closure employment options have typically been less secure and well paid than mine work, and compensation and pension schemes are usually only extended to full-time mine workers, excluding part-time and casual staff, as well as those employed in supply chains and secondary industries (Aung and Strambo 2020: 8). As expected, these programs have different impacts on women and men given that women make up the majority of part-time and casual workers in secondary industries.

Case Study 6.

Recruiting women in energy supply chains: ENERGIA Gender and Energy Research Program

This five-year program by ENERGIA (International Network on Gender and Sustainable Energy) focused on the participation of rural women and men who have experienced discrimination, marginalization, and exclusion in the development of energy infrastructure. While it found that including women in energy supply chains was beneficial for them and their households, their participation was contingent on several supportive factors. The findings of the research into the inclusion of women in renewable energy supply chains include:

- Women selling energy products perform as well as men, if not better.
- Involvement of women in energy-system supply chains is good for them, their families, and business.
- To support women in overcoming challenges induced by gender norms, four types of support are required to significantly enhance the performance and sustainability of women's energy businesses: (a) business education and skill development; (b) training to foster personal agency and initiative, and at the business level; (c) access to finance and capital; and (d) access to coaches, mentors, and networks.

Sources: ENERGIA (2019) and Kooijman-van Dijk (2020).

Economic investment programs to revitalize former mining areas typically take a long time to bear fruit and have had limited success to date. Furthermore, the benefits of these programs are gendered. Aung and Strambo (2020: 9) find that in some instances economic diversification and revitalization programs have focused on attracting highly skilled workers or supporting the development of SMEs, which can limit the participation of women who may face a range of structural barriers due to low education or skill levels, need for flexible or part-time work, and limited access to capital in order to participate in entrepreneurial activities.



Many governments and mining companies – often in consultation with trade unions – have undertaken re-training and education schemes to assist mine workers to transition to new industries or forms of employment.

Like compensation schemes, these programs tend to favor male workers. However, it has been found that re-training schemes for male workers have been inappropriately designed and left former mine workers ill-equipped for alternate employment. Sartor (2018: 29) identifies several problems with transition skills training programs for coal sector workers, including:

- Structural unemployment and lack of jobs in the surrounding labour market.
- Lack of consultation with potential employers/other industries to identify needed skills.
- Focus on technical skills instead of providing a holistic approach to unemployment assistance, such as career advice, relocation assistance, counseling and personal support, and employer–employee matching.
- Lack of monitoring and evaluation of training programs to ensure continuous improvement and learning over time.

These programs also often ignore the well-documented structural barriers to female economic participation, including:

- double work burden and caring responsibilities;
- lack of financial or credit access;
- lack of control/power over household finances and investment decisions;

- need for flexible employment; and
- need for transferable work skills to assist with mobility.

Local contextual factors as well as structural and intersectional barriers to the participation of women and men in labour market transition and training schemes following mine closure must be analyzed, understood, and incorporated into the design of such programs to realize their benefits.

Coordination and Cooperation

Between Different Levels

of Government

In keeping with the general limitations in the literature on social impacts of closure, there is limited information on the short- and long-term outcomes of response measures and transition programs. The evidence that does exist suggests that two factors may help to mitigate mine closure impacts: a high level of involvement and leadership from local governments, and the availability of different financial levers to support different response measures and collaboration between different levels of government. Coordination and a shared vision between private and public actors are also critical to effective transition planning (Strambo et al. 2019: 11).

A common finding that emerges from both mine closure literature and literature on mainstreaming gender in energy policy is that a broad disconnect exists between national (and international) charters and policy frameworks and lower levels of

government that are required to implement and operationalize a wide range of policies and programs. Regional and local levels of governments need the resources, skills, and capacity to effectively implement gender-sensitive policies and programs, including for mine closure and energy transition. Funding and technical support, scaffolding, and linkages must be created between different levels of government so that national resources can be mobilized to assist regions impacted by coal sector decline, and local conditions and knowledge can inform policy response (Clancy and Mohlakoana 2020; Fraune 2018; Mohr et al. 2020; Sesele 2020).

Future Land Use, Ownership, and Access

These are important closure considerations where both state and industry policies and processes have significant bearing on gendered impacts. These critical issues lie at the intersection of environmental, social, economic, livelihood, and gender impacts and require integrated analysis and planning. According to Lamb and Coakes (2012: 2), potential future land use scenarios should ideally be considered at the pre-feasibility stage of a mine development as small changes in the design phase can have a major implication for closure options. Planning for future land use after closure therefore also needs to be as consultative as possible and involve landowners (and users) and impacted communities.

If mining companies enter “ad hoc” arrangements with customary owners to lease land during the operational years, significant problems can emerge for indigenous peoples when land is relinquished to the state following closure. This requires a detailed understanding of landownership and use issues before mining activities commence

and throughout the project cycle to minimize post-closure impacts (Owen and Kemp 2018: 17). Understanding local laws (both informal and formal) governing land ownership and access is an important pre-feasibility step for addressing these impacts and is a requirement of companies under the United Nations Framework on Business and Human Rights as well as Free, Prior and Informed Consent (FPIC) obligations for projects which engage with or affect indigenous peoples:

The United Nations Framework on Business and Human Rights sets out the obligations of business enterprises, namely that they respect human rights and avoid contributing to human rights harm by exercising “human rights due diligence”. In other words, companies need to be able to “know and show” that they respect human rights by having policies and processes in place to identify, prevent, mitigate and enable remediation (e.g. via grievance mechanisms) of human rights impacts. A gender impact assessment is a vital component of this due diligence process. (Hill et al. 2017a: 6)

Fostering Sustainable Livelihoods

Within the literature on mine closure there is a strong focus on the role of industry in fostering community resilience, capital, capacity, and economic diversity during the life of mine so that communities are better prepared for closure. However, this comes at the risk of “dependency” not just on mining activities, but also on social investment and community development schemes that are implemented as part of company CSR initiatives (Evers 2020). Critical to the success of gender-sensitive livelihood diversity programs is the development of a comprehensive community profile through a detailed gender impact assessment (GIA) process, active community participation in all planning stages, and creating sustainable initiatives that



can be fully transferred to local people to run independent of industry or government assistance (Edwards and Maritz 2019; Grant and Lacy 2016).

Both industry and governments need to consider embedding a sustainable livelihoods approach to employment schemes, community development, economic diversity, and other mine closure and transition programs.

According to Chambers and Conway (1991: 6), a sustainable livelihood is one that can “cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to their livelihoods at the local and global levels and in the short and long term.” Using this approach can assist policymakers, planners, and community development professionals to consider whether labour market and CSR programs can be sustained in the context of the broader economic decline that often follows mine closure, and what activities and investments on the part of mining companies and governments can best support sustainable livelihoods for affected communities.

mine closure makes no reference to gendered impacts, although it does make a brief reference to the participation of women, youth, and other vulnerable groups in social transition planning.

Lack of consideration of gender in closure planning is symptomatic of gender-blind approaches to community engagement and development on the part of the industry.

Keenan et al. (2016: 610) note that company–community agreements have evolved over time from early preoccupations with compensation for land access to underpin relationship–building with local communities and sustainable development, and that such agreements should accordingly “integrate gender as an intersectional frame of analysis, and gender equality as a strategic goal”. In their analysis of agreements between mining companies and local communities, Keenan et al. (2016) reveal that despite awareness–raising by independent researchers, NGOs, and major donors for at least a decade, the impacts and changes wrought by mining, as well as mitigation strategies, continue to be largely understood at a “community” level, and do not account for the differential impacts of mining on people.

Key Barriers to Gender-Sensitive

Closure Planning

Gender-Blind Policies and Processes

Independent consultants to industry that advocate for better mine closure planning and the integration of social impact assessment throughout the project life cycle make little to no reference to gendered impacts, although most acknowledge the importance of consulting with “vulnerable” or “marginalized” social groups (Lamb and Coakes 2012; Costa 2015). The recently updated ICMC guide (2019: 26) to integrated

Participation

Throughout the literature on the gendered impacts of mine closure and energy transition, women’s lack of participation is a constant theme (Evers 2020; Fraune 2018; Mohr et al. 2020; Sesele 2020). Whether in terms of policy development, national or local government, or community consultation processes, women in the Global North and South are underrepresented in a wide range of decision–making spaces, from local–level committees to the highest levels of national government and industry. Thus, their voices, needs, and interests are not heard, understood, or incorporated in the policies that affect their lives.

In terms of the mining industry, this is cited as a key obstacle to gender-sensitive development and planning. While host communities can feel disempowered in consultations with mining companies (Browne et al. 2011), women may feel constrained, particularly in contexts where they may have lower status and greater economic dependence on men (Evers 2020). This highlights the ongoing barriers, complexity and contingency of women's participation in negotiations with mining companies with implications for gender-sensitive closure planning, as well as the need for an intersectional understanding of the gender impacts of closure.

Lack of Closure Planning Skills,

Knowledge, and Capacity

Despite increasing awareness of social impacts and commitments to adopt international closure standards and protections, there is an industry-wide social performance “capability gap”, which diminishes the ability of mining companies to identify, analyze, and manage complex problems and processes – a deficit that becomes “acute in closure processes” (Owen and Kemp 2018: 4). This deficiency in understanding, addressing, and managing the impacts of closure is also shared by governments that struggle to compete with industry when it comes to employing people with an appropriate level of expertise to assess closure plans (McCullough 2016: 333).

In terms of accountability, Owen and Kemp (2018: 13) note that closure plans are often outsourced to specialists who may not have any detailed or first-hand knowledge of either the mining operations or impacted communities. Use of consultants is important

Case Study 7.

Understanding gendered barriers to participation: Intersectionality matters Case Study 7. Understanding gendered barriers to participation: Intersectionality matters

A comparative analysis of mining company and community agreements reveals that women's participation in both informal and formal agreement processes was lower in contexts where there was a “highly patriarchal gender dynamic” (Keenan et al. 2016: 611). Further, the general trend of female exclusion was not necessarily assisted by holding separate consultation processes for women and men. There were intersectional factors that exacerbated exclusion in some contexts, with young and middle-aged women who had not acquired the status of “elder” and women who had migrated or married into the community and were considered outsiders, along with widows and single mothers, all experiencing further barriers to participation. Structural barriers to participation were also noted, with women who had “personal economic independence” more likely to engage with agreement-making processes.

The culture and employee diversity of the mining company and negotiation teams was also found to be influential in the gender dynamics of agreement processes. Open, transparent, and participatory processes also assisted the inclusion of women. Much also depends on a company's approach to agreement-making, with more positive outcomes associated with companies that saw agreements as long-term relationship-building mechanisms. According to Keenan et al. (2016: 612), women's exclusion from agreement processes did not necessarily mean that their views and needs were not influential or considered, but it was noted that men tended to advocate for women's practical, rather than strategic, needs.

Source: Keenan et al. (2016)

where mining companies have knowledge and technical deficits, but these capacities need to be built internally and have gender-sensitizing strategies, such as internal gender audits to assist with embedding gender-sensitive planning. The need for “iterative” participative closure planning throughout the life of mine points to a related need for internal staff with these skills, capacities, and long-term relationships with affected communities.



Section C: Gender Analysis and Impact Assessment for Mine Closure

While assessment of the social impacts of mining is commonly undertaken prior to project commencement as a requirement of approval, lack of explicit attention to gender may limit understanding of differentiated impacts by treating the “community” as a homogenous unit.

Communities are made up of different women and men with different roles, rights, needs, and interests that are shaped by factors such as age, sexuality, marital and socioeconomic status, race, ethnicity or caste, and ability.

The value of undertaking gender impact assessment (GIA) and gender analysis (GA) is in their explicit focus on gender roles and relations and their ability to capture the complete extent of impacts on all members of a community, as well as ensuring that the needs, interests, and views of vulnerable or marginalized women and men are identified and understood. Gender-blind policies and programs can heighten gender inequality. Incorporating a GA framework into policy development, monitoring, and evaluation processes is therefore a critical step for gender-transformative approaches (Hillenbrand et al. 2015).

GA is a key preliminary step in GIA and enables the collection of important baseline data on gender roles and relations which can then be used to inform a more detailed, in-depth GIA process.

According to a guide to undertaking GIA for the extractive industries (Hill et al. 2017a: 3), a GIA should:

- be conducted at an early stage, ideally before project commencement;
- involve women as active participants;
- identify and prioritize the needs, interests, experiences, and perspectives of local women;
- identify the likely impacts of the project cycle – including closure – on different men, women, boys, and girls, and their roles and relationships; and
- identify positive impacts that mining companies can have on women and men in mine-affected communities.

Preliminary Considerations

The choice of framework and the way in which a GIA and/or GA are conducted (community consultation and participation strategies, inclusion of critical steps and processes, data collection methods, etc.) and by whom are important considerations. The right framework, people, and processes are needed to deliver a GIA that is credible, transparent, participative, and non-discriminatory, and yields robust, reliable, and insightful data to inform a wide range of policies and programs. Numerous GA and GIA frameworks have evolved over the years, all with different strengths, limitations, and scope. Recent iterations of these frameworks have expanded to include considerations of human rights and the importance of intersectionality when considering and analyzing gender roles and relations.

Undertaking a GIA requires careful and sensitive management and implementation to ensure the full and active participation of all people in a community. This requires an experienced, trusted, and independent professional who can work collaboratively with contracting staff and community members (Hill et al. 2017a). Practical provisions for an inclusive, participatory, and non-discriminatory approach to GIA include:

- Gender-balanced project teams of trained male and female facilitators.
- Simple, clear, and accessible written materials in a range of appropriate languages.
- Data collection and presentation methods that allow for a wide range of literacy levels.
- Non-technical and accessible data collection methods to encourage the sharing of diverse knowledges, perspectives, and world views.
- Identify and address barriers to the participation of particular groups (e.g., childcare for women, mobility/access needs of aged and persons with disabilities).
- Meetings at appropriate time and locations to maximize attendance and participation.
- Careful handling of culturally sensitive issues such as the participation of women in public forums or privacy concerns around the discussion of household matters.

Guiding Principles

A GIA should be approached as a tool with “transformative potential” that can address unequal power relations between companies and communities, and within communities (Hill et al. 2017b: 6). It should also be viewed as an opportunity for companies (and/or governments) to gain an in-depth understanding about affected communities and the same for affected communities about the project cycle and its impacts. A GIA should be guided by the following principles:

- **Participation:** Participatory research processes engage all women and men within a community through an active, inclusive, non-discriminatory process of reflection, analysis, and learning. Equal opportunities should be given to each person to participate using accessible qualitative research methods such as interviews, life stories, and focus group discussions. Holding separate and combined, large and small forums for different groups of women and men allows them to speak freely and build mutual understanding.
- **Intersectionality:** This proposes that people’s identities and lived experiences – including discrimination and inequality – are shaped by a range of intersecting social categories including gender, race, ethnicity, age, class, caste, sexuality, and ability. In practical terms this means ensuring that everyone from different ages, cultural, and socioeconomic backgrounds, and those with disabilities and diverse gender identities, are actively engaged, included, and given a voice in the GIA process. An intersectional approach



also captures the diverse knowledge systems, world views, and theories of different women and men.

- **Transparency:** A transparent approach to GIA involves full disclosure of the aims and objectives of a GIA, the processes and steps involved, and making the outcomes accessible to all participants for feedback. A GIA for mine closure must include information about predicted closure dates and likely closure impacts, including the risks and impacts of sudden closure.

Intersectional Approaches to Gender

Analysis and Gender Impact Assessment

Intersectionality proposes that no single social category or variable can explain people's unique situations or their lived experience. Gender categories are not the sole determinant of a person's subject position and can obscure the importance of other social categories (such as race, ethnicity, age, class, caste, sexuality, and ability) that shape a person's everyday lives, including their experience of discrimination, marginalization, and oppression (Colfer et al. 2018; GADN 2017; Hankivsky et al 2014).

The gendered impacts of hydropower projects hold numerous insights into those of mine closure. Further, they highlight that transitioning to renewable sources of energy has the potential to increase gender inequality if these impacts are ignored in the planning process. Like mining, hydropower projects have a large environmental footprint and attendant impacts, including:

- loss of agricultural and residential land to inundation;
- loss and permanent altering of waterways; and
- relocation and resettlement of entire communities.

While conducting a GIA into the gendered impacts of hydropower projects in Laos and Vietnam, Hill et al. (2017b) deduce that loss of agricultural land and changed access to water resources had significant impacts not just on the livelihood activities of both women and men, but the diversity of livelihood activities and options. In turn, these livelihood changes impacted the economic security of both genders and resulted in changed gender roles and status within the family and community. These gendered impacts included:

- Loss of access to agricultural land along river beds that was traditionally a significant economic activity of women, diminishing their independent economic contribution to the household, status within the community, and household food security.
- Loss of access to agricultural land for men, who were forced to take up insecure wage labour work as their sole source of income.
- Increased access to formal work opportunities within the hydropower plant for men, but not women.
- Compensation payments made to male heads of households often did not benefit other household members.
- Lack of diverse economic and livelihood opportunities in re-settled areas for both women and men.
- Lack of consultation with women over the design of resettlement housing, leading to defective, unsafe, and unsanitary housing.

While the gendered impacts of resettlement resulted in greater levels of economic vulnerability for men, they were particularly negative for women. Loss of agricultural land and lack of livelihood options increased women's economic dependence on men. Household conflict and domestic violence escalated with the rise in insecurity in men's work. Poor quality housing led to health problems, increasing women's burden of care within the household. Overall, these impacts increased stress and conflict within households and diminished the economic and cultural status of women.

Source: Hill et al. (2017b).

Intersectional approaches to GA can thus capture social complexities and hidden sources of marginalization by identifying the interaction of multiple social categories or identities. It is concerned with power, in particular who has the power to define and reinforce social constructions of gender, race, and class. These constructions are the basis of inequality, which limits people's access to a range of resources, but are also fluid. Intersectional analysis is therefore not just concerned with identifying marginalized people, but also with understanding the institutions and processes through which power and inequality are produced, reproduced, and can be resisted.

Undertaking Gender Analysis

for Mine Closure

GA is undertaken to form a baseline picture of gender roles and relations in any community or population. It is a critical preliminary data-gathering step in GIA. The data gathered should allow researchers and policymakers to gain detailed insights into how various factors (cultural, institutional, structural, and local contextual) influence gender roles, relations, and inequality, as well as other social categories, and to identify which persons are most socially, economically, and politically disadvantaged or marginalized. Both the process of undertaking GA and the resulting data can assist researchers and communities in designing policies, programs, and interventions that do not exacerbate or entrench existing gender inequality and other forms of social and economic exclusion or disadvantage. It can also assist in gaining a greater understanding of the likely impacts on different women and men of any project, policy, or program.

Key components of Gender Analysis

GA examines the different roles, responsibilities, assets, resources, benefits, rights, decision-making capacities of women and men, as well as enabling and constraining institutional factors in order to better understand the causes and consequences of gender differences and inequality. GA frameworks can be tailored to gather a range of relevant data. Most frameworks incorporate the following key steps and areas of inquiry:

Household division of labour: A household division of labour and time-use tool provides data on productive, reproductive, and community/political activities, and the time needed for these diverse activities and responsibilities.

Access and control profile: This records who has access to and control over which resources and assets both at household and community levels. The purpose is to understand which women and men have rights to own, use, access, and control certain assets and resources and who benefits.

Practical needs and strategic interests: A needs and interests assessment asks what it is that different women and men need in a practical, immediate sense to improve their lives and what their longer-term strategic interests might be.

Power, rules, participation, and decision-making: Examining who has the power to make rules and decisions at both household and community levels can reveal a great deal about gendered power relations.

Values and norms: This step examines cultural and social norms, ideologies, beliefs, and perceptions, and asks how values are defined and by whom.

Institutional constraints and opportunities: This step examines the influence and impact of institutions, laws, and policies on the lives of different people.

Sources: WHO (2020); JHPIEGO (2020); and Hill et al. (2017a).

An intersectional approach to GA expands the scope of inquiry to consider the ways diverse “social stratifiers” and identities interact and co-constitute a person’s lived experience (Hankivsky et al. 2014; WHO 2020). It looks beyond “male” and “female” as defining categories to consider the experience of non-binary individuals as well as the interaction of social categories such as age, ability, ethnicity, class, caste, and socioeconomic and marital status, which may play constraining



or enabling influences on people's lives. Intersectional GA must therefore capture the diverse social categories that people in each community identify with, how those categories are perceived by others and the different ways that individuals experience advantage, disadvantage or marginalization according to their unique social identity (Colfer et al. 2018: 26).

Gender as an Entry Point

Although intersectionality emphasizes the importance of moving beyond binary gender categories as defining units of analysis, gender remains a critical entry point for analysis. This is because gender remains one of the most pervasive forms of inequality globally. Understanding how gender affects people with non-binary identities is equally important as understanding how it interacts with other social stratifiers to create different experiences of marginalization and disadvantage (WHO 2020:18).

Multilevel Analysis

This is a cornerstone of intersectional analysis and involves understanding the effects between and across various levels in society by examining the influence and interrelationship of macro-level (global and national) institutions and policies, meso-level (provincial or regional) institutions and policies, and micro-level factors (local/community/grassroots organizations, institutions, household, and individual) on processes of inequity (Hankivsky et al. 2014: 35).

Reflexivity and Diverse Knowledges

These two intersectionality principles must be embedded within the GA research process. This requires researchers to consider how their own subject position may influence research design, process, and outcomes, and to privilege the diverse knowledges, views, and voices of participants in the research process and outcomes (GADN 2017).

Time, Space, and Context

Intersectional research is locally grounded, context-specific, and acknowledges the dynamic nature of social and gender relations and social categories, which can change over time due to a range of factors and forces (Hankivsky et al. 2014: 35).

Transformation, Collaboration, and

Building Coalitions

Although intersectional approaches seek to understand and reveal how various individuals and groups may experience inequity and marginalization and the institutions, norms, and narratives that sustain marginalization, they are also focused on achieving social change through building common ground and coalitions between diverse actors and stakeholders. This recognizes that the structural inequalities that produce gender and social inequalities cannot be resolved by the most marginalized people alone but must be addressed through the collaborative effort of a range of actors, including development agencies, governments, and society (Colfer et al. 2018: 31).

Reframing mine closure impacts as “shocks”

Mine closure, particularly unplanned or abrupt, is a form of economic shock. An alternative approach to identifying closure impacts is one that asks workers to consider what “shocks” a mining project may cause and how different women and men cope with these shocks:

- What shocks will mine closure cause?
- Who will be most affected by this shock?
- How are they affected?
- How do different women/men respond when they experience shocks?
- What are the impacts of these different experiences on gender relations?
- How can these shocks be avoided or mitigated?
- How can women/men be best supported?

This approach can lead to consideration and discussion about related questions of:

- Sustainable livelihoods. (What is needed for women and men to have sustainable livelihoods that can help them to withstand the shock of mine closure?)
- Vulnerability. (Who and what is vulnerable following mine closure and what can be done to reduce this vulnerability?)
- Institutional support. (What forms of institutional and social welfare support can assist women and men in impacted communities?)
- Resilience. (What can be done to enhance the resilience of different women, men, and communities to cope with the impacts of mine closure?)
- Resistance. (What can women and men do to challenge this situation?)

Sources: Hill et al. (2017a: 18); GADN (2017).

Intersectional Gender Analysis

Framework for Mine Closure

The following intersectional gender analysis framework incorporates four interrelated domains of gender power relations: distribution of labour and roles; access to assets and resources; norms and values; and institutions, rules, and decision-making power. Power is an overarching dimension that is embedded in all these domains, which reinforce and influence each other through a range of practices, institutions, and discourses. Power can also be negotiated and changed to address inequity, which is a key goal of intersectional approaches to policy and gender research (JHPIEGO 2020; WHO 2020).



Power pervades all domains: It informs who has, can acquire, and can expend the authority to acquire and expend assets. It affects decisions over one's body and children. It determines if an individual can take advantage of opportunities, exercise rights, move about, and associate with others, enter into legal contracts, and run for and hold office. Power also determines the way women and men are treated by different types of institutions, policies, and laws, which forms an important part of what it means to be socially marginalized and disempowered (JHPIEGO 2020).

Gendered division of labour, roles, and time-use analysis	Access to and control over assets and resources	Norms and values, beliefs, and perceptions	Institutions, laws, and policies	Methodology and multilevel analysis
Who does what, when, and where? Analysis of productive and reproductive roles, responsibilities, activities, and time use of women, men, girls and boys across diverse social categories (marital status, age, ability, socioeconomic status, ethnicity, caste, gender identity etc.), including: • Productive and reproductive household-based activities. • Livelihood activities within and outside the home. • Roles, responsibilities, and participation in the broader community. • Membership of community, social, and political groups. • Public leadership and decision-making roles.	Who has what and control over what? Establish a comprehensive access and control profile capturing the diverse gender and social identities within households and the wider community, including: Tangible assets: • Income. • Land. • Natural resources. • Savings/capital. • Tools/equipment. Intangible assets: • Knowledge. • Education. • Information. • Social, professional, and political networks.	How are values, beliefs, and perceptions defined? Collect, analyze, and discuss data in relation to influential cultural beliefs, norms, stereotypes, popular narratives, and discourses about gender roles and relations as well as other key relevant social categories and variables (age, ability, sexuality, ethnicity, caste, class, etc.), including: • Religious beliefs. • Cultural and customary norms and roles. • Popular culture. • Mainstream media narratives.	Who and what determines people's rights, responsibilities, advantages, and disadvantages? Collect, analyze, and discuss data in relation to women's and men's formal and informal rights and the existence and impacts of policies and institutions affecting gender roles and power relations and other forms of social, economic, and political inequality, discrimination, and marginalization, including: • Laws and institutions governing the right to own and inherit land and other assets. • Equal opportunity and anti-discrimination laws. • Gender diverse/inclusive workplace quotas and policies, political participation, and representation.	Methods: participatory action research (PAR), interviews, life stories, focus groups, and ethnographic and desk-based socioeconomic background research. Micro level (household) Gendered division of labour and time-use tool, and access and control profile. Meso level (local/ regional) Analysis of gendered and intersectional patterns of participation, leadership, and decision-making in public life, local/regional community groups, social and political organizations, or other decision-making bodies. Macro level (national) Analysis of relevant laws, policies, rules, discourses, and institutions that influence gender roles and relations, social inequality, and either constrain or enable the rights and lives of diverse women and men.

What are the interrelationships between these different domains? How is the gendered division of labour influenced by prevailing norms or laws and policies? How is access to resources influenced by gendered patterns of time use or cultural beliefs? How is access to assets related to gendered decision-making? Do popular narratives influence how women's and men's roles are valued? Are macro-level institutions influential at the meso or micro levels? What influence do local contextual factors have on these domains? Have these domains changed over time? How and why?

How is power negotiated and changed in this context/community?

Intersectionality-Informed Gender Analysis: Guiding questions

Reflexivity:

- What knowledges, values, and experiences do each member of the research/policy team bring to this analysis?
 - What is the policy “problem” under consideration? Who defines this problem?
 - What assumptions/beliefs underlie views about the problem and which group/s are or will be most affected?
 - How are different groups affected by this view of the problem? Who is considered most and least impacted?
 - How have governments or other actors responded to the problem? Has this response addressed, maintained, or created inequities between different groups?
-

Intersecting categories:

- What forms of identity are prevalent/important within this community/region (e.g., gender, race, ethnicity, religion, sexual orientation and gender identity, age, caste, ability)?
 - What differences between women, men, and non-binary people should be considered?
 - Are there differences between different subgroups of women, men, and/or non-binary people?
 - What are the practical needs and strategic interests of these diverse individuals and subgroups of women, men, and non-binary people?
 - Which gender-relation domains are most relevant for the issue or problem under investigation? How do these domains interact, reinforce, and influence each other?
 - How might each domain affect the overall outcomes of research or any planned interventions?
-

Diverse knowledges:

- Which knowledges are privileged in defining gender roles and relations and other social categories of exclusion and inclusion?
 - Which knowledges are privileged in defining the problem, the impacted people, and possible solutions?
 - Have the perspectives, knowledges, experiences of marginalized people been incorporated into the analysis and the design of possible interventions or solutions?
-

Social justice, equity, collaboration, and transformational change:

- How is power negotiated and changed in this context/community (personal/collective action and structural/environmental change)?
 - What inequities exist in each gender domain? Which social categories and institutions influence inequity in each domain?
 - What approaches can be used to promote discussion, dialogue, and understanding of these inequities across differently affected groups?
 - What interventions/policies/actions can help address or reduce these inequities?
 - At what level or combination of levels (macro/meso/micro) can interventions be made?
 - What are the knowledge gaps about the problem across the diverse population groups? How can these knowledge gaps be addressed?
 - Who will be part of the proposed intervention? Will affected individuals and communities be meaningfully engaged and supported to provide input and involvement in terms of design, implementation, and the evaluation of outcomes?
 - How will the proposed intervention/s encourage dialogue, partnerships, and coalition-building across and between different groups, interests, and stakeholders?
-

Sources: Hankivsky et al. (2014); WHO (2020); JHPIEGO (2020); Colfer et al. (2018); and GADN (2017).



Undertaking GIA for Mine Closure:

Guiding Questions

Best-practice guides to mine closure emphasize that closure and transition planning should commence before project approval and be embedded as an iterative process throughout the project cycle, as well as throughout community economic development and social investment programs.

Deficiencies in closure planning partly stem from a disproportionate focus on the part of companies, governments, and communities with the initial impacts at project commencement, rather than other impacts generated at other stages of the project cycle, particularly closure.

A GIA for closure should ask and seek to answer the following questions:

- What institutional factors can influence/mitigate mine closure impacts? What are the strengths and weaknesses of these institutions?
- Which women and men are the most vulnerable to the impacts of closure? What measures can be taken to minimize adverse impacts?
- What are the likely impacts of closure on gender roles and relations? Which women and men will be impacted and how? What measures can be taken to minimize adverse impacts?
- What are the likely impacts on land-based livelihoods and subsistence activities following closure? Who will be impacted and how? What measures can be taken to minimize adverse impacts?
- What are the likely direct and indirect employment impacts of mine closure? Who will be impacted and how? What measures can be taken to minimize adverse impacts?
- How viable or sustainable are alternative livelihoods, economic diversification, and investment initiatives in the context of mine closure and broader coal sector decline?
- How transferable are the skills and experience of labour market and training initiatives?
- What is the likely level and impact of outmigration following closure? Who will go and who will stay? What measures can be taken to minimize adverse impacts?
- What government services are vulnerable in the context of mine closure and coal sector decline? Who will be impacted by the decline in service provision and how? What measures can be taken to minimize adverse impacts?
- What commercial goods and services are vulnerable in the context of mine closure and coal sector decline? Who will be impacted and how? What measures can be taken to minimize adverse impacts?
- What local infrastructure is vulnerable in the context of mine closure in terms of ownership, maintenance, and service? Who will be impacted and how? What measures can be taken to minimize adverse impacts?

A GIA Framework for Mine Closure

The following GIA framework for mine closure draws on a recent guide to undertaking GIA for the extractive industries (Hill et al. 2017a), as well as the Intersectionality-based Policy Analysis (IBPA) framework (Hankivsky 2012). These frameworks have been modified to allow for specific consideration and data collection on the gendered impacts of mine closure

based on current available evidence. While consideration of these known impacts is important, it is vital that different women and men contribute their own insights and observations of likely closure impacts and that these local perspectives are incorporated into the analysis in a generative way. This allows for a richer contextual understanding of gendered impacts in affected communities.

Step 1: Collect baseline data about women and men in the affected community

Key steps:

- Collect data on institutions that influence/mitigate mine closure impacts. Assess strengths, weaknesses, and effectiveness of these institutions, including relevant mine closure policies, laws, guidelines, closure funds, programs and agreements, relevant government departments, community groups and NGOs.
- Collect data on the socioeconomic conditions of the community with a focus on the level of economic vulnerability and dependence on mining.
- Collect data on the socioeconomic profile of different households within the community (i.e., income, education, poverty levels), noting those households that are economically dependent on mining.
- Collect data on the ownership, management, maintenance, availability, use and access to community-based infrastructure and social services (i.e., water, waste, sanitation, health, and education services).
- Disaggregate all data by a range of intersectionality factors (gender, age, ethnicity, caste, indigeneity, disability, and other relevant forms of identity).
- Undertake GA to understand the gendered division of labour within households and the community and who has access to and control of different resources and benefits (single male- or female-headed households should be included and the relevant contribution of boys and girls).

Key outputs/outcomes:

- Profile of enabling/constraining institutional factors influencing mine closure impacts.
- Baseline socioeconomic profile of the impacted community.
- Profile of household and community economic dependency/vulnerability to mine closure.
- Comprehensive GA data and profiles, including gender division of labour profile, access and control profile, assessment of needs and interests, power and decision-making, and institutional constraints and opportunities.



Step 2: Distribute, discuss, and analyze the information collected with women and men

Key steps:

- Hold meetings with different groups of women and men (separately and together) to discuss and analyze the data and research findings.
- Incorporate feedback/insights from community forums into baseline profile.
- Identify women and men impacted by mine closure, and how and why.
- Identify ways to mitigate and minimize the negative impacts of closure on different women and men

Key outputs/outcomes:

- Building an understanding of and insights into gender roles and relations.
- Analysis of institutions that contribute to gender inequality and those that support gender equality.
- Identifying structural or institutional factors that increase women's and men's vulnerability to mine closure impacts.
- Identification of strategies to positively influence relevant institutions.
- Identification of strategies to increase the participation of marginalized women and men in decision-making processes and forums.
- Identify the gendered impacts of mine closure.
- Develop closure plan/identify strategies to mitigate the negative impacts of closure on different women and men.

Step 3: Plan and agree to actions to minimize and mitigate the impacts of closure

In this final stage the data are used to inform the design of “gender-responsive engagement, decision-making and planning” for closure (Hill et al. 2017b: 19).

This includes ensuring that all planning activities during the project cycle are inclusive and maximize the participation of women and men.

The data gathered and strategies identified during the GIA can then be used to develop a range of gender-responsive plans and initiatives including those related to closure, such as:

- Participative, iterative community-driven mine closure plans.
- Mine closure compensation and severance agreements.
- Sustainable community development and livelihood programs.
- Sustainable economic diversity and employment plans.
- Sustainable, transferable skills training programs.
- Transfer of social and community assets and infrastructure at closure.
- Environmental management plans.

Step 4: Continuously review and undertake ongoing engagement with different women and men in the community to mitigate/monitor closure impacts

This step involves agreeing on a schedule to regularly monitor, evaluate, learn, improve, and report on the implementation of all community engagement, investment, and planning activities, including updating community mine closure plans.

This step is particularly critical given that closure timelines can change and divestment can substantially alter the commitments given by previous owners to various closure initiatives. Early, participative, gender-responsive closure planning should empower community members to advocate for their needs and interests following divestment by informing them about their rights, likely impacts, and mitigation options.

Formal evaluations should be conducted by external experts with experience in GIA and gender-sensitive monitoring and evaluation. Review processes must be participatory with special consideration to secure the inclusion of marginalized and vulnerable women and men.

Section D: Gender in Energy Transition – Lessons and Tools for Policy and Planning

Introduction

Several studies have confirmed that there is no “one-size-fits-all” approach to energy transition and a wide range of factors are impacting the degree of planning and preparedness for energy transition in different jurisdictions

(Gambhir et al. 2018; ILO 2018; Sartor 2018; UNRISD 2018). Some countries and regions exhibit a high degree of forward planning while others are experiencing the impacts of shock or unplanned transition. The diverse countries and contexts undergoing energy transitions make the design of energy transition policies complex. Past evidence of coal sector decline suggests that the successful governance of energy transitions requires a range of factors, including multiagency and stakeholder collaboration and coordination and participative policy planning. While national governments may appear to be the best equipped to coordinate complex policy problems, it is critical that this capacity – and resourcing – is matched at lower implementing levels of government and that local contextual factors are embedded in both the policy response and implementation strategies (Aung and Strambo 2020; Sartor 2018; Strambo et al. 2019).

Optimally, this suggests that a multilevel policy process is required in which the resources and expertise of national agencies are effectively utilized, but implementation is decentralized, and policy is closely tailored to local needs (Gambhir et al. 2018; Sartor 2018). In terms of a Just Transition policy framework, Sartor (2018: 32) recommends a combination of “bottom-up knowledge with targeted top-down financial or regulatory support.” This must however be combined with participative governance structures to avoid the pitfalls of poorly designed or implemented policies that either do not reflect local needs and conditions or are beyond the capacity of regional or local government agencies, as the mine closure literature attests (Mohr et al. 2020; Sesele 2020; Sesele et al. forthcoming).

If there are lessons to be drawn from the literature that documents the sometimes severe social and gendered impacts of mine closure, it is that long-term participative planning, substantial state-based investment, and a strong, coordinated policy response is required to manage the decline of the coal sector and transition communities into new, sustainable livelihoods. Thus far, few examples exist of governments successfully achieving this, but most are found in the Global North, in particular, northern Europe (Gambhir et al. 2018; ILO 2018; Sartor 2018; World Bank 2020). Comparative analysis points to political economy, rather than policy factors, having the greatest bearing on how “just” energy transitions can be (Wiseman et al. 2017). The political factors and barriers to long-term planning and policy implementation, such as short political terms, political instability, and lack of bi-partisan, technical, and financial support, are all identified in the literature on gender mainstreaming in the energy sector (Clancy and Mohlakoana 2020).



Current research suggests that as per the extractive and energy sectors as a whole, attention to the gendered dimensions of energy transitions remains largely absent or an afterthought of such planning, despite the substantial evidence that de-industrialization, economic shocks, and mining sector decline have significant gender-based impacts (Aragón et al. 2018; Aung and Strambo 2020; Bennett 2015; Browne et al. 2011; McDonald et al. 2012; Pini et al. 2010; Sesele 2020; Strambo et al. 2019; UNAIDS 2012).

Gendered Impacts of Energy Transition

Several recent studies have found that the impacts of energy transitions are clearly gendered, but this remains an under-researched area (Braunger et al. 2020; Fraune 2018; Lieu et al. 2020). Attention to the social or human impacts of energy transitions is the primary concern of the Just Transition movement; however, Braunger et al. (2020) find that energy transition policies exhibit the same tendencies of the energy sector more broadly in which “masculinity” is the unquestioned norm. This “constitutive power” allows the norm to be embedded within institutions that allocate and distribute resources and in turn creates a form of “path dependency” wherein the gender order is unquestioningly reproduced. Thus, they conclude: “If gender is not recognized in energy transition policies, they are not gender neutral, but overlook and thereby reproduce inherent power dynamics” (2020: 10–11).

According to Fraune (2018: 71), due to the adoption of the free market and anti-discrimination laws, there is an assumption that in most industrial countries energy policy will be gender neutral. On closer examination this appears not to be the case and in fact this assumption has led to gender norms being further entrenched. The issues that have received the most attention in the gender-energy literature are those typically framed as “women’s issues” and are largely concerned with consumption and efficiency, such as access to alternate cooking fuels and appliances in developing countries. Until recently, research on gender and energy has been largely “siloe” from Just Transition research, which has been concerned with broader questions of justice and power (Braunger et al. 2020). Fraune (2018: 72) argues that feminist political-economy approaches are an important analytical tool for revealing “how gender regimes and energy transformation are intertwined.” In this way, energy systems can be seen as “social institutions” that reveal how resources and power are distributed within a society.

The following sections present evidence that structural and institutional barriers in terms of women’s labour force participation, participation in decision-making spaces, and energy ownership schemes continue to hamper a gender-just energy transition.

Labour Market

While there is evidence of an increase in women's work participation in the renewable energy sector as compared with the traditional energy sector, the trends (and the underlying causes) overall are similar for both sectors: women are overrepresented in lower paid positions in areas such as administration, communications, and HR, and are underrepresented in management, technical, and executive positions (Fraune 2018: 66; IRENA 2019). In large part, this reflects the low rates of participation and retention of women in STEM fields, barriers to full-time employment due to caring responsibilities and the double burden of unpaid domestic work, as well as the “masculine” culture of the energy sector (IRENA 2019). Thus, it remains an open question as to whether renewable energy will expand or generate new work opportunities for women on current trends. Evidence to date suggests that rather than generating new occupations; existing occupations are complemented by undertaking renewable energy-specific training (Fraune 2018: 66).

Removal of these barriers requires systemic change to a range of institutions and economic systems that impact female labour market participation and gender segregation in the workplace, such as social welfare regimes, paid parental leave and flexible and gender equity workplace policies. For instance, retention in STEM fields has been found to be overwhelmingly due to sociocultural factors and workplace culture. In industrialized countries that have achieved gender equality and eliminated gender differences in mathematics achievement, women's retention in STEM careers is still very low. Thus, it appears that without direct

intervention to support workplace gender diversity, gender segregation in the renewable energy sector may increase (Fraune 2018: 67; IRENA 2019).

Energy Asset Ownership

In the EU, Fraune (2018: 67) finds that women are also underrepresented in citizenship associations that operate renewable energy plants. A pilot study in Germany found that on average women own 22% while men own 75% of citizen energy associations, indicating a gender wealth gap; the rest was owned by communities or private firms. Thus, citizen-owned renewable energy schemes and associations can reflect persistent underlying structural gender-based inequality, even in well-developed countries of the Global North. The ILO estimates that it will take another 70 years to close the gender pay gap under a business-as-usual scenario (2017: 1), suggesting a continued exclusion of women from the benefits of energy transitions.

Political Participation and

Decision-Making

To date, much of the focus on gender and energy transition has concerned household energy use (largely driven by SDG 7) and the nexus between gender and energy poverty, since other areas of energy policy have tended to be gender neutral and have lacked an explicit, broader focus on gender roles and equality (Fraune 2018; UNSW IGD 2020). As with their participation in the extractive and energy sectors, women continue to be underrepresented in decision-making and policy forums at all levels of government.



For example, Fraune (2018: 71) notes that in Germany federal energy transformation policies are implemented at the district and/or local government levels that have lower female representation than at the federal level. This lack of representation extends to women's participation in stakeholder and other grassroots organizations within communities. Thus, gender perspectives are lacking amongst policymakers as well as in community consultation processes designed to ensure stakeholder input in energy policymaking and implementation. This pattern of women's low-levels of participation in decision-making spaces is noted throughout the literature on the gendered impacts of mine closure and energy transitions. In the case of Columbia, Mohr et al. (2020) cite this as an ongoing barrier to the development of a gender-aware coal transition and climate change policy.

Engendering Energy Transition Policy

With the acceleration of energy transition over the past two decades, there has been increased scholarly attention to the “gender-energy nexus” (ENERGIA 2019; Feenstra 2002; Kooijman-van Dijk 2020). The Just Transition debate has begun generating interest in the gendered impacts of energy transitions in terms of production, employment, energy ownership, and governance (Braunger et al. 2020; Feenstra and Özerol 2021; Fraune 2018; Lieu et al. 2020). During this same period, with the 20th anniversary of the Beijing Platform for Action, critical reflections on the shortcomings of gender mainstreaming as a strategy for achieving gender equality have led many feminists and gender and development experts to argue that policy intentions have too often fallen short in terms of implementation and that there is a need for a renewed focus on human rights, social justice, and the relational, political, and structural nature of gender

inequality (Cornwall and Rivas 2015; Kabeer 2015; Parpart 2014). Taken together with the evidence of the gendered impacts of mine closure, it confirms the existence of persistent and emerging structural and institutional constraints to both gender mainstreaming and gender equality in the extractive and energy sectors.

The emerging literature on the gendered impacts of energy transitions shows that women remain largely excluded from the benefits of energy transitions due to underlying structural factors which limit their participation at all levels. Given this and the broad socioeconomic implications of energy transition, policymakers need to look beyond energy policy and expand the perception of energy and gender beyond household energy consumption (Feenstra and Özerol 2021: 2), which stereotypes women as passive consumers and men as active producers of energy (Lieu et al. 2020). The need of the hour is for a broader examination of women and men's different engagements with and within the energy sector for a gender-responsive Just Transition policy framework. Braunger et al. (2020: 5) argue that for a Just Transition to occur, “questions of power, distribution and participation within gendered energy regimes must be raised.” According to Fraune (2018: 64), it is critical that the energy transition that is taking place in most countries across the world presently is understood as not just a technical challenge in terms of the supply of energy, but as a transformation that will affect the “modes of production and living in society.” Gender analysis of energy transitions can thus provide further insight into the gendered distribution of power and resources. It is therefore critical that the political and institutional context of energy transition is analyzed, rather than viewing energy transition as a purely technical process, i.e., political and institutional conditions need to be favorable to achieve a Just Transition.

Institutional Constraints:

Recent Interventions and

Policy-focused Research

Energy transition from old to new technologies and resources has a wide range of distributional impacts and thus requires a multifaceted policy response across a number of key areas, including energy use and production, mine closure planning and regulation, environmental rehabilitation and management, land use change, infrastructure development and maintenance, structural economic decline and revitalization, labour market planning, skills, training and education, relocation assistance and demographic planning, and business investment.

In order to mainstream gender through these relevant policy areas several “enabling” institutional conditions need to be met (Feenstra 2002). Current research on the gender-energy nexus confirms that standalone measures or simply increasing electricity supply or access are not sufficient to achieve gender equality or produce a gender-responsive energy transition policy. Governments therefore need to look well beyond the workings of specific sectors and toward a range of other critical policy areas that impact and “enable” gender equality.

Environmental and Institutional

Analysis: Baseline Assessment

and Audit Tools

A framework of enabling conditions for developing a gender-aware energy policy is presented in Table 10. This can be used as a starting point to assess conditions at both national and local levels that are conducive to the development of a gender-sensitive transition policy framework. This involves analysis of the institutional, political, and legal environments, as well as the capacity, resources, and level of coordination of relevant implementing government agencies.



Table 10

Enabling Environment for Engendering Energy Policy

Sources: Clancy and Mohlakoana (2020: 4) and Feenstra (2002: 107).

Dimension	Description
Participatory planning	Involving a range of actors (including civil society) is considered more likely to create a greater opportunity for women's voices to be heard than traditional approaches to policymaking.
Gender methodology	Involves having a gender strategy, collecting sex-disaggregated data, and conducting gender analyses to develop a gender-aware energy policy.
Legislation on gender equality	Form and scope: e.g., is gender equality enshrined in the constitution?
Political commitment	Putting pledges into practice: e.g., the existence of a National Gender Policy.
Institutional support	This can come from within government, e.g., a Ministry for Women's Affairs or a gender ministry, or from civil society (e.g., NGOs active in gender and energy).
Financial commitment	Allocation of sufficient resources to implement gender-aware policies.
Formulation process towards realizing a gender-aware energy policy	
Gender-disaggregated data	Sex-disaggregated data are available.
Gender-mainstreaming	Recognize that policy (particularly for energy) is gender blind. Does any ministry carry out gender budgeting? Does women's/ gender ministry provide support?
Participation	Women and men are involved in the policy formulation process.
Recognition of gender energy needs	A clear statement recognizing (a) women's role in energy provision and use, and (b) different practical, productive, and strategic energy needs of women and men.
Integrated energy planning	An attempt to integrate supply and demand sides via cross-ministry cooperation: e.g., energy and health, energy and education, and energy and small industry.

While an assessment of institutional constraints to gender equality is important for GA, undertaking a broad assessment of an enabling policy environment does not in itself guarantee that policy implementation will occur, particularly at lower levels of government. The lesson of much of the literature on the gendered impacts of mine closure and the limitations of gender mainstreaming is that a disconnect often exists in translating national policy frameworks into local action. In less developed countries and remote regions this disconnect is particularly evident (Mohr et al. 2020; Sesele 2020). Thus, analysis of lower tiers of government, local institutions, and barriers to implementation at all levels is also required to adequately assess both enabling and constraining factors.

Gender Audits

A gender audit is a systematic process of assessing the institutionalization of gender equality into organizations through an examination of their policies, programs, projects, services, structures, proceedings, and budgets (ILO 2012). Gender audits can be undertaken to assess internal and external policies, processes, and activities. A recent evaluation of ENERGIA's gender audit program by Clancy and Mohlakoana (2020) illuminates both its benefits and the persistent barriers to narrowing the gap between policy intention and implementation, notably, that of funding.

Over a six-year period (2005–11) ENERGIA conducted a series of external gender audits in 20 countries in Africa and Asia and training workshops in several partner countries. A key goal of the audit was to build the capacity of experts in gender and energy at the national level in order to embed gender approaches in energy planning and support gender mainstreaming in other policy areas and organizations. The audit teams comprised representatives from energy sector organizations (including NGOs), government departments, and academia. The gender audits were spread over several months and drew on an eight-step method (Table 11) developed in South Africa in response to limitations with gender mainstreaming in policy, which was linked to key steps in Feenstra's (2002) framework of enabling conditions.



Table 11

ENERGIA Gender Audit Methodology.

Source: Clancy and Mohlakoana (2020: 5).

Process	Outcome
Background review of national gender and energy enabling framework	Gender situational analysis: identification of gender organizations and government directives, mandates, policies, and legislation on gender. Inventory of energy production/supply by source, demand and consumption by sector, access and affordability; energy sector organizations including employment profiles; energy policy formulation and implementation processes.
Energy policy review	Gender awareness of energy policy based on quick-scan document analysis using keywords. Energy statistics, data, and indicators - extent of sex-disaggregation.
Gender budget analysis	Extent of budget allocation to energy programs which recognize the differentiated benefits for women and men.
Gender organizational assessment	Capacity assessment of the Ministry of Energy to mainstream gender and of gender institutions to support gender mainstreaming in the energy sector.
Key stakeholder analysis	Analyzing perceptions about gender and the national energy policy by key stakeholders in the energy sector. Identifying the types of support that key stakeholders could provide to support gender mainstreaming in energy policy.
Pre-validation: SWOT analysis	Identifying strengths, weaknesses, opportunities, and threats of gender mainstreaming in energy policy.
Gender and energy action plan (GAP)	Agreeing on goals, outcomes, indicators, outputs, activities, and responsibilities.
Validation and dissemination	Validation and dissemination, ownership and endorsement of the GAP by the Ministry of Energy and key stakeholders.

The evaluation of gender audits in three focus countries – Kenya, Senegal, and Botswana – found a range of direct and indirect benefits, but also identified limitations which made it only partially effective in integrating gender issues into energy policy. An important caveat is that unlike most gender audits, the ENERGIA research teams only undertook external audits of policies and programs.⁸ In terms of direct and indirect benefits, Clancy and Mohlakoana (2020: 5–6) note that the audit program helped to establish a group of national gender and energy experts who were able to “articulate the gender dimension of energy in the local context” and assist with mainstreaming gender in the energy sector in participating countries. Participation in the audits led to the development of baselines for project monitoring, the implementation of road maps (e.g., a GAP), and the identification of drivers of gender-mainstreaming processes. It also led to organizations adopting a gender approach in employment policy, project design, and implementation. Other key findings of the evaluation were:

- Adopting gender-aware policies occurred rapidly in organizations that participated in the audits.
- Male employees more readily accepted gender policies when they could see that policies also benefit men (“gender” does not mean “women”).
- Participants felt the approach was flexible and could be adapted to lower levels of government.

Despite these benefits, Clancy and Mohlakoana (2020: 6–7) also find that a significant time lag occurred between the audits and the adoption of gendered policies. They point to the persistence of a range of “pragmatic, conceptual and political barriers” to gender mainstreaming:

- **Pragmatic barriers:** Lack of gender-disaggregated data, resources, and funding – unfunded or underfunded policies and programs cannot be implemented or achieve their objectives.
- **Conceptual barriers:** Lack of an understanding of the concept of gender, limiting analysis of gender roles and relations to the household level, and viewing gender as an externally imposed concept in societies where sex-based difference is seen as the ultimate and widely accepted marker of difference.
- **Political barriers:** These are underpinned by conceptual barriers and other factors. A combination of weak or limited understandings of gender roles and the absence of women from policy spaces leads to gender-blind policies. Other factors include the political dimension of policymaking and distrust or lack of collaboration between government, civil society organizations, and other key stakeholders.

⁸ It is usually recommended that both internal and external gender audits take place. Internal audits are a means for an organization to evaluate how gender issues are addressed in internal policies, programs, and processes and can therefore increase awareness of gender perspectives, gender blindness, and gender bias among staff.

The authors conclude that although they can assist, gender audits alone cannot remove these barriers. Key recommendations from the evaluation include:

- External audits should be supplemented with internal gender audits to encourage greater internal “ownership” of external audit findings.
- GA should be conducted in order to sensitize key stakeholders to gender perspectives and broaden the conceptual understanding of gender roles and relations beyond the household and gendered patterns of energy use and access.
- Increase the participation of women in public policy roles and other decision-making spaces to reduce conceptual and political barriers.
- Increase the participation of different local men and women in the audit process.

In terms of pragmatic barriers, a critical finding of the evaluation was that there was no budget allocation for gender mainstreaming in the energy sector in any of the countries surveyed. Financial commitment is the greatest indicator of governments “moving beyond a statement of intent to providing the resources for implementation” (Clancy and Mohlakoana 2020: 5). Lastly, political will or commitment cannot be realized without political stability. Given the length of time needed to achieve policy change, political churn and instability can undermine the long-term, bipartisan commitment needed to achieve gender equality. These barriers to gender mainstreaming have been observed by many feminist researchers, including

those examining the gender-energy nexus. According to Parpart (2014: 383), an overt focus on policy and institutions can obscure the fact that policymaking is “a political process more suited to setting agendas than to operationalizing them and that policy implementation is deeply influenced by economic, political and cultural forces.”

Although formulated to mainstream gender in energy policy, the lessons of both the strengths and limitations of ENERGIA’s audit program remain valuable and relevant to the Just Transition policy discussion. In this emerging research and policy area it also underscores the benefits of undertaking comprehensive evaluation of gender mainstreaming strategies so that new approaches are developed and adopted.

At the opposite end of the spectrum from national policy audits, other recent interventions by donors and NGOs have focused on promoting the inclusion of marginalized women and men in a range of roles within the renewable energy sector, including supply chain industries. Enrolment of women in small business and entrepreneurial schemes as a way of development and empowerment, however, has been critiqued for ignoring persistent structural causes of inequality (Cornwall and Rivas 2015; Eerdewijk and Davids 2014; Kabeer 2015).

ENERGIA's Gender and Energy

Research Program (2014–19)

The DFID-funded Gender and Energy Research Program was carried out by nine teams with 26 partners in 12 countries in Africa and Asia over five years (2014–19).

The multidisciplinary research program investigated five cross-cutting areas of the energy–gender nexus with a view to accumulating “credible” data for policy formulation (Kooijman–van Dijk 2020). Research methods included combining GA with analysis of political and economic processes in order to understand the strategic energy needs of rural women (and men) who have experienced discrimination, marginalization, and exclusion in the development of energy infrastructure (ENERGIA 2019).

A significant finding of the research program was that transformation in gender roles and relations did not occur with changes to energy use per se but occurred when underlying conditions meant women were given opportunities to take up new roles in energy supply or in male-dominated fields (Kooijman–van Dijk 2020: 98). The synthesis report concludes:

The overall message of this research is that many insights into more effectively linking gender and energy are simply not being translated into action on the ground.

For this reason, in addition to the empirical research already mentioned, “dissemination–influence–change” programmes, coupled with capacity development of target stakeholders/influencers, are required to facilitate the uptake and utilisation of research recommendations. (ENERGIA 2019: 86)

These findings imply a need for a much broader approach to mainstreaming gender into energy policy than piecemeal sectoral initiatives or programs, and the involvement of a much greater constellation of actors as well as a need for significantly more locally grounded participative research that builds engagement with political processes and institutions.



Case Study 8.

Colombia: Barriers to a gender-responsive climate and energy transition policy

Almost 90% of Colombian coal is extracted in the northern regions of La Guajira and Cesar. These remote and predominantly poor indigenous communities experience “structural exclusion” in terms of low levels of representation in political and other decision-making bodies at the local, state, and national levels. While coal contributes a significant amount to the GDP of these regions, very little is invested in coal-affected communities by mining companies, and mining is estimated to only contribute 2% of jobs. The adverse impacts of coal mining on local communities, in particular, indigenous peoples, are well documented. The gendered impacts of coal mining in Colombia include environmental degradation, pollution, and disruption of water resources, prostitution, and sex trafficking.

Colombia currently has no comprehensive energy transition policy, despite being a signatory to the Paris Agreement. While the country has a range of disparate policies to address climate change and the impacts of mining on host communities, gender considerations are not sufficiently integrated in these policies. A team of researchers from two INGOs identified a range of obstacles to developing a gender-responsive climate policy that could facilitate both gender justice and a Just Transition.

- Invest in research to close knowledge gaps on the climate–gender nexus.
- Remove structural barriers to women’s participation in decision-making institutions.
- Create networks and build trust amongst key actors and stakeholders.
- Strengthen “bridging” actors between national policymaking and local communities.
- Develop an engaging narrative that can generate support from diverse actor coalitions.
- Strengthen the capacities of public institutions and raise awareness about inclusive, intersectional understanding of gender.
- Develop long-term capacities amongst officials and NGOs.
- Broaden the concept of Just Transition to include gender perspectives and tackle structural inequalities to avoid reproducing them

Given that the La Guajira and Cesar coal mining regions of Colombia have been identified as potential sites for renewable energy projects it is particularly important that a comprehensive and inclusive energy transition policy is developed to address and mitigate the potential for cascading impacts of climate change, mining, mine closure, and new generation energy production on local communities.

Source: Mohr et al. (2020)

An Intersectional Approach to Coal Transitions

Recent research by Mohr et al. (2020) and Braunger et al. (2020) identify the lack of attention to intersectionality as a limitation of current research into the effects of coal transitions on women and men. The risk of focusing on the differences between the genders as homogenous categories is that this can lead to a reinforcement of traditional gender role models and a blaming of women as “the problem” rather than focusing on identifying and solving the underlying causes of inequalities.

Intersectional Analysis Frameworks

Over the past two decades feminist theorists have developed several frameworks for intersectional analysis, involving multilevel analysis, structural/institutional analysis, and individual or interpersonal analysis of social categories and the multiple sources of power, privilege, and disadvantage that shape a person’s lived experiences and access to resources. The promotion of social justice and equity is a key goal of intersectional analysis. Hankivsky’s (2012) Intersectionality-based Policy Analysis (IBPA) framework encompasses several key principles of intersectionality (see Appendix A). As detailed in Section C, there are various commonalities between intersectional analysis and gender analysis (GA), which also seeks to understand women and men’s different levels of access to and control over resources as an indication of levels of gender equality and different institutional and cultural factors that influence gender roles and relations.

Intersectional principles can be used to expand the scope and analytical lens of GA and GIA processes and frameworks. According to the Gender and Development Network (GADN 2017), key elements of an intersectional approach to GA include:

Power analysis: Individual people can experience diverse identities that inform their political agendas and choices.

Politicization and transformation: Rights-based approaches or social justice paradigms are central to an intersectional approach to development. Intersectionality is oriented towards transformation and seeks to build coalitions among different groups with the goal of social justice.

Building resistance: Using knowledge to build appropriate forms of resistance to oppression. Recognition of the different and intersecting forms of oppression creates opportunities for building new alliances between groups that share a common political interest.

Context: Understanding and tackling discrimination should be linked to the wider social, political, economic, and legal environment in which they appear. Social constructions of social categories of identity are dynamic and changing.

Reflexivity: Researchers, advocates, and policymakers must consider their own social positions, identities, and relationships, and how these might shape their perspectives and analyses. Those with access to power must facilitate this access with and for other women.

Diverse knowledge: An intersectional approach focuses on different women and men's diverse knowledge and experience

gathered through participative methods, personal accounts, and case studies, and recognizes how power can influence which forms of knowledge are considered legitimate.

Change the funding model: Intersectional approaches are complex and demonstrate the importance of providing funding for core activities that can support longer-term and more transformative change, rather than project-based initiatives.

Benefits of an Intersectional

Approach to Coal Transition

There are a number of benefits in taking an intersectional approach to the interrelated policy areas of mine closure impacts, coal sector decline, and energy transition. At a purely practical level multilevel analysis resonates with the overwhelming findings of research into the persistence of gender inequality in the extractive and energy sectors and the gendered impacts of mine closure and energy transition (Braunger et al. 2020; Clancy and Mohlakoana 2020; Fraune 2018; Kooijman-van Dijk 2020; Lieu et al. 2020; Mohr et al. 2020; Sesele 2020), which include:

- Continued lack of political commitment and funding for gender equity policies and programs at the national/organizational levels (macro level).
- Continued existence of legal, structural, cultural, and institutional barriers to gender equality (macro, meso, and micro levels).
- Lack of capacity, technical skills, and funding to implement gender equality policies and programs at regional and local government levels (macro and meso levels).



- Lack of research and understanding of local contextual factors and participation of local women and men in informing and developing gender-aware policies and programs (macro and meso).
- Lack of effective coordination and consultation between diverse stakeholders and different levels of government in planning mine closure and energy transition policies (macro and meso).
- Women and marginalized groups of women and men continue to be underrepresented in all decision-making spaces across all jurisdictions, from national parliaments to local community forums (macro, meso, micro).

These findings indicate that the solutions to understanding, addressing, and addressing the gendered impacts of coal sector decline, mine closure, and energy transitions must also be multilayered, requiring coordination and action at all levels of government and operation within private sector actors and other key stakeholders, such as unions, as well as within the institutional structures, processes, and practices of local communities.

Intersectional approaches are also primarily concerned with marginalization, power, and social justice. This aligns with the prevailing concerns of the Just Transition movement, yet only relatively recently have considerations about gender and other intersectional factors begun to be explored or considered in energy transition policy research. According to Colfer et al. (2018), the social justice dimension of intersectional analysis can be understood “as a way of transforming how resources and relationships are produced and distributed so that all can live dignified and ecologically

sustainable lives.” This resonates with Fraune’s (2018: 72) observation that energy systems are “social institutions” that reveal how resources and power are distributed within a society.

Embedding intersectionality is particularly vital in any policy, project, or intervention involving indigenous women and men, who may have experienced historic and ongoing systemic forms of racism, abuse, dispossession, and marginalization. There is already evidence of the systemic exclusion of both indigenous people and indigenous perspectives from mine closure planning (McCullough 2016; Monosky and Keeling 2018; Owen and Kemp 2018), something that appears to be continuing with energy transitions (Lieu et al. 2020; Mohr et al. 2020).

Lieu et al. (2020: 6) indicate that the “social and environmental risks of largescale renewable energy development – such as geothermal, hydro and wind – are largely borne by Indigenous communities.” However, this continues to be poorly understood due to a failure to embed intersectionality in social impact research. As an example, they cite a public engagement research initiative in Alberta, Canada, which was designed to collect insights for the province’s energy–climate future pathways; while it included gender perspectives, indigenous perspectives were excluded due to the design of the project’s research process.

Several researchers examining the policy response to energy transitions note the need for building coalitions and the importance of effective stakeholder collaboration at all levels (Aung and Strambo 2020; Gambhir et al. 2018; ILO 2018; Sartor 2018; Strambo et al. 2019; UNRISD 2018; UNSW IDG 2020). This aligns with the view of Parpart (2014) that the shortcomings of gender mainstreaming indicate that gender equality advocates must

find new alliances and partnerships to further their aims. According to WEDO (2016), a Just Transition away from fossil fuels implies a “transition away from prevailing power structures and a sexually disaggregated labour force”, a process that requires an understanding of “intersectional realities” and locations of marginalization and oppression, including gender, class, and race.

Intersectional approaches focus on the principles of resistance and resilience, and the identification of opportunities to resist and disrupt power and dominant ideologies, and challenge oppressive norms, values, and practices via collective action (Colfer et al. 2018). The broad coalitions that are required to achieve a Just Transition indicate the importance of marginalized groups finding voice and common ground to challenge prevailing inequalities in terms of energy access, production, ownership, and distribution.

Case Study 9.

Indigenous knowledge systems and mine closure

In their critical review of ten mine closure plans covering a range of mining operations in the north-west territories of Canada, Monosky and Keeling (2020) find that few, if any, integrate indigenous knowledge systems and there was great variability in the extent to which local communities were engaged in closure planning. In sum, without firm regulatory guidelines, the quality of the closure plans in terms of addressing and integrating community concerns and interests depended entirely on the willingness of companies to go “above and beyond” the minimum standards required by governments. These closure plans also lacked “any common understanding, acknowledgement, or standard practice” for addressing the socioeconomic impacts of closure. Given this, it is not surprising that none of the closure plans had in place clear, concrete strategies to mitigate negative impacts. The scholars thus conclude: “In closure planning, it is engineers and professional scientists who have the privilege and power to construct the future, rather than communities” (2020: 6–7).

Source: Monosky and Keeling (2020)



An aerial photograph of a massive open-pit mine. The mine is characterized by deep, terraced levels of earth and rock, creating a series of concentric, stepped slopes. A network of roads and tracks winds through the various levels, with numerous large yellow and orange haul trucks and other mining equipment visible. The terrain is rugged and dark, with some lighter-colored rock exposed in certain areas. The sky is clear and blue, and the overall scene conveys a sense of large-scale industrial activity.

Conclusion

As the Just Transition movement has gathered momentum globally, attention has turned to the neglected issue of gender justice within social and economic impacts of transitioning to a sustainable future (Braunger et al. 2020; Feenstra and Özerol 2021; Lieu et al. 2020).

Given the persistence of widespread gender inequality it is impossible to realize a socially just and transformative energy transition without an explicit focus on gender. Thus, unless gender considerations are an intrinsic part of the policy response to decarbonization, they risk perpetuating or exacerbating gender inequality (UNSW IDG 2020).

Intersectional approaches to GA and bringing a feminist lens to policy development can play an important contribution to the achievement of gender justice and an inclusive Just Transition.

GA remains a powerful analytical tool for revealing the complex causes and consequences of gender-based inequality and other forms of marginalization at multiple levels (household, community, and institutional), while a critical feminist approach can reveal underlying structural impediments to achieving gender equality (Fraune 2018; Hillenbrand et al. 2015; Kooijman-van Dijk 2020).

Despite several decades of raising gender awareness and gender mainstreaming, gender equity has still not been achieved even in the advanced economies of the Global North (ILO 2017). Analysis of the shortcomings of gender mainstreaming has found that policies and development interventions continue to ignore the underlying structural and political impediments to women's economic participation and empowerment (Cornwall and Rivas 2015; Eerdewijk and Davids 2014; Kabeer 2015). Extensive research has confirmed that these structural barriers are found to different degrees in almost every country. These include:

- **Burden of care:** Women are disproportionately responsible for the care of children and elderly family members, limiting their participation in a wide range of economic and other activities.
- **Double work burden:** Women continue to undertake the majority of unpaid domestic work along with paid work, further constraining their economic participation.
- **Lack of financial access:** In many countries women are constrained in accessing financial services due to a wide range of legal and cultural factors, including the inability to own assets such as land.
- **Lower levels of education:** Women and girls continue to have lower levels of education and skills training than boys and men, particularly in countries of the Global South.
- **Lack of participation in decision-making spaces:** Women are underrepresented in political and other decision-making institutions meaning that their needs and perspectives are not included or considered in policy and planning decisions.
- **Gender pay gap:** Women continue to be paid less than men for doing the same work in many countries, resulting in higher levels of poverty, financial vulnerability, and lower levels of savings and superannuation.



- **Insecure, casual, part-time work:** Due to many of the constraints listed above women are over-represented in insecure, unskilled, casual, and part-time work, furthering their economic vulnerability.
- **Reproductive agency:** Lack of access to and control over reproductive health and family planning.

Addressing these structural barriers requires governments to enact and fund comprehensive social welfare and gender equity policies, including paid leave for both parents, universal childcare and healthcare, and the eradication of sex-based discrimination. This also requires that governments hold the private sector to account for meeting a wide range of labour standards, including gender quotas and targets (WEDO 2016). Many developing countries do not have the capacity to make these investments or implement these policies and will require the assistance of developed countries and international donors to facilitate a Just Transition process (UNSW IDG 2020). The International Trade Union Confederation (ITUC) calls for a global fund for Just Transition projects (ILO 2018). This also underscores that political economy and other local contextual factors will be critical in framing appropriate policy responses.

While much of the discussion in the report focuses on the enduring barriers to female economic participation and empowerment, it is clear that with globalization, economic liberalization, and other significant structural economic and workplace changes, including de-industrialization and mechanization, the workplace has also changed radically for men in the past three decades. These global forces have impacted men everywhere, but in the Global South in particular, have created and entrenched new livelihood patterns, such as seasonal and long-term work migration, with significant consequences for both women and men and entire communities (Bennett 2015; McDonald et al. 2012; Pattnaik et al. 2018). The demise of unions has seen both genders lose an important source of political and economic advocacy and support. Like women, men have increasingly found themselves in casualized, insecure, dangerous work without social welfare safety nets. These are the significant intersectional, structural, economic, and livelihood challenges facing many women and men today in the context of local and global energy transitions.

IPBA Guiding Principles.

Source: Colfer et al. (2018: 8) based on Hankivsky (2012)

Principle	Description
Intersecting categories	Refers to the idea that human lives cannot be reduced to single categories only, and policy analysis cannot pre-assume that only one social category is relevant. Social categories must be viewed as interacting and intersecting with one another to create unique locations that vary according to time and place.
Multilevel analysis	Concerned with understanding the effects between and across various levels in society, including macro (global- and national-level institutions and policies), meso (provincial- and regional-level institutions and policies), and micro levels (community, grassroots institutions, and policies as well as the individual or “self”).
Power	(a) Operates at discursive and structural levels to exclude some types of knowledge and experience; (b) shapes subject positions and categories; and (c) these processes operate together to shape experiences of privilege and penalty between and within groups. Power is relational, so it is important to recognize the different forms - power over, power to and power with.
Reflexivity	Reflexivity acknowledges the importance of power at the micro level of the self and one's relationships with others, as well as at the macro levels of society. Practicing reflexivity is to commit to ongoing dialogue about tacit, personal, professional, or organizational knowledge and their influences on policy. Reflexivity can help transform policy when we bring critical self-awareness, role-awareness, interrogation of power and privilege, and the questioning of assumptions and “truths” to our work.
Time and space	How we experience and understand time and space depends on when and where we live and interact. Within these dimensions of time and space different knowledge are situated, our understandings of the world are constructed, and the social orders of meaning are made. Privileges and disadvantages, including intersecting identities and the processes that determine their value, change over time and place. Thus, time and space are not static, fixed, or objective dimensions and/or processes, but are fluid, changeable, and experienced through our interpretations, senses, and feelings, which are, in turn, heavily conditioned by our social position/location, among other factors.
Diverse knowledge	Power and knowledge are intimately connected to the extent that power operates at discursive and structural levels to exclude some types of knowledge and experience. Intersectional analysis calls for investigating how certain knowledge traditions are included, privileged, or marginalized, along with the social, material, psychological, and political ramifications for different social groups. Including the perspectives and worldviews of people who are typically marginalized or excluded in the production of what constitutes “knowledge” can disrupt unequal power relations.
Social justice and equity	Can be understood as a way of transforming how resources and relationships are produced and distributed so that all can live dignified and ecologically sustainable lives. Equity refers to fairness and justice with the objective of equalizing outcomes between more or less advantaged groups.
Resistance and resilience	These can disrupt power and oppression. Even from so-called “marginalized” spaces and locations, oppressive values, norms, and practices can be challenged. Collective action can destabilize dominant ideologies. Conversely, policies and discourses that label groups of people as inherently marginalized or vulnerable undermine the reality that there are no “pure victims or oppressors.”



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